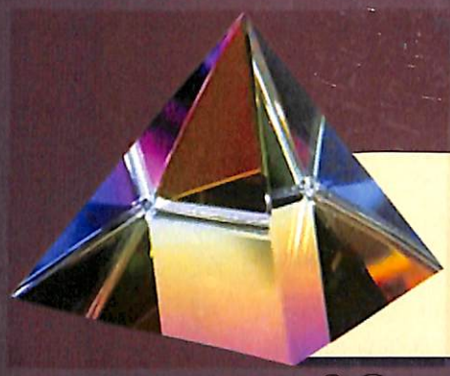

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To Study Stress and Frustration Level of Breast Cancer Patients

Shikha Khandelwal and Sohini Acharya

ABSTRACT

The present study was undertaken with an aim to study the Stress and Frustration level of Breast Cancer Patients, as Breast Cancer has found to be the second most common cancer among women in India. The National Cancer Institute estimates that 12.7% of women born today will be diagnosed with Breast Cancer during the course of their lifetime. Breast Cancer can impact patients psychologically as well as physically, which can manifest as post-mastectomy depression, increased anxiety, shame, and occasional ideas of suicide. The survey was designed with 51 cancer patients and post cancer survivors (for approx. 2 months to 2 years) with mean age of 54 years. The data pertinent to the study was collected with the help of Stress Questionnaire (downloaded from internet) and Reaction to Frustration Scale by Dr. B.M. Dixit and Dr. D.N. Srivastava and was analyzed by using statistical analysis (Mean & S.D.). The obtained result indicates that breast cancer patients suffer from average stress but a very high level of reaction to frustration.

Keywords: Breast Cancer, Reaction to Frustration, Stress.

Introduction

Our body is made up of various types of cells. Normally the regulatory mechanism of our body does not allow the cells to grow in an unregulated manner. As a result of this an individual gets a definite shape and size of a particular organ. In cancer this regulatory mechanism is lost. Cells proliferate in an uncontrolled manner. This unregulated cell division leads to a formation of tumor. The tumor may be of two types Benign and Malignant.

Benign tumors usually does not cause harm to the body, does not reappear after removal, and does not invade the surrounding tissues and spread through lymphatic or blood to distal organs. In most cases simple removal of these tumors, cures the patient. But in case of Malignant tumors or cancer, the tumors recur after removal, invade the surrounding tissues and spread to the distal organs through lymphatic or blood and eventually they are responsible for killing the host or patient.

In case of Breast Cancer, the cells invade the surrounding breast tissues, spread to the regional lymph nodes and goes to distal organs like lung, liver, brain, bone etc. and finally it kills the host by invading these vital organs[8].

The incidence of Breast Cancer in India is on the rise and is rapidly becoming the number one cancer in females pushing the cervical cancer to the second spot[4]. This is because more and more women in India are beginning to work outside their homes which allow the various risk factors like family history, late age at first childbirth, fewer children and shorter duration of breast-feeding. In addition, early age at menarche and late age at menopause add to the risk to some extent [3]. There are 4 stages in Breast Cancer, in which curative surgery is possible only if cancer is limited locally to stage 1 and stage 2. In stage 3 and 4 the disease has spread beyond the breast, to the distal organs and is therefore an advanced case of cancer[10].

The available methods of treating Breast Cancer patients are Surgery, Radiotherapy, Chemotherapy and Hormone Therapy.

In one of the researches Oktay has mentioned that Breast Cancer elicits concern regarding a woman's view of herself as many treatment for cancer, challenges a woman's body image and sexuality. The systemic treatment of Breast Cancer with chemotherapy or hormonal therapy may also affect self-image, fertility, and libido—all important components of femininity. The combined effects of breast surgery, loss of hair, decreased libido, and early menopause constitute a serious threat to a woman's self-image. In addition, as the rate of Breast Cancer has increased in younger women, issues of femininity arising from the impact of disease on fertility are increasingly important[6].

Due to these issues psychological phenomena like Stress and Frustration affect patient's life. Studies have indicated that Stress can affect tumor growth and spread to the other parts of the body[1]. The experience of cancer is different for each individual. Research, however, suggests that specific psychosocial factors play a role in disease onset and progression as well as psychological adjustment.

Methodology

The type of sampling used in the present research is "Purposive Sampling". The sample consists of 51 patients/survivors of Breast Cancer and this study was carried out in Kolkata with the help of Bengal Oncology Society and Hitoshini an NGO. The tech-

nique used for the collection of data is Questionnaire Method and tools used were: Stress Questionnaire (downloaded from internet) [12] and Reaction to Frustration Scale- by Dr. B. M. Dixit and Dr. D. N. Srivastava[9]. The data collection was processed by undertaking statistical tests (Mean and S.D.)

Results & Discussions

Table 1: Showing Mean and S.D. (Standard Deviation) Score of Breast Cancer Patients

Sl. no.	Area of study	Mean level	S.D.	Obtained	Hypothesis
1	Stress	57.29	11.4	Average	Rejected
2	Frustration	108.86	11.9	Very high	Accepted
3	Aggression	24.64	4.7	Very high	Accepted
4	Resignation	22.12	5.6	Average	Rejected
5	Fixation	30.71	4.8	Low	Rejected
6	Regression	30.55	4.8	Average	Rejected

Breast Cancer is the commonest form of cancer in women worldwide. The situation of Breast Cancer in India is similar to many countries of Asia and other regions where dramatic economic and social changes are taking place.

Breast Cancer Patients are influenced by high level of emotional distress both before and after diagnosis (Iwamitsu, et. al)[5].

From the obtained result it has been found that the Breast Cancer Patients are Average in Stress Level indicating that sometimes they get easily irritated, depressed, feel restlessness, tensed and fatigued. In addition to the above symptoms experienced, psychological intervention given to them is helping them to cope better with the situation. More or less they express their emotions and sometimes they get involved in activities which are appealing to them and reduce their Stress Level.

It has also been found during the course of study that Reaction to Frustration level of Breast Cancer Patients is Very High. This indicates that since Breast Cancer Patients suffer a lot of pain both psychological and physical during the treatment and also post treatment period, they meet a more or less insurmountable obstacle or obstruction in their route to the satisfaction of any vital needs. It is also because of their unmet needs and low quality of life, they get frustrated.

Frustration has a different set of behavior mechanism. It is expressed in various modes like Aggression, Resignation, Fixation and Regression.

In the area of Aggression it has been found that the Breast Cancer Survivors are Aggressive in their mode of Reaction to Frustration, because of the reason that their pleasure seeking behavior or pain avoiding behavior is blocked[2]. Feeling of fear of failure thus germinates Frustration.

In second dimension Resignation, the obtained result shows that Breast Cancer Survivors are average in Resignation behavior indicating that these patients/survivors are more or less not in dilemma and are trying to adjust with few changes in their lives and during certain situations to avoid conflicts they try to escape themselves from the society rather than trying to discuss and share their problem.

Result in Fixation, another dimension in Reaction to Frustration show that, Fixated behavior of Breast Cancer Survivors is low i.e. these patients or survivors adapt themselves in new situation with strong will power to survive and restart their lives after getting treated with Breast Cancer.

The last being Regression, describes that Breast Cancer Patient/Survivors has scored Average in Regression mode in Reaction to Frustration indicating that more or less they have self-control and they are comfortable in sharing their past experiences with others and trying to adjust with reality by sometimes avoiding escapist behavior.

Conclusion

In this study the feelings of Breast Cancer Patients/ Survivors has been reported as significant fatigue, body aches, pain, anxiety, irritability, tension, headaches, hot flushes, trouble in sleeping, mood swings, depression, sadness and complex conditions resulting from cancer diagnosis and treatment, aging, hormonal changes, their life experiences. They try to control their Stress Levels by identifying and avoiding sources of stress, talking about their emotional turmoil with their friends, family members and doctors hence they have been found to have Average Stress Level but have Very High Frustration Level. In different modes of Reaction to Frustration: Aggression Level is Very High, Fixation is low, Resignation and Regression Level are high.

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A Study of Life Satisfaction among Sex Workers in Kolkata

Prachi Goenka and Krishnakali Bhattacharyya

ABSTRACT

Satisfaction with life conditions being considered a crucial aspect of human welfare, the present study aimed to investigate the level of Life Satisfaction of 32 marginalized women- the sex worker (aged between 30-55 years) from different areas of the city Kolkata, West Bengal. They were interviewed personally and Life Satisfaction Scale by Dr. Promila Singh and Mr. George Joseph was administered. The findings revealed trafficking and poverty were the main reasons for being in the profession. Although some stated to join out of their own wish having no option to earn money. It was also found that contrary to the existing notion most of the respondents have an average level of life satisfaction.

Keywords: Life Satisfaction, Prostitution / Sex Work, Sex Workers.

Introduction

Sexuality research in India was and to a large extent still is characterized by its focus on high risk groups, clients of female sex workers (FSWs), Human Immunodeficiency Virus (HIV) / Acquired Immunodeficiency Syndrome (AIDS) awareness, but life satisfaction of FSWs has remained a largely unresearched area due to difficulty in data collection and due to the assumption that a sex worker is naturally unhappy and dissatisfied with her life. Life satisfaction refers to a person's general happiness, freedom from tension, interest in life, etc.

Prostitution as a commercialized vice has existed in the world from time immemorial, though its institution has never been recognized by the society as such. It existed in some form or other as long as society has attempted to regulate and control sex relationships through the institution of marriage and the family. Society has not recognized it because it brings in its train not only personal disorganization of the persons concerned, but also affects the life organization of the family and the community at large[3]. Prostitution is one of the oldest professions of the world practiced since the birth of the organized society. It is practiced in almost all the countries and every type of society and India being no exception.

In India, sex-workers are a group of underprivileged and marginalised women belonging to the lower socioeconomic strata. There are several cultural, economic, and psychological factors that contribute to their present status. Family expectations and problems are common factors why many enter the prostitution business. Although poverty and associated economic factors form the prime reason for resorting to sex-work, the undercurrent of tradition prevailing in some parts of India makes its way silently still in the 21st century when western technology, material advances, expertise are taking its entry in a great pace. Some other common factors for entry into prostitution are ill-treatment by husband, desertion by spouse, dejection in love and deception. The children living near brothels or in the company of immoral persons become so used to seeing sex trade that they come to accept it as normal.

The life of a prostitute in India is terribly difficult and painful. Escape, especially without the help of other people, is also nearly impossible. Prostitutes are usually guarded and kept under watch constantly.

The impact of Prostitution on the society at large seems to be colossal and varied as to destroy its very ethos. Besides bringing down the moral standards in our society, it casts a stigma on all the connected, conniving persons to this dastardly act[6]. In India, more than 90 per cent of HIV transmission is through the sexual route and commercial sex workers (CSWs), who have multiple sex partners, are at a risk of getting infected with HIV, which causes AIDS. In a research done on sex workers by R. Jayasree and K.A. Parvathy, they found that 72.5 percent of the respondents stated that they had experienced one or more reproductive health problems[2].

Most of these women neither have any hope nor do they have any knowledge about their rights to basic living. Being rescued from a brothel is not always the end of a dark tunnel. Rather, it could be the beginning of a more traumatic life because of the health issues and stigmatisation associated with this kind of a work.

Methodology

Sample:

The data for the present study has been generated from 32(N) female sex workers from the areas of Sonagachi, Bowbazar and Kalighat areas of

Kolkata, West Bengal. All sex-workers interviewed were females, some unmarried while others married and some having children. They are involved in the profession for the last 10 years and residing in Kolkata. Some of the sex workers (15 respondents) were approached through Durbar Mahila Samanwaya Committee (DMSC), a local non-governmental organization (NGO). Rest of the data was collected by using snowball sampling, a technique for developing a research sample.

Tool Selection:

Life Satisfaction Scale by Dr. Promila Singh and Mr. George Joseph[5] was administered individually to the respondents. This particular tool was used because the 35 statements present in it cover most of the life aspects.

Collection and Analysis of Data:

The Life Satisfaction Scale, the only tool used in the study was translated in Hindi and Bengali by professional translators respectively. Personal interviews were conducted on one-on-one basis and general information of the respondents was gathered. Working with the Life Satisfaction Scale the researcher put forth each statement at a time and the respondent were asked to indicate just one of the alternatives that holds true for her from the five alternatives being offered.

For the purpose of the present study, the statements in the scale are divided into five dimensions suggested by Neugarten et al.[4] for the expediency of analysis of data by the researcher.

Results & Discussion

Becoming A Sex Worker:

Of the 32 women interviewed for this research, majority, 18 (around 56.25%) started sex work in their teens and the majority of them were between 16 to 20 years of age when they became a sex worker.

It was found that, the greater part (15) of these sex workers started sex work because they were either sold here by someone known or unknown to them or were trafficked. In the present study the reflection of disadvantaged background was revealed when the respondents reported hardship, issues in the family and poverty made them enter this work. Some women mentioned not wanting to burden their families with the financial responsibility of looking after them and felt compelled to fend for themselves through selling sex. A striking finding of the present study which matches no other cause was that some started sex work because they lived near the red-light areas. Many felt it was an easy way to earn money and be independent since they lacked education, skill and were naive.

What the respondents revealed through personal interview in the study, it can thus be said that becoming a sex worker is the result of multiple causes. However, amongst all these factors, trafficking, economic and social factors mainly compel girls/ women into prostitution.

In the present research, Life Satisfaction Scale was administered and the 35 statements present in it were divided into five dimensions. The results are discussed below.

For the dimension on 'Taking Pleasure in Everyday Activities', the sex workers were asked questions to ascertain how they felt about their day to day activities, their satisfaction related to their job and if they obtained pleasure by doing some kind of social work. Generally there appears to be a difference in attitude and opinions with regard to sex work. When asked questions relating to it, they gave diverse responses, majority choosing 'seldom' as their choice, but few even chose 'always', 'often', 'sometimes' and 'never' as their options. This suggests that the majority of the respondents are not satisfied with their work whereas some are. Strikingly nobody opted for the answer 'never' to statement which says 'I enjoy whatever I do' and at the same time statement which states 'I derive satisfaction from whatever I do'.

When asked questions relating to social and community activities, most responded positively. It was found while talking to them informally, that majority of the respondents work with NGOs. They help spread awareness about HIV, AIDS, and importance of health checkups. They lend a hand to other members of their community who need support and comfort.

Many of the sex workers enjoyed getting involved in leisure activities. They take pleasure in watching television, listening to music and even dancing. Few enjoyed sports activities. Most of the respondents said to derive pleasure from doing house hold chores, specially cooking whereas few totally disliked it.

By asking questions on dimension of 'Considering Life Meaningful', the responses indicated that majority of the sex workers frequently consider their life significant. Most of them believe that since they have got a human life, it is for living. They are a little apprehensive but they take each day as it comes and try to enjoy their lives. Many of the respondents want to use their ability to improve

their general well being. 19 out of 32 respondents said that they always or often have control over their lives. These women are independent and competent enough to take their own decisions. Many are the bread winners of their families and have to look after their parents, siblings, husbands and children. Earning money to feed the loved one appears to be the motivating factor for these women.

Sex workers are undoubtedly well aware of the prevailing social attitude toward their behaviour. It would seem that these women develop a set of beliefs which counteract the social anathema attached to their way of life. This set of beliefs allows them to continue their behaviour and to face and retaliate against persons who share the dominant and negative social values toward them.[1]

To study the dimension of 'Holding a Positive Self- image', the respondents were asked some questions related to how they perceived themselves. The responses indicated that they hold a positive self-image often or sometimes.

Almost 71% of the respondents fell in the above mentioned categories and said that they earn their own living, are independent and often consider themselves to be a self made man and a successful person. They possess a healthy sense of self and are courageous. They often try to maintain self respect in various roles and often understand their strengths and weaknesses. But at the same time it may become difficult for them because they may face physical and mental violence by their clients. Considering themselves self sufficient and saying that they disliked being dependent on anyone, they further reflected their positive self image.

Among the various outcastes that our society has always ostracized, sex workers face the maximum ordeal as their profession strips them off their dignity and honour. But irrespective of it they try to maintain a positive self- image.

Is your glass half-empty or half-full? How one answers this age-old question about positive thinking may reflect one's outlook on life, attitude toward them, and whether one is optimistic or pessimistic.

Seven questions related to optimism were asked to ascertain this dimension (Having a Happy and Optimistic Outlook). The respondents gave varying responses. Not all the respondents enjoy their life and almost all want to raise their standard of living. In red light areas sanitation and civic amenities are in deplorable conditions. These areas have numerous narrow alleyways which are spotted with food scrapes, wastes, garbage and rats running around. Each tenement houses several brothels in which the numbers of rooms vary and eliminate these women of any privacy.

Despite the above mentioned oddities some sex workers often hold an optimistic outlook towards life whereas some can seldom retain it. They said that they feel happy when their children achieve success and are proud of them; none of the sex worker ever wanted their girl child to become a sex worker. They feel contended when they achieve their goals. Some always or often try to face unanticipated hardships whereas some can seldom do it.

To determine the dimension of 'Feeling Success in Achieving Goals', the sex workers were asked some questions based on how they felt about goals, demands of life, money making and related issues. 11 of them said they 'sometimes' set realistic goals for themselves and others responses varied from 'always' to 'seldom'. Most of them feel happy when they achieve their goals but they still think it's difficult sometimes for them to fulfil the demands of their lives. On a whole they sometimes plan out their days work by setting priorities.

In the present study when asked if money making was not the only motto of their life, none of them said 'always' although some had got involved in the sex industry because of some financial crunch. But even now after many years they still feel the crunch and say that money is the sole reason why they are in this trade even though they do not earn a very heavy amount. By earning not as much money they require, it becomes difficult for them to fulfil their needs. They have to neglect their wishes. But regardless of the hardship they try not to leave their work incomplete and tend to solve their problems effectively.

Taking into account all the statements of the scale together of all 32 respondents, the overall computed mean is 125.15 which lie in the Average category, suggesting that the sex workers studied in the present study have average level of Life Satisfaction. Thus the present study questions the common notion that sex workers are totally dissatisfied with their lives.

Conclusion

Aiming to know about the life satisfaction of the women who are considered as threat to monogamous morality – the sex workers – the present study dealing with 32 such women in Kolkata found that they are more or less (average) satisfied with their lives. Majority try to be optimistic about their futures, often being a courageous person and mostly considering themselves as a self made person. Al-

though deriving satisfaction from sex work is next to impossible, most of them admitted they seldom do so.

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A Study on Challenges Encountered by Mothers while raising Mentally Challenged Children in the age group of 6-10 years

Zodinpuii and Sohini Acharya

ABSTRACT

The present study was undertaken with 35 mothers of mentally challenged (aged between 6-10 years). A questionnaire was prepared for them which consist of 48 questions divided into seven dimensions . The present study focuses on the mother's adjustment with self, with family member and also with the society. It has been found that most of them are well adjusted with their retarded child. Most of them stated that they have to face a myriad challenges when bringing up a retarded child and they have to face certain unique situations. They often face certain life situations that are sometimes difficult for them to solve and difficult for others to understand.

Keywords: Attachment, Mentally Challenged, Self Esteem, Socialization, Stress.

Introduction

A family with a mentally retarded child has to face some serious complications. It often requires a re-orientation and re-evaluation of family goals, responsibilities and relationships. In India the majority of persons with mental retardation have traditionally been cared for by their families. In today's modern society the home-based care has resulted in many adverse consequences. Factors such as changes in the social system (e.g.breaking up of joint families and the economic system, unemployment, inflation etc) have contributed to the stress that parents of mentally retarded children experience[2,19].

Mental retardation is one of the most challenging problems of childhood. It affects not only the child but also the mothers, fathers, brothers and sisters, other family members and the community[10]. Mental retardation has been known for centuries and different terms have been used to explain it. Early in the twentieth century, the terms moron, imbecile and idiot explained the different levels of mental retardation. During the 1940's the term feeble-minded was used. In recent years terms like 'mental sub normality' and 'developmental disability' are being used. Until the twentieth century, retardation was defined in terms of individual's inability to meet the minimal demands of society. The Stanford Binet Intelligence Scale was adopted as a standardized, non reference way of identifying retarded children. IQ became a standard for classification of mental retardation[14]. The American Psychiatric Association (2000) in DSM-IV-TR defined mental retardation as "significantly sub average general intellectual functioning that is accompanied by significant limitations in adaptive functioning" in certain skill areas such as self-care, work, health and safety. The DSM-IV-TR describes various levels of mental retardation:-

1. Mild Mental Retardation: Individuals in this group are considered 'educable' and their intellectual levels of adults are comparable to those of average 8- 11 year old children.
2. Moderate Mental Retardation: They fall in the educational category of 'trainable', which means that they are presumed able to master certain routine skills.
3. Severe Mental Retardation: Severe mentally retarded individuals are sometimes referred to as "dependent". In these individuals, motor and speech development are severely retarded, and sensory defects and motor handicaps are common.
4. Profound Mental Retardation: The form "life-support retarded" is sometimes used to refer to profound retarded individuals. Most of these people are severely deficient in adaptive behaviour and unable to master any but the simplest tasks[3].

Methodology

The study deals with multiple indicators hence operational definitions of concepts like attachment, self-esteem, stress and socialization were formed.

Sample:

In the present study the data was collected from a sample of 35 mothers of mentally retarded children in Kolkata. The data was collected from five (5) Special schools in Kolkata.

Data Collection Method:

The technique used for collection of data in the present study was questionnaire method. There are 48 questions which have been grouped under 7 dimensions. The questions were presented randomly to the mothers of mentally challenged children from different schools.

Results & Discussion

The present study was aimed to find out the challenges encountered by the mothers while raising mentally retarded/challenged children in the age group of 6-10 years. In the present study, the selected group was selected randomly and were presented with questions which were related to their life and about raising their mentally challenged children. In the present study 7 dimensions were covered which consists of 48 questions. The questions were all presented randomly to the target group. The dimensions covered were :-

1. Health status of the mothers during pregnancy.
2. The mothers attachment with the mentally challenged children.
3. Mothers self-esteem for having a challenged children.
4. Mothers stress for the challenged children.
5. Challenged child's educational needs as viewed by the mothers
6. Role of family members in raising the mentally challenged child in the family.
7. Socialization of the mothers and the mentally challenged children.

All parents expect and plan for a healthy child. The period when a woman is pregnant is often looked at in isolation this is not put in a larger context of the mothers overall health. Although this has been the traditional approach to pregnancy, which is promoted by the WHO. The mother's health before and during pregnancy may be affected by genetics, as well as malnutrition, acute and chronic disease, exposure to environmental toxics and a number of other factors[4].

From the present study it has been found that 82.85% mothers' pregnancy was planned and 17.14% of mothers reported that the pregnancy was unplanned, but only 28.97% reported that they had suffered from ailments / disease during pregnancy. Most of them are not addicted and did not take any medicine but had accident/accidents which they feel might lead to mental retardation in their children. Many aspects of the mothers health and lifestyle before pregnancy have been shown to affect her subsequent pregnancies with potential to impact the health of her children.

Hampton (2004), states that the fetal origin hypothesis purposes that certain genes in the fetus may or may not be " turned on" depending on the environment that the mother is exposed to while pregnant[9]. In the World Health Organization lifecourse approach to disease prevention, the passing on of excess risk for chronic disease from mother to child based on parental environmental exposures is known as the inter-generational effect. The intergenerational effect is thought to be one reason behind the clustering of chronic disease risk factors in families in lower socioeconomic status. Women in lower socioeconomic classes are more likely to be exposed to extreme environmental conditions and have substandard heath care that exacerbates problems. Intervention should seek to improve the mothers health before and during pregnancy to improve the short and long term health of her children[11].

Freud said that for the baby, his mother is "unique, the first and strongest love object and as the prototype of all later love relations for both sexes[7]." More recently, Greenspan, Schore and Siegal have written convincingly about the ways that the early care giving relationship influences the child's developing cognitive ability, shapes her capacity to modulate affects, teaches her to empathize with the feeling of others, and even determines the shape and functioning of her brain. The attachment and care giving systems are at the heart of that crucial first relationship[8,16,18]. From the obtained study it has been found that 62.86% of mothers are attached to their retarded child like mothers of other normal children. 22.85% mothers had difficulty in accepting their mentally retarded child after they were born. Some mothers hold the challenged child responsible, and make their child independent as they are scared what will happen to the child in their absence. Since the child is mentally challenged some mothers do face difficulty in understanding behaviours of them. It has been found that mothers like their mentally retarded child to mingle with the normal ones. Almost all the mothers play an important role in their child's life because she is the one who ensures all the basic needs of her child.

Bowlby referred to attachment bounds as a specific type of a larger class of bonds that he and Ainsworth described as 'affectional' bonds. It is important to note that infant does not have only one attachment relationship. Bowlby posited that babies routinely form multiple attachment relationships, arranged hierarchically, although they most likely have a single preferred attachment figure to whom they will turn in times of distress if she is available[1].

It was found that most of the mothers were terribly shocked that their child was mentally challenged, because it can be a life long problem. About 82.85% of the mothers were terribly shocked when they came to know about the specific retardation of their child but most of them do not blame them-

selves and do not feel guilty or unfortunate for giving birth to a retarded child. Though they have a difficulty in their lives and still they do not like to get any advice by other people because few of them think that they are the only person who can take care of their retarded child. 60% of the mothers informed that they need the support of their family to raise their retarded child. Most of the mothers feel unaccepted in the society for being a mother of mentally challenged child.

According to Mc Bride and Black, mothers appear to be more sensitive to troubled children, because it is the mothers who bears the children. They are likely to feel responsible for a diseased condition[13]. Farber found that mothers of intellectually disabled children and neurotic children undergo more stressful experience than mothers of chronically ill or normal children. Some mothers undergo tremendous guilt feelings, experience deep sorrow, low confidence and unrealistic goals. All these can affect different parents differently[6].

From the obtained result it has been found that few mothers have lost their self confidence suffer from useless thoughts, depression, have sleepless nights because they worry about their child's future, they get angry without any reason. Some mothers feel that the mother having normal children will never understand their problems because their life is different from them.

Peshawaria et al stated that there were gender differences in facilitating and inhibiting factors that affect coping in parents of children with intellectual disability in India. Mothers are under more pressure to balance childcare needs and household chores. Physical support was a relief to them[15]. In the present study all the MR children go to special school and all the mothers understood the importance of special education in their child's life where they follow special curriculum for the child i.e. Individualised Education Plan (IEP). Most of the mothers go to special school authorities where they meet special educators, counsellors, therapists and talk about the progress of their child at regular intervals. Usually parents and teachers share their successes and failures and work together and reach their goals. Most of the mothers are worried about their child's future. Most of the mothers feel that somebody may harm their children in their absence. Mahoney found that the disabled child can have an integrative effect by focusing the family's energy in a concerned, loving manner, thereby minimizing some of the other day to day problems. Some parents expressed a new appreciation for life and ordinary things they used to take for granted[1].

It has been found from the present study most of the mothers do not blame the husband nor do they get blamed by the family members for the mentally retarded child in the family but sometimes have misunderstanding with the other family members because the kind of parenting style they follow is not liked by their family members. Most of the mothers get help from their husbands in taking care of their child because the fathers are also aware of their child's needs and both of them cooperate with each other in raising their retarded child and to fulfil his/her needs and wishes.

Faber studied the effect of retarded children on their normal brothers and sisters. He found that the variable which seemed of greatest importance to the siblings was the degree of dependence of the retarded child that is how much he was able to do for himself. The more dependent the child, the more adverse was his effect on his siblings. In other words, the more responsibility required by the normal siblings (particularly girls), the less likely the handicapped child would be welcomed into the fold by his brothers and sisters. Jealousy and resentment may also develop if the handicapped child requires most of his parents attention, leaving short tempers and impatience for the others[5].

From the present study it has been found that the majority of the mothers like to attain all social occasion and functions because they are not ashamed of their challenged child and do not feel that their child is an obstacle for the family.

Seshadri et al reported a direct relationship between the degree of perceived burden, social emotional burden, disruption of family routine and disturbance in family interaction for women with intellectually disabled children rather than men[17].

Conclusion

The birth of a baby is usually anticipated with great excitement and expectations of a future filled with happiness and success. This exuberance may be dampened with a birth of a challenged baby. It does not matter whether the handicap is mental or physical. The family into which the child is born will change in some ways. In the present survey, it has been found that the mothers usually perceived the challenged child as only her responsibility and suffer from shame, embarrassment, guilt, anxiety and social rejection. It was seen from the present investigation that the acceptance of a mentally challenged child may be eased if parents meet other parents of children like their own. They share experiences, learn that their problems are not unique, and try to find out common solutions. Mothers of

children with mental retardation are under greater stress than the mothers of other typical developing children. While doing the present study it has been found that the mothers of older mentally challenged children are more stressed because they worry more about their child's future In fact some mothers of children with mental retardation overcome such condition readily, but others require considerable support in accepting these circumstances.

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A Study of Occupational Stress, Depression and Reaction to Frustration among Special Educators and Regular School Educators

Tulika Agarwal and Punam Mehra

ABSTRACT

The present study is an endeavor to investigate the levels of occupational stress, depression and reaction to frustration among special and regular educators. The study constituted of 114 educators out of which 55 were regular educators and the rest 59 were educators dealing with special children. The results showed that there is a significant difference in the level of depression among the regular and special educators. In the modes of aggression, fixation and regression there is no significant difference, while significant difference is present in resignation mode of reaction to frustration. Overall the hypothesis is accepted in the dimension, reaction to frustration. Significant difference is there on the level of occupational stress. No significant difference is present in sub-scales group and political pressures, under participation, powerlessness, poor peer relation. In sub-scales role overload, role ambiguity, role conflict, responsibility for persons, intrinsic impoverishment, low status, strenuous working condition and unprofitability significant difference is present. Positive correlation is achieved among the three variables in both the groups.

Keywords: Depression, Occupational Stress, Reaction to Frustration, Regular Educators and Special Educators.

Introduction

"Education is the guardian of democracy. It is the only dictator that free man recognizes, and the only ruler that free man requires".

Education is a philosophical as well as a sociological concept, denoting ideologies, curricula, and pedagogical techniques of the inculcation and management of knowledge and the social reproduction of personalities and cultures. It is mostly concerned with schooling, including the expansion of higher, further, adult and continuing education[2].

Whereas special education means specially designed instruction that meets the unusual needs of an exceptional child. Special materials, teaching techniques, or equipments or facilities may be required. For example children with visual impairment may require reading materials in large prints or Braille or students with hearing impairment may require hearing aids etc. The single most aim of special education is finding and capitalizing on exceptional children's abilities[1].

Educating a regular child or a special child is done by a teacher who gives lessons in a subject to a class or pupil. Teacher constitutes a special class of professionals who are charged with the responsibility of shaping the destiny of the nation. A teacher is the single most important factor in the success of pupils thereby the entire society[3].

All teachers have to play somewhat similar role in the development of a child but teachers of children with special needs have to perform some extra duties. He/she should be very careful about the teaching methods and must teach every child according to his/her disability or impairment.

While concentrating on their roles and duties teachers/educators might be stressed occupationally because of their job or do they experience any mood change due to non attainment of their goals which leaves them frustrated at the end.

Methodology

The sample for the present research comprises of two groups. Group I consisted of Special Educators (female) whose mean age was found out to be 40.27 years. Group II consisted of Regular Educators (female) whose mean age was found out to be 38.94 years. The sample for the present study was selected using Purposive Sampling. Four special schools and two regular schools were considered by the researcher for the study. The scales used were IPAT Depression Scale, Occupational Stress Index and Reaction to Frustration Scale. All the mentioned scale is standardized. Questionnaire method was used to collect the data. Data obtained by the use of various tools was analyzed by employing Mean, Standard Deviation, Correlation(r) and "t" ratio.

Results & Discussions

Table 1: Mean, Standard Deviation, "t" Values Of Two Groups On The Various Dimensions Of Occupational Stress, Depression & Reaction To Frustration

	Groups (I) (II)				
	Special Educators		Regular Educators		't' value
Factor	Mean	Standard Deviation	Mean	Standard Deviation	
Occupational Stress	124.45	13.12	113.69	15.20	4.06**
Reaction on Frustration	96.55	11.99	92.96	12.87	1.54
Depression	27.89	8.35	22.50	8.41	3.45**

** $p \leq 0.01$

Table 2: Correlation Coefficient Values Of Both The Groups:

Educators	Variables	Values
Regular Educators	Reaction to frustration and depression	0.93
	Depression and occupational stress	0.95
	Reaction to frustration and occupational stress	0.98
Special Educators	Reaction to frustration and depression	0.95
	Depression and occupational stress	0.96
	Reaction to frustration and occupational stress	0.98

From the above study undertaken it has been found out that there is no significant difference present in the aggression, fixation and regression mode of reaction to frustration between group I and group II. The reason might be that, in today's world more and more workshops are being conducted which helps the teachers to understand their job better and be more efficient, and that they are ready to take up challenges and bring about an improvement in the life of special children as well as regular school children. In the resignation mode of reaction to frustration significant difference is present. The overall level of frustration is low in both the group I and II and there is no significant difference is present at the level of 0.01. This may be because the responses which they get from the student and the organization is usually neither very positive nor supportive, which may in turn make them feel negative about themselves.

The term depression covers a variety of negative moods and behavior changes. The level of depression is higher in special educators compared to that of regular educators. Significant difference is present between both the groups at level of 0.01. Long working hours and expectation of the parents from the educators might be the reasons. The educators are the first source of learning for a special child. Reward which a child gives to an educator in terms of responding and achieving good marks, is delayed in case of a special child which also could be one of the reasons for her getting depressed.

Among the various occupational stressors significant difference has been found in role overload, role ambiguity, role conflict, responsibility for persons, intrinsic impoverish-ment, low status, strenuous working conditions and unprofitability. The reason might be that special children require more attention and care. The needs and wants of a special child are completely different from that of a regular child and also that each special child requirements are different from that of other. The special educators has to play a dual role, one in the stream of academics and other that of a special educator who for example has to acquaint the child with simple self-help skills for example from simple food habits to personal hygiene, to dress and un-dress themselves. A parent of the regular child teaches such basic things to their children but for a special child more repetition is needed in school but at times the educator feels that her labor is not of much use. The other reasons might be, the conditions which are provided in the special schools are not satisfactory compared to the regular schools and that the pay which they get for their service is not satisfactory because the number of hours and the amount of labor which they give is much more as that compared to the regular educator. While no significant difference is present in the dimensions of unreasonable group and political pressures, under participation, powerlessness and poor peer relations. This may be because both the groups do not belong to any political groups and they work in apolitical environment. They are getting similar opportunities according to their capacity and are allowed to participate in events of the institution and also that both the groups to some extent are given the power to take decision for the betterment of the children.

Correlation Coefficient was also found out in the research conducted. Correlation Coefficient was found for both the groups among all three the variable that is occupational stress, depression and reaction to frustration. In both the groups among all the three variables positive relationship was found. This means that being high on one variable would lead to the high score of the other variable.

Conclusion

Educators are an integral part of a child's life. They are the one who are responsible for adding colors to the life of children. They play a very important role in providing individuals who are educated and in near future will work for the betterment of the country. They help the children to establish a name for themselves in the society.

The job of an educator is not an easy one. He/she is given the responsibility to shape the nation. While performing this job they might be stressed, depressed or at times get frustrated. The levels of the above mentioned factors can be higher in a special educator because they have a major responsibility on their shoulders. They have to live to the expectation of themselves as well as of the child's parents. Most of the times the reward in terms of response which they get from children is negative.

Thus from the study it may be concluded that special teachers are occupationally stressed, depressed and also react when they are frustrated compared to the regular educators.

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A Study on the Impact of Yoga and/or Meditation on Life Satisfaction and Level of Anxiety, among Women Working as Professionals

Shruti Agarwal and Punam Mehra

ABSTRACT

The present investigation was undertaken with the aim to study the impact of yoga and/or meditation on life satisfaction and level of anxiety among 141 women (married and unmarried) working as professionals between the age group of 25-40 years. The obtained results reflected that there is no significant difference between professional women (married or unmarried) practicing or not practicing yoga and/or meditation in the dimension of life satisfaction and anxiety. There is also a significant negative relationship between the total anxiety and life satisfaction.

Keywords: Anxiety, Life Satisfaction, Meditation, Yoga.

Introduction

In the age of advanced thinking and unparallel discoveries of Science and Technology, and the materialistic world of rat race, human beings might undergo a lot of problem. There is no time to explore ones inner depth and nature and no peace of mind and happiness. Due to this, they might not have a strong health and positive attitude towards life[7].

But the group most affected by these pulls and pressures are the women. They are under a lot of physical and mental pressure. She now does the work of not only maintaining harmony in the family, but also taking up employment, not only to meet financial pressures, but to fulfill her own social and psychological needs. Exposure to constant stress and strains of modern life might have an impact on their health and mental peace; which plays a deciding role in determining their quality of life and in turn making them anxious[1].

Anxiety : Worries, when frequent and intense, may lead to anxiety, a "painful uneasiness of mind concerning impending or anticipated ill"[2].

Life Satisfaction : Life Satisfaction has been defined as the function of the physical, psychological and social well being[5].

Therefore, a professional woman now tries to find means to reduce anxiety and be mentally at peace and thus to achieve Life Satisfaction. One of the means to achieve this peace of health can be without the aid of drugs and tonic, but through Yoga and Meditation[1]. The daily practice of Yoga and Meditation might be of great help to modern women, to live a full balanced and peaceful life[7].

Yoga on one hand covers a very vast field- from the various realms of conscious and sub conscious planes to physical, mental, moral and spiritual aspects[3] while Meditation on the other hand calms the mind, brings self composure and enables one to concentrate ones mental powers[6].

Thus, it is being increasingly realized and recognized by modern psychologists that Yoga and Meditation should form part and parcel of the daily routine of everyone, especially today's working women, in order to provide a counter-balance to the intensely active life that women are involved in the present-day world[6].

Methodology

The sample consisted of professional women practicing yoga and/or meditation (48 married and 24 unmarried) and professional women not practicing yoga and/or meditation (45 married and 24 unmarried) between the age group of 25-40 years in the city of Kolkata. The technique used for the collection of data in the present study is Questionnaire Method. The tools used in the present study were:

1. State Trait Anxiety Test (STAT) by PSY-COM services[4].
2. Life Satisfaction (LS-SCALE) by Dr. Promila Singh and George Joseph[5].

Results and Discussions

The present study was undertaken with the aim to find out, the impact of Yoga and/or Meditation among women working as professionals. The results obtained from the present study with two variables, Anxiety and Life Satisfaction of the four groups are cited below.

Key For Table 1

Group 1 Married Professional Women practicing Yoga and/or Meditation

Group 2 Unmarried Professional Women practicing Yoga and/or Meditation

Group 3 Married Professional Women not practicing Yoga and/or Meditation

Group 4 Unmarried Professional Women not practicing Yoga and/or Meditation

Table 1 : Showing The mean (M), standard deviation (Sd), "t" Values And correlation Coefficient (R) Of The Four Groups Among anxiety And life satisfaction

Areas	Group I		Group 2		Group I		Group I		't' Values	
	M	SD	M	SD	M	SD	M	SD	Group I & III	Group II & IV
Guilt Proneness	8.89	3.89	9.16	3.55	9.66	3.37	10.58	4.09	1.04	1.29
Maturity	3.7	2.38	4.62	2.73	4.46	2.19	4.83	2.07	1.48	0.3
Self Control	4.66	3.09	5.95	3.02	4.6	3.38	4.62	2.53	0.09	1.66
Suspiciousness	4.81	1.61	4.58	1.52	4.51	1.47	5	1.41	1	1
Tension	9.31	3.68	9.37	3.84	8.95	3	9.37	3.06	0.72	0
TotalAnxiety	31.47	11.03	33.7	10.66	32.2	9.67	34.41	7.48	0.33	0.26
Life Satisfaction	146.85	13.6	146.29	14.18	145.77	12.26	140.54	12.16	0.4	1.5
(r)	-0.70		-0.32		-0.03		-0.50		—	

* $P \leq 0.05$

** $P \leq 0.01$

From the obtained result, it has been found that in the first dimension of Anxiety (Gp) Guilt Proneness, there is no significant difference between Group I and III and Group II and IV. This means that all the four groups have similar Guilt Proneness. According to the mean values, of dimension Guilt Proneness (Gp), it was found that all the four groups were low on Guilt Proneness; which indicates that they tend to be self-assured, confident, sincere, and placid, with unshakable nerve. They even tend to have mature, unanxious confidence in themselves.

In the dimension of (Ma) Maturity, there is also no significant difference between Group I and III and Group II and IV. The mean values were low in this dimension; this indicated that they show high Maturity (Ma). They are thus emotionally stable, face reality and are calm.

There is also no significant difference in the dimension (Sc) Self Control between Group I and III and Group II and IV. The mean values were low showing high Self Control (Sc). The results depicted that they are very inclined to be socially aware and careful. It may also be said that they are socially very precise and follows self-image.

Furthermore, from the results obtained it has been found that there is no significant difference in the dimension (Su) Suspiciousness between Group I and III and Group II and IV. It was also found that the groups show average mean values in dimension Suspiciousness (Su), i.e., they are average in this dimension which means that at times they are suspicious, mistrusting and doubtful while at other times they are trustful, moderately adaptable, cheerful and free of jealous tendencies.

In the last dimension of anxiety, (Tn) Tension, it has been found that there is no significant difference between Group I and III and Group II and IV in the dimension (Tn) Tension. The mean values were average in this dimension Tension (Tn) indicating that all the four groups face some degree of tension, frustration and restlessness.

Over all, it was found that there is no significant difference between professional women (married or unmarried) practicing or not practicing yoga and / or meditation in the variable anxiety. This means that all the four groups have similar anxiety. The mean values indicate that Group I and Group II as well as Group III and Group IV were low in this dimension.

In the variable Life Satisfaction, there is also no significant difference between Group I and III and Group II and IV. The mean values revealed that all the four groups are highly satisfied. They are free from tension, take interest in life and have a happy and optimistic outlook.

Correlation Coefficients were also found out of all the four groups among anxiety and life satisfaction. The results indicated that there is a significant negative relationship between the total anxiety and life satisfaction.

Conclusion

Thus from the present study it may be concluded that professional women (married or unmarried) practicing or not practicing yoga and / or meditation have similar Level of Anxiety. As far as Life Satisfaction is concerned, all the four groups are highly satisfied; irrespective of their marital status and whether they are practicing or not practicing yoga and / or meditation.

Furthermore, it may be concluded that among all the four groups, i.e., Group I and II as well as Group III and IV, there is a significant negative relationship between the Total Anxiety and Life Satisfaction.

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Preference of Toys among Preschoolers

Megha Gajendra Jain and Krishnakali Bhattacharyya

ABSTRACT

To investigate the preference of toys, viz, dolls (western- Barbie doll and traditional- Rajasthani Putli) 25 preschool girls between 2-6 years of age were studied. Data were obtained by interviewing the mothers and through participant observation while the children were playing with the dolls provided to them. Content analysis was done with the gathered qualitative data. It was found that the mothers choose toys for their children focusing on their educational values of the toys whereas; children choose toys to which they get attracted. The findings revealed that nothing much changed with time as both mothers during their childhood years and children now play with dolls at home. It was further found some children preferred Barbie ignoring the traditional doll while some done the reverse showing preference and playing with the Rajasthani Putli. Few children also liked both the dolls. Some formed attachment with the doll(s) within a short span of time, reflected in their crying to part with them. Types of play behavior being observed were imaginative play, associative play and group behavior.

Keywords: Dolls, Play, Preschool Children, Toys

Introduction

A toy is any object that can be used for play, are usually associated with children. Toys and dolls, distinct in their vibrancy and colors, transport the child to the world of unbound imagination. They bring to life a fascinating world of fantasy, engrossing a childhood full of dreams[4]. They energize their imagination, exercise their body, teach them to think, and invite them to socialize. Toys not only help children mature emotionally but, they also help them learn emotional control. Children play to express themselves via fantasy and play results in part from wish fulfillment.

One kind of play that generally becomes more social during the preschool years is imaginative play, which shifts from solitary pretending to dramatic play involving other children[2]. Young children follow unspoken rules in organizing dramatic play, staking out territory, negotiating or setting the scene. As imaginative play becomes increasingly collaborative, story lines become more complex and more innovative. Dramatic play offers rich opportunities to practice interpersonal and language skills and to explore social roles and conventions[1].

Play and playing behavior goes through various transitions and significant changes occur. But mostly children play to express themselves via fantasy and play results in part from wish fulfillment.

Overall, toys are the essence of play and play is essential activity of children, which helps them organize and understand themselves and their environment[3].

Methodology:

Present investigation was done on 25 preschool girls between the age group of 2 years to 6 years who belonged to Marwari Community and residing in west Bengal from past two generations.

Participant observation was used as the main tool to carry out the present study along with the interview method.

In the present study data were collected by observing the play behavior of the girls when they were provided with the dolls (Barbie doll and Rajasthani doll) through participant observation which is any act of observation undertaken in circumstances which include the observer as a part of the situation or setting which is being observed. Mothers of each child being observed were interviewed. The interview schedule was in the form of questionnaire.

Qualitative analysis of the data was done.

Results & Discussions:

The present study found that mothers who choose toys for their children reported that they mostly choose the toys on the basis of some requirement of their children, like toys which have educational value. On the other hand, when children are choosing their toys they were mostly on the basis of attraction, while some ask for the toys that they have seen somewhere or belonging to someone else.

Regardless of the mother's emphasis on buying toys of educational value it was found that the children at home play with dolls and kitchen sets. This reflects the age old preference for dolls among the girls and also a reflection of imaginative play which takes its shape with the dolls and kitchen set is what mothers reported, a play called 'ghar-ghar'. Researchers have proposed that fantasy play may serve to develop the capacity for using imagery, which is necessary for adaptive thinking about the past (memory) and the future (imagination)[5].

Mothers of these children reported that they used to play with traditional dolls or the dolls available at that time, except one who reported to be playing

with Barbie but use to dress it in an Indian traditional way. So it may be said that with passage of time nothing changed much particularly with the way the girls play and the type of play and the materials they take into account while playing. The only exception being emphasized on educational value of toys by the mothers.

Another important aspect which came to light with respect to the children of the joint family is that of playing together, they prefer to play in groups. To them being in a group is more important than the type of toy being played with.

Preference For Barbie Doll - Data obtained through observing girls revealed that out of 25 girls the ones who preferred to play with Barbie doll are 10. Among these few were observed one time, few twice and some were even observed thrice. It can be said that while playing with the Barbie doll some of the girls revealed some kind of imaginative play whereas, unoccupied behavior, onlooker behavior, solitary independent play, parallel play and associative play were also being observed. However, most of the girls were assisted by some or the other authority from the family itself as their presence made them feel secure and comfortable and helped them feel secure and comfortable and helped them overcome the stranger anxiety or the anxiety of being observed by the researcher while they were playing. It was found with repeated exposure of dolls, the child grew a sense of familiarity and played with Barbie, even making a choice and showing preference for it over the other, traditional doll.

Preference For Traditional Rajasthani Doll - Data obtained through observing 25 preschool girls revealed that number of girls preferred traditional doll were 10 when observed once, twice and thrice. Number of girls who were observed one time and preferred to play with traditional dolls were 4. 4 were observed thrice who chose to play with traditional doll. It can be said that while playing with the traditional Rajasthani Putli all girls made it dance and the main reason for their liking for the doll was the dress worn by the doll and their identification with the culture. It was also observed while interacting with the children that although play can manifest itself in different ways its spontaneity may be hampered by presence of others.

Liking For Both The Dolls - Out of 25 girls being observed 5 of them equally liked both the dolls i.e. they played equally with both the dolls, not showing a feeling of liking of one over another. 4 girls observed 1 time choose to play with both the dolls and only one girl who was observed twice preferred to play with both the dolls. It was observed that the girls who showed preference and played with both the dolls reflected associative play, imitative behavior, imaginative play and also make-believe play. One common activity that was observed in all was making the traditional Rajasthani doll dance.

Conclusion

In the present study when children were provided with Barbie doll and traditional Rajasthani Putli, no specific trend for preferring one over the other was found among all the 25 preschool girls of 2-6 years being studied, when children were provided with Barbie doll and traditional Rajasthani Putli. Rather equal number of girls (10 each) preferred Barbie and Rajasthani Putli. The rest played equally with the two toys. Interestingly, it was found from the responses of the mothers that although they prefer to buy toys having educational value, children prefer to play 'Ghar-Ghar' with dolls and kitchen set at home. This play is no different from what their mothers have played during childhood years. Thus it can be said that dolls, as good toys are rooted in tradition.

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A Study to Identify Factors Influencing the Preference for Branded Women's Wear Among Different Socio Economic Groups

Neha Hoon and Atri Chakraborty

ABSTRACT

The study was carried out to identify the factors influencing the preference for BW'sW among different SEG's. For this purpose my sample of 100 women were divided into four equal groups (A, B, C and D) on the basis of their EL and IIPA to ensure uniformity in representation from different SEG's. Group A represents women with lowest IIPA and EL while women of group D had the highest IIPA and EL compared to the other three groups. Information regarding the BBW was collected using the QM in the COK.

In this study we identify the major nine factors which significantly affect the preference for BW'sW. All these nine factors play a major role in influencing a woman in her purchase decision. Some other findings results showed that there is difference in BBW that is the difference in their frequency of purchase, different sources of purchase. It also revealed that most of the women from all the four groups were found to be highly interested in new trends. My study reveals that urban women from the COK are in general aware about the different BW'sW available in the market even though women from different SEG's differ in their buying pattern.

Keywords: Branded Women's Wear (BW'sW), Buying Behavior of Women (BBW), City of Kolkata (COK) , Educational Level (EL) , Individual Income Per Annum (IIPA), Socio Economic Groups (SEG's), Questionnaire Method (QM).

Introduction

With changing lifestyles, consumers are becoming increasingly sensitive towards the brands they use. This is because brands express & reinforce certain values and opinions that the consumer has. There is a common misconception among marketers that branded women's wear are only for the rich affluent class of people and that middle class women cannot afford branded women wear. The reality is far different , currently women from different socio economic backgrounds whether employed or unemployed are able to purchase branded wear due independence of finance available , cash or credit facility & more plentiful shopping venues than the prior socio economic groups today's women is perhaps the busiest, most market-savvy consumer group[1].

"A brand that captures your mind gains behavior. A brand that captures your heart gains commitment." - Scott Talgo, Brand Strategist

Brand awareness: Brand awareness is commonly used in marketing communications to measure effectiveness. It investigates how many targets customers have prior knowledge of a brand as measured by brand recognition and brand recall.

Brand Knowledge: It is by definition an aggregate, i.e. brand level phenomenon so it can be considered to depend upon total number of positive image association held by the market. Thus, it can be expressed as a sum of brand awareness and brand image.

Brand Loyalty: It can be defined as preference of attitude or behavior towards one brand in a product category or inertia which refers to the repeat purchase behavior out of convince or indifferences.

Brand Switching :Brand Switching can be defined as purchasing pattern characterized by a change from one brand to another[4].

Consumers buying behavior : The term consumer behavior can be defined as the behavior that consumers display in searching for purchasing, using evaluating and disposing of products, services and ideas which they expect will satisfy their needs. The study of how individual makes decision to spend their available resources (money, time, energy) on consumption related items. It includes the study of what they buy, why they buy, how they buy it, when they buy it, where they buy it, and how often they buy it.

Factors influencing consumer buying behavior: Cultural factors: Culture, sub culture and social class are particularly important influences on consumer buying behavior. Culture refers to sect of values, ideas and attitudes that are accepted by a homogeneous group of people and transmitted to the next generation. Culture also determines what is acceptable with product advertising. Culture determines what people wear, eat, reside and travel. Each culture consists of smaller sub-cultures that provide more specific identification and socialization for their members. Subcultures include nationalities, religions, racial gaps & geographic regions. Social factors: In addition to cultural factors, a consumer's behavior is influenced by such social factors such as reference groups, family, social role and status[2].

Reference group consists of all the groups that have a direct or indirect influence one person atti-

tude or behavior. Some primary groups are family, friends, neighbors and co-workers, with whom individuals interact fairly, continuously and informally. Secondary group, such as professionally and trade union groups tend to be more formal and require less continuous interactions[6].

The family is the most important factor influencing consumers buying decision. The family of orientation consists of ones parent and siblings. The person's position in each group can be defined in terms of roles and status. A role consists of the activities that a person is expected to perform. Each role carries a status. People chose products that communicate their role and status in society.

Personal factors: The third factor affecting consumer buying decision is personal characteristics, including the buyer's age, stages in life cycle, occupation and lifestyle unique to a particular person.

Advertising and Psychological Factors: All successful advertisement must make a sufficient number of contacts to (1) capture attention (2) hold attention (3) to make useful lasting impression. The impression should have selling value must last until there is an occasion to buy. These objectives relate to such psychological terms as interest, attention, desire, emotions, belief, conviction, association and memory. The objective or requirement of every advertisement is that it makes an impression which will get the kind of response the advertiser wants. For most advertisements this means that the impression either has direct selling value or will aid somehow in making sales easier. The quality of impression made is fundamental in determining the effect of advertisement[3].

Fashion - "Fashion is the signs of appearance, and it inspires one with the desire to seem rather than to be." – Henry Fielding.

Practical consideration - Price: Consumer wants the best brands at the best price. Price is probably the most important consideration for the average consumer striving for a branded wear. They may compare the total perceived worth of a style with the retail price and with their own budgets.

Fit: Size is not guarantee of fit. It is difficult to set size ranges and grading rules to fit every figure. Each brand tries its sample garment on models with different figure size which are typical of its target costumers, which make sizing, vary from brand to brand.

Comfort: People need clothes to keep warm in cold weather or cool in warm weather. With the rising population an increased traveling, people also want clothes that are comfortable to move in, sit in, and travel in and so on. So keeping this under consideration a brand has to decide its wear and product accordingly.

Appropriateness: It is important that consumers find suitable or acceptable fashion for specific occasion or to meet the needs of their lifestyles. Consumer consider their clothing needs for job and leisure time activities as well as what is appropriate for their figure type, personality, coloring and age.

Brand or designer label: Brands are a manufacturer's means of product identification. Some consumers buy on the basis of a particular brand reputation, often as a result of heavy advertising. Designer Giorgio Armani said,' a brand name is important as long as it is combined with a proper relationship of quality and price."

Quality: Consumer demand for quality has risen in recent years. The designer or bridge customer considers clothing as an investment and may not mind spending more for the lasting qualities of fine detailing and work man ship. Some consumers may look for a particular brand or name on the basis of a reputation for quality.

Convenience: With time and energy in increasing short supply, consumers are looking for ways to make shopping easier. Consumers want to find what they need easily and quickly. In response to consumer's needs, catalog and internet shopping for branded wear has increased. In the stores, consumers are demanding services and in-stock assortments[7-10].

Fabric performance and care: The durability of a garment and the ease or difficulties of caring for it are often factors in selection. Many consumers prefer easy-care fabric because they do not have the time or interest in ironing or the money to pay for dry cleaning. To protect the consumers, government regulation may require fiber content and care construction labels to be sewn.

Methodology

Sample selection: The study was carried out in the city of Kolkata. The sample consisted of hundred urban women ranging from primary educated to highly educated women (i.e. whose educational qualification ranged from below graduation and goes up to doctoral and professionally qualified).The women falling between the age group 15-55 years whose individual annual income ranges from no income to five lakhs and above. Such families were chosen who were either nuclear, joint or joint extended families comprising of number of family members and number of earning

members in the family. This population was then subdivided into four groups A, B, C and D, on the basis of their income (per annum) and educational qualification (Table 1):-

Table 1: Division of population on the basis of Income and Education

Groups	Education Level	Income (per annum) INR	Groups
Group A	Below Graduation	0 – 1,50,000	Group A
Group B	Graduation	1,50,001 – 3,00,000	Group B
Group C	Post Graduate + Doctoral	3,00,001 – 5,00,000	Group C
Group D	Professional	5,00,001 and above	Group D

Tool Selection: To carry out the survey it was necessary to construct a questionnaire schedule. Keeping the objectives in mind, the questionnaire was thus constructed to obtain the needed information. The individual statements were phrased in simple, easy to understand, unambiguous and precise language so that the respondent would not face any problem while answering them, and would give the most suitable and correct answers as possible. Confusing and misleading statements were avoided.
Collection/Processing of Data: The personal distribution of the questionnaire was the procedure for collecting data from the respondents (women) personally and individually from each group. The investigator had to approach the respondent (women) individually for the distribution of questionnaire scheduled. It was made sure that the questionnaire was only distributed to the women who were falling under the criteria of the four groups formed. A personally administered questionnaire was judged to be the best technique for the collection of data. The data was collected by the primary data collection method.
Analysis Of Data: Once the data were collected, emphasis was logically turned to analysis which amounted to the research for meaning in the collected information. A coding plan and Spearman's rank correlation coefficient method were used.

A coding plan was developed which included the code for each item in the questionnaire scheduled. The data from each questionnaire was tabulated in the code sheet. The tabulation was done according to the objective. In the first place, the education, family income (per annum), number of earning members in the family, number of family members and the frequency of purchase of the respondents were calculated and tabulated.

In the questionnaire scheduled the question was asked what are the factors influencing her purchase whether she was affected by the price, product quality, comfort, availability. The analysis of their answers were done and tabulated. These factors were ranged according to their level of importance the most important factor was ranked while the least important was ranked 9 for all the four groups. This was the evaluated by Spearman's rank correlation coefficient was used to evaluate the assumed main nine factors affecting the women's buying behavior for all the four groups. This was calculated by the given formula:

$R = 1 - (6D^2) \sum n (n^2 \cdot 1)$

Where, n = Number of factors

D = Difference in ranks of a group

Results & Discussions

Various factors in relation to difference in education and income of an individual (woman) coming from different socio economic backgrounds were analyzed. This was done to be able to evaluate/ find out the differences in the buying behavior of women belonging to different socio economic backgrounds and even the factors affecting their buying behavior. The results evaluated through this study were used to conclude and justify the objective of my study. Hence the followings were evaluated from this study:

The results showed that the buying behavior of women that is their frequency of purchase which decreased from shopping weekly to monthly and it is relatively at a much higher scale during half yearly and yearly as we move on from group A to B to C and D respectively. It is seen that women from all the four socio economic groups are more planned than impulsive in their shopping pattern. Women from group A and B are more influenced by their friends & relatives while making their purchase decision when compared to women of group C and D. It is seen that women from all the 4 groups like to purchase their wear from departmental store compare to other shopping outlets. Women of group A and B purchase more during special offers while women of group C and D purchase more from fresh stocks compared to all the other offers available in the malls. It also revealed that most of the women from all the four groups which were considered were highly interested in new trends. Hence in this study we identify these major nine factors price, comfort, quality, look / style, brand name, credit facility, installments, packaging and extra benefits which significantly effect the preference for branded women's wear. All these factors play a major role in influencing a woman in her purchase decision. These nine factors were evaluated through Spearman's rank correlation coefficient method. It

was found that since the rank correlation coefficient is the largest between B and C, the groups B and C have the nearest approach regarding the factors affecting the buying behavior of women's wear. While rank correlation coefficient is lowest between C and D, the groups C and D have the furthest approach regarding the factors affecting the buying behavior of women's wear.

Hence one can conclude that women of groups B and C have a high similarity when it comes to purchasing their wear. The above evaluated factors are very strongly noted in women falling under B and C socio economic groups which reflect their buying behavior. Whereas the women falling under the socio economic groups C and D thinks and behaves very unlike when it comes to purchasing their wear's.

Conclusion

Hence the study to indentify factors of influencing the preference for branded women's wear among different socio economic groups towards purchase of women's wear was conducted. The conclusion derived from the results of this study is summarized as:

1. The present study shows that majority of women from all the four groups A, B, C & D are more planned than impulsive when it comes to shopping of their wear.
2. From the survey in regards to my study it was seen that women of group A & B are more influenced by their friends/relatives, where as women of groups C & D believe in making their own decision while making their purchase decision.
3. It was found from the survey that women from all the four groups would mostly like to purchase their wear from departmental stores as compared with other shopping outlets.
4. The study reveals that women of group C & D are purchasing maximum fro fresh stocks, where as women's of group A & B are purchasing maximum during special offers. While purchase behavior is relatively high in group C compared to the other three groups, it is the lowest in group D during this period.
5. It has been found that with increase in education and income the frequency of purchase decreases from weekly to monthly to quarterly to half yearly and yearly from all the four groups.
6. From the survey it was found that women of all the four groups are aware about the different brands available in the market. While women of groups A & B possess lesser branded garments in comparison to the women of the other two groups.
7. The study reveals that majority of women from all the four groups have purchased a branded apparel some time in their life by just seeing its advertisement, offers, lucky draw and samples etc.
8. It was seen that the majority of women from all the four socio economic groups were more interested in the new fashion category in comparison to the other mentioned.
9. The study shows that women of groups B & C have the nearest approach and while women of groups C & D have the furthest approach regarding the aforesaid factors affecting the buying behavior of women'a wear. The study revealed that there are nine major factors which affect the buying behavior of urban women from the city of Kolkata. Price is one of the major factors one has to pay to for the product .The quality & comfort as the 2nd and 3rd most important factors. It was noted that brand label also influenced the buying decision of many urban women. Look / style of a wear are the first aspect which attracts women which makes her consider the factors and make her decide whether to buy or not to buy the outfit. Paying in installments and credit facility also influences one to buy expensive wears. Packaging of a product influence the customer to buy that product. It also assists in differentiating one brand from another. Last but not the least extra benefits like exchange offers, free gifts, coupon, contest etc initiate the women from different socio economic backgrounds to try out a new brand and at the same time make them aware of the new brands in the market. Hence these nine factors were identified as the major factors influencing the preference for branded women's wear for women belonging to different socio economic backgrounds.

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A Study on Identifying the Physical and Behavioural symptoms of Stress among nurses working in Shifts, in Private hospitals

Nancy Jaiswal and Ishita Biswas

ABSTRACT

In three private hospitals of Kolkata, a research work was carried out to identify physical and behavioural symptoms of stress among nurses working in shifts. The study was conducted on ninety nurses, thirty from each hospital through questionnaire method. Quantitative analysis was generally done through percentages and cross tabulations. The study revealed that some form of physical and behavioural stress was experienced by nurses. For physical stress, Fortis hospital and for behavioural stress Mercy hospital was the least variable. Back pain and often feeling fatigue besides working hour was identified as the most common physical symptoms of stress. Disturbance in sleep pattern, non adaptation to the frequency of changes in the shifts and lack of appetite was mostly seen in night shift nurses. Age, number of years in nursing profession, marital status of nurses and their area of professional specialization also contributed to experiencing stress to a high degree. The study revealed that nurses working at night shift and those married, were stressed more, in private hospitals in Kolkata metropolis.

Keywords: Behavioural Symptoms, Physical Symptoms, Shift Work, Stress.

Introduction

Stress is thought to be the principal cause of physical illness and millions of working days every year are believed to be lost as a consequence of this[6]. Stress levels in various occupations are known to differ[1]. Stress on the job becomes an occupational hazard for "helping" professionals such as physicians and nurses[2]. Since nursing is repeatedly referred to in the literature as an inherently taxing profession hence one third of nurses report their occupational stress as high[3]. As stress begins to take its toll on the body and mind, a variety of symptoms on physical level such as lack of energy, headaches, muscle tension, gritting teeth, feeling of being bloated or constipated without any apparent physical cause is experienced. Some of the common behavioral effects of stress may be nervous habits such as pacing, moving legs up and down or nail-biting, unable to carry out normal tasks, eating too much or not enough, disturbed sleep pattern, neglecting responsibilities altogether[2].

Nowadays it is justifiable to talk about occupational sickness among shift workers. The dominant symptoms being those of chronic fatigue are weariness even after a period of sleep, mental irritability, moods of depression, general loss of vitality and disinclination to work. The state of chronic fatigue is also accompanied by loss of appetite, disturbance of sleep, digestive troubles and stomach and duodenal ulcers[5].

Ongoing changes in the private health care system include the feeling that professionals themselves have to work longer, in different shifts to maintain their current economic status[8]. These trends strongly influence the workplace environment and are a potential source of stress among nurses working in hospitals. Since studies have found that shift work is a common occupational stress factor[7] and most of the nurses today have jobs requiring them to work in shifts[9], hence stress in the occupation can cause all kinds of disruptions like lower productivity and increased workload, which is not good for a healthcare industry[4]. Bearing this in mind, the present study "Identifying physical and behavioural symptoms of stress among nurses, working in shifts in private hospitals" focusses on experiencing various symptoms of stress, aiming at providing contribution to the development of further better qualified nursing assistance, even though this research subject has been explored widely by academic studies lately.

Methodology

Since the researcher was a resident of the city of Kolkata, hence the study was conducted in the same city itself, during the period of November 2010 to February 2011. The subjects of the study were nurses currently working in shifts in private hospitals of Fortis, Mission of Mercy and Nightingle, comprising the sample size as ninety. Since hospital industry is a busy scheduled industry hence questionnaire method through random sampling was considered to be the most appropriate. In order to give weightage to the questionnaire, all the physical and behavioral symptoms of stress, which were in form of questions, were scored accordingly. An average mean score for physical stress was calculated, which determined whether the nurses were stressed out. No statistical test was performed. Both quantitative and qualitative analysis of the data was done. Quantitative analysis was generally done through percentages and cross tabulations. Bar diagrams, line diagrams and pie charts have been used to analyze the quantitative data.

Results and discussions

The qualitative data generated by the respondent was used to strengthen the quantitative data generated. The result yielded for thirty nurses from each hospital – Nightingle, Mercy and Fortis, after the process of scoring, was converted in the form of mean and standard deviation. The study revealed that some form of physical and behavioural stress was observed in the samples collected from all the three hospitals. For physical stress, Mercy hospital had scored a mean average of 6.3 with standard deviation 2.7. Average mean for behavioural symptom of 10.6 was obtained from Fortis hospital and the sample collected from Mercy hospital was the least variable among the three hospitals.

This research allowed us to affirm that nursing professionals in private hospitals, in their vast majority were from the age group of 20 - 25 years with the highest response to the questionnaire from general care unit. Nurses claiming their jobs to be stress free had been working for a mean duration of more than 5 years.

As it was assumed by the researcher that nurses working in private hospitals, would experience stress on various levels, the results in the findings were significantly different. It was found in the study that only 12 % of the respondents experienced frequent headaches whereas of the total respondents, 61% of the sample was not at all prone to coughs, colds and flu. Chest pain, as a symptom of physical stress was experienced frequently by nurses from Mercy Hospital. The result yielded was negative, when nurses were asked to report if they had a habit of drinking excessive tea/coffee during their shifts. Similarly, a large percentage of 86 % of the respondents denied the habit of grinding teeth when under pressure, thus proving the researcher wrong in her assumptions and no marked distinction was seen in the sample of the three hospitals. Only a small percentage of respondents were noted to have complaints regarding their behavioural symptoms when they experienced stress. Opposing to the assumption of the researcher, only 20% of the nurses had the habit of nail biting, Nightingle Hospital being noted with the highest percentage for the same.

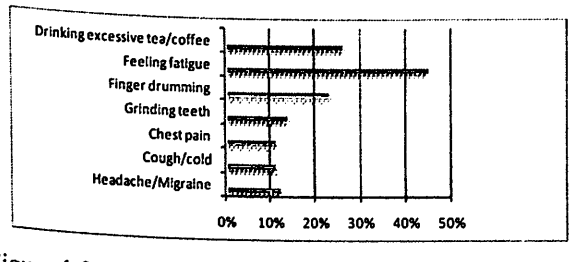

Figure 1.0 A bar graph to show the percentage of physical symptoms of stress experienced by nurses.

The researcher explored different variables like age, marital status of the nurses and number of years of their experience in nursing profession which were taken into account to study the various aspects of stress.

Nurses from the age group of 20-25, felt that they were stressed "frequently", which resulted in physical stress in form of back pain, being most prominent in this age group. Physical stress was identified with 32% of respondents having problem of migraine, 43% of the respondents with cough/colds and another 10% of the sample with chest pains experienced "sometimes". Hence, physical stress often overwhelming seemed persistent in the lower age group.

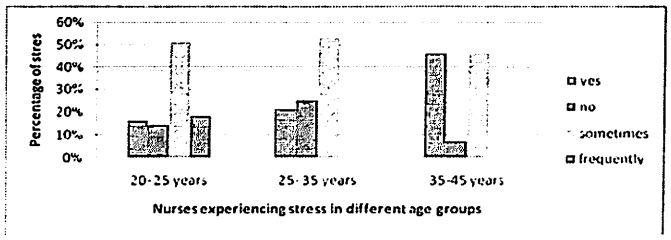

Figure 1.1 Bar graph showing stress experienced by nurses in relation to their age.

It was found in the study that the married nurses experienced stress at a higher level than single women participants. Out of the total married women, 14% of them experienced stress frequently which was higher when compared to the nurses who were single. Nurses who were married, undergoes physical workload contributing to 31% of the total workload.

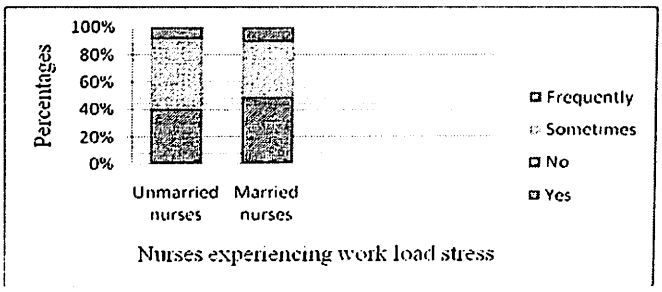

Figure 1.2 Bar graph showing work load stress in relation to the marital status.

TABLE 1.0: Table showing source of job stress among single and married nurses.

MARITAL STATUS	N	%	SOURCE OF JOB STRESS									
			ROLE EXPECTATION		BLOCKED PROMOTION		CONTINOUS VIGILANCE DURING WORK		WONDER WOMAN SYNDROME		OTHER	
			N	%	N	%	N	%	N	%	N	%
(a)Single	55	62	28	50	1	2	11	20	5	10	10	18
(b)Married	35	38	19	56	5	14	-	-	9	25	2	5

Nurses do suffer from lack of role clarity and role conflict. This was revealed in the study when fifty six percent of nurses, mostly married considered "role expectations" as the major source of stress. Most of the nurses having the responsibility of home and family, kept on juggling at the expense of their physical health. Thus wonder woman syndrome contributed to be an important stressor among married nurses.

A significant relationship was found between nurse's competency and their years of experience. Nurses with experience of five years & more had higher levels of competency. This relationship was stronger for older nurses than younger nurses. The latter experienced significantly more personal self-doubt.

The study revealed that nurses working at night were more stressed out than those working during day time. A marked percentage of the nurses working in night shifts had a habit of nail biting and the tendency to sweat for no good reasons. Breathelessness without much exertion, was also accounted for the nurses working in night shifts.

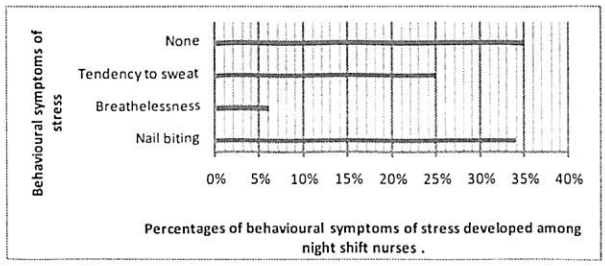

Figure 1.3 Bar graph showing behavioural symptoms of stress among night shift workers.

Much emphasis was given on the quality of sleep to determine whether the nurses suffered from the problem of sleeplessness. More than fifty percent of the nurses, who were generally assigned day shifts, rated their sleep quality as good. The data as decoded in the study, concludes that almost 86% of the nurses having more of night shifts, slept less than four hours during daytime which is an indicator for poor sleep caused to nurses because of their shifts.

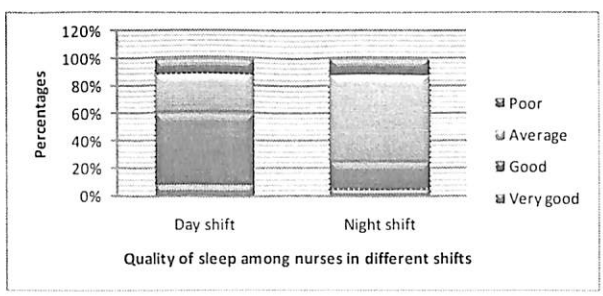

Figure 1.4 Bar graph showing sleep quality of day shift and night shift nurses.

The rate of adaptation to the frequency of the shifts was higher for the nurses in day shift than those in night shifts. Out of 49% of the nurses having night shifts, only 57% were adapted whereas the remaining 43% were in a way to being adapted, thus leading to physical problems such as lack of appetite and frequent indigestion.

Out of 51% of the nurses in day shifts, almost 63% felt a lack of concentration which was much higher than 32% of the nurses who felt deviated from concentrating on their job, working in night shifts. Thus it may be concluded that since night shift workers were more prone to acute and chronic stress yet they did not deviate from their job concentration. On the other hand, nurses working in day shifts, undergo less stress yet they felt more declined from their concentration level.

Conclusion

Nursing is known to be a stressful profession. Nursing staff working at the bottom of the hierarchy, in hospitals are the ones who are more stressed out. There is a paucity of data on prevalence of stress amongst nurses in the health care industry in the Indian setting. Stress among nurses results in a decrease in the quality of life. Stress experienced by nurses on the job adversely affects the quality of their nursing care, "It is the draining of emotional resources that limits the ability of the nurse to engage effectively with the patient on a psychological level". According to these facts, it is crucially important that the professionals who work in health care industry receive special attention; hence, this study can be considered as decisively valuable for the Nursing field as a whole, bearing in mind the need for favorable means that provide these workers with integral health. Studies on the manifestation of occupational stress among nurses can bring a better understanding of the problems faced by these professionals, and allow for intervention proposals and a search for solutions. Hence the research project "Identifying physical and behavioural symptoms of stress among nurses, working in shifts, in private hospitals" was carried out in Kolkata, keeping in mind, hardly any research have been done before in private hospitals.

Thus this research studies that people react to stress in different ways, manifesting itself in physical and behavioural symptoms. Different stressors are responsible for stress in different people. Nurses who were reported as being too stressed had a range of health and behaviour problems, highlighting the clear links between high stress scores and adverse working conditions.

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A relationship between anthropometric measurements and kitchen designs in simplification of kitchen activities.

Neha Golchha and Roshmi Banerjee

ABSTRACT

An intensive survey was conducted on 7 Kitchens of 7 Indian families. The anthropometric dimensions of each kitchen were studied. The average height of the kitchen users were 5'3". Each user prepared a standard Indian meal for 5. The kitchen that consumed the least possible time was identified as the Model. Analysis showed that anthropometric measurements were not taken into consideration while designing.

Link was established between factors affecting work simplification, anthropometrics and architecture. The kitchens were redesigned to yield improved level of work simplification and customer satisfaction.

Keywords: Work Simplification, Anthropometrics, Architectural Redesign

Introduction:

Kitchen is the heart of the home, the friendly centre of a house, room where family and friends gather, place where food is cooked, stored and sometimes eaten. In modern times kitchens also serve the purpose of family den or dining rooms.

The average Indian Woman spends 7 to 8 hours in a kitchen. Unless the anthropometric factors are not harmoniously coordinated in the architectural planning and design the activity becomes monotonous, physically painful, time consuming and also undesirable.

Hence there is a tremendous scope in experimenting with the 3 factors namely the architectural planning factors, the anthropometric dimensions and Work Simplification techniques. In most of the modern day housings offered by the promoters their focus lies purely on the generation of extra square feet area and profit thereby with least consideration to the user's point of view. Say for example factors like appropriate location of water connection point, electrical point etc are grossly neglected which creates a major disproportioning of the Work Triangle which is the pivotal part in a Kitchen.

The two most important aspects in designing the aspired kitchen are Anthropometrics and Work Simplification.

Anthropometry (literally meaning measurement of humans), refers to the measurement of the human individual for the purposes of understanding human physical variation. Today, anthropometry plays an important role in industrial design, clothing design, ergonomics and architecture where statistical data about the distribution of body dimensions in the population are used to optimize products.

Work simplification may be defined as a conscious seeking of the simplest, easiest and quickest method of doing work. It can also be defined as, "accomplishing more work with a given amount of time and energy, or as reducing the amount of time or energy or both to accomplish a given amount."

Goals of time management are more often implied than defined. In short it can be defined as, "the use of time so that it will mean the most in the attainment of individual and family goals in the real objective of time management."

Human anatomical features that are to be taken into consideration while designing a kitchen are:

1. To build the cabinets to fit the cook.
2. To build the shelves to fit the supplies.
3. To build the kitchen to fit the family.

The Work Triangle is a line is drawn from the center of the cooking surface to the center of the sink to the center of the refrigerator and back to the sink. These three lines formed a "Balanced Triangle". The three points of the triangle identified major centers of activity within the kitchen.

Today, the work triangle is between the refrigerator, primary food prep sink and primary cooking surface, measure from the center front of each.

The following size recommendations are suggested:

1. Each leg of the triangle should be between 4' (121.92 cm) and 9' (274.32 cm) long.
2. The total of all three legs of the triangle should be less than or equal to 26' (792.48 cm).
3. Family traffic pattern should not interfere with the primary triangle.
4. Cabinetry should not intersect any one leg by more than 12" (30.48 cm).

In a contemporary kitchen there are some or all the following areas:

1. Primary clean-up Sink Centers / Secondary Sink Center / Preparation Center.
2. Cooking Center / Microwave Oven Center / Pantry Center.

Kitchens are divided into two large groups:

1. Those considering metrical plane differences and
2. Those considering size.

The first group takes into consideration the arrangement of furniture and other kitchen elements, and according to these we find 6 main types of kitchens:

One wall kitchen /Corridor shaped kitchens /L-shaped kitchen /L-shaped kitchen with an island / U-shaped kitchen /G-shaped kitchens.

Methodology:

The specific study involves 7 Indian Kitchens. The details include the study of

A. Anthropometric measurements of the Kitchens in respect to the users
B. Details of the Work Triangle
C. Architectural Layout of the Kitchen
D. Time taken to complete a standard Indian meal for the purpose of Work Simplification.

Hence

a. Pert chart was evolved to study the various steps in standard meal making.
b. Each event of the pert chart was thoroughly analyzed.
c. Effective and efficient management of the resources available to achieve Resource management / Work simplification /Effective space planning / Safety / Convenience and comfort / Health and hygiene.

The researcher selected seven kitchens of multistoried apartment housing in Kolkata which were professionally designed and were of the sizes specified. The kitchens identified were studied in detail by the researcher. The needs and requirement, comments and satisfaction of the user pertaining to the existing kitchen were obtained by the questionnaire. The user of all the kitchens were also assigned the task of preparing a standard dinner in the least time as possible which evaluated the need for modifying the work triangle.

The Redesigning Criteria included:

Identifying a Model Kitchen which came closest to the desired criteria of blending the ideal anthropometric requisites and simplification of work principles. Also to give the required satisfaction level to the Kitchen user. Accordingly the following steps were taken:

1. To redesign the other kitchens based on the data and information provided by the Model Kitchen.
2. To analyze the merits and demerits of the revised layouts vis-à-vis the guidelines to achieve the aforesaid design criteria.
3. To gauge the satisfaction of the user towards the revised layouts vis-à-vis the specific design criteria.

Selection criteria of cases of study:

1. The respondents belong to the family residing in Kolkata only.
2. Architects and/or interior designer designed their kitchens.

Data collection method:

Of the many ways in which the researcher data may be collected such as, by observation of the respondent, by providing the respondent with a questionnaire to be filled up, by interviewing the respondent by the fixed number of questions, by giving them the same task to doing the least time possible, the techniques incorporated in the study was

1. Review of the existing theoretical concept and research studies in various journals, books, periodicals and magazines, Observation of the existing kitchen layout in perfect details, Interviewing the respondent with the help of the questionnaire prepared by the researcher, By making them cook the standard Indian meal in the least time as possible, Identifying the model kitchen which took the least time to cook the meal and also has the higher satisfaction level.
2. Finally, redesigning the existing kitchen as per the respondent needs and preference.

Data processing procedure:

The procedure followed for the study was as follows:

After identifying and analyzing the problem, the researcher was involved in a thorough review of literature to understand the theoretical concept, components to be studied as:

1. The basic layout of the kitchen.
2. The anthropometric measurements.
3. Evaluation of the work triangle.
4. The lighting aspect.

The researcher formulated the guidelines for the design of the kitchen according to the basic needs and requirement of the user. The guidelines were formulated vis-à-vis the following design criteria:

Work simplification / Effective space utilization and correct positioning using anthropometric dimensions / Resource management and efficiency / Comfort and convenience / Safety / Health and hygiene.

The researcher then attempted to make an analytical study of all the kitchens selected. The researcher judged the kitchen on the basis of guidelines formulated, the analysis conducted, the task assigned to them and the feedback obtained. Keeping one of the kitchen as the Model kitchen (the kitchen which took the least time in preparing the standard dinner) all the rest of the kitchens were redesigned.

The researcher redesigned the kitchens following the guidelines formulated, on the basis of the analysis of the kitchens and adhering to the needs and requirement of the user as obtained through the questionnaire.

The Essential Factors that were taken into consideration in the Entire Redesigning exercise were as follows:

1. Tools of Time Management which includes:
A. Steps to make realistic estimate of time
B. Objects of Project Planning
C. Stages of Project Planning
D. Method of Scheduling
E. Implementation of PERT / CPM Network and their development
2. Anthropometric features in architectural Planning which includes:
A. Functional Design of Work Place
B. Anthropometrics of Work Place
C. Work Centres
D. Principles and guidelines of Storage.
3. Study of the above details.

Results and discussions:

Step I – Analysis of Work Simplification:

All the six kitchen users were asked to make a standard Indian meal comprising of the following items:

1. Chapatti
2. Dal
3. Vegetables

The steps for Meal Preparation are accordingly broken in the steps shown in the Pert Diagrams. The Time Limit recorded for each Kitchen was observed. It ranged from 56 minutes for Kitchen VII to 79 minutes for Kitchen III.

Based on the least time taken the Model Kitchen has been identified. It is Kitchen VII.

Step II – Analysis of anthropometric Data:

To study the existing anthropometric conditions of the 6 Kitchens the following Information sheet was handed over to the kitchen users. The connecting architectural features were noted and a link established in the subsequent study made by the researcher. The data was subsequently analyzed.

Step III – Result sheet-Survey analysis:

Kitchens	1	2	3	4	5	6	7
Kitchen Type	L Shape	L Shape	Double Alley	Double Alley	U Shaped	Broken U	Island Kitchen
Length Of The Work Triangle	7.58 Ft.	7.06 Ft.	15.41 Ft.	11.63 Ft.	8.70 Ft.	10.62 Ft.	18.09 Ft.
Area Of The Kitchen	7 X 9 Ft.	9.9 X 5.3 Ft.	15.8 X 7 Ft.	14.5 X 6.6 Ft.	10.5 X 6.7 Ft.	14 X 15 Ft.	13.2 X 13.2 Ft.
Time Taken For A Standard Dinner	62 Mins	76 Mins	79 Mins	65 Mins	74 Mins	68 Mins	56 Mins
Space Requirement For: Cooking	3.75 Sq. Ft.	1.5 Sq. Ft.	3.75 Sq. Ft.	1.5 Sq. Ft.	1.5 Sq. Ft.	5 Sq. Ft.	5 Sq. Ft.
Chopping	5 Sq. Ft.	5 Sq. Ft.	6 Sq. Ft.	5 Sq. Ft.	5 Sq. Ft.	5 Sq. Ft.	5 Sq. Ft.
Kneeding	4 Sq. Ft.	4 Sq. Ft.	6 Sq. Ft.	5 Sq. Ft.	4 Sq. Ft.	4 Sq. Ft.	4 Sq. Ft.
Beating	3 Sq. Ft.	3 Sq. Ft.	3 Sq. Ft.	3 Sq. Ft.	3 Sq. Ft.	3 Sq. Ft	3 Sq. Ft
Mixing	4 Sq. Ft.	4 Sq. Ft.	2 Sq. Ft.	4 Sq. Ft.	4 Sq. Ft.	4 Sq. Ft	4 Sq. Ft
Dough Rolling	7 Sq. Ft.	6.5 Sq.Ft.	6 Sq. Ft.	7 Sq. Ft.	7 Sq. Ft.	7 Sq. Ft.	7 Sq. Ft.
Grinding	5 Sq. Ft.	5 Sq. Ft.	3 Sq. Ft.	5 Sq. Ft.	5 Sq. Ft.	5 Sq. Ft	5 Sq. Ft
Area Of The Window	9 Sq. Ft	9 Sq. Ft	9 Sq. Ft	9 Sq. Ft	9 Sq. Ft	12 Sq. Ft	9 Sq. Ft
Time Taken To Travel: From Store To Wash	5 Secs	10 Secs	1 Sec.	30 Secs	5 Secs	2 Secs	1 Secs
Wash To Cut	10 Secs	20 Secs	1 Sec.	30 Secs	3 Secs	5 Secs	1 Secs
Cut To Cook	5 Secs	5 Secs	1 Sec.	30 Secs	5 Secs	2 Secs	1 Secs
Distance From: Store To Wash	1.75 M	1.725 M	1.6 M	1.165 M	1.115 M	0.815 M	2.4752 M
Wash To Cook	1.085 M	1.2 M	1.925 M	1.215 M	0.85 M	1.281 M	1.0741 M
Cook To Pantry	0.745 M	0.625 M	1.175 M	1.165 M	1.1 M	1.5804 M	1.7287 M
Time Taken To: Put And Finish Cooking Of Dal	1 Min More	9 Mins More	8 Mins More	2 Mins More	6 Mins More	3 Mins More	
Cooking Vegetables	2 Mins More	12 Mins More	7 Mins More	3 Mins More	7 Mins More	2 Mins More	
Kneading Dough	1 Min More	1 Mins More	3 Mins More	1 Min More	1 Min More	1 Min More	

Step IV - Critical Analysis of the Architectural features of the existing plans:

The existing architectural features of the Kitchens were studied under the following heads

1. Length, breadth and area of the kitchen.
2. Location of the oven / sink/ door/ window/ storage system.
3. Characteristics of the work triangle.
4. Number of switches/ fixtures for appropriate lighting and ventilation.

Step 5 - Critical Analysis of the factors in Work Simplification of the Existing Kitchen Types:

The flaws in the kitchen were observed under the following heads:

1. Work triangle size which did not conform to the comfortable / ideal range
2. Storage space not designed according to anthropometric measurements
3. Inadequate plug points which were not sufficient because there were situations when more than one appliance was used. Due to this working process became slower.

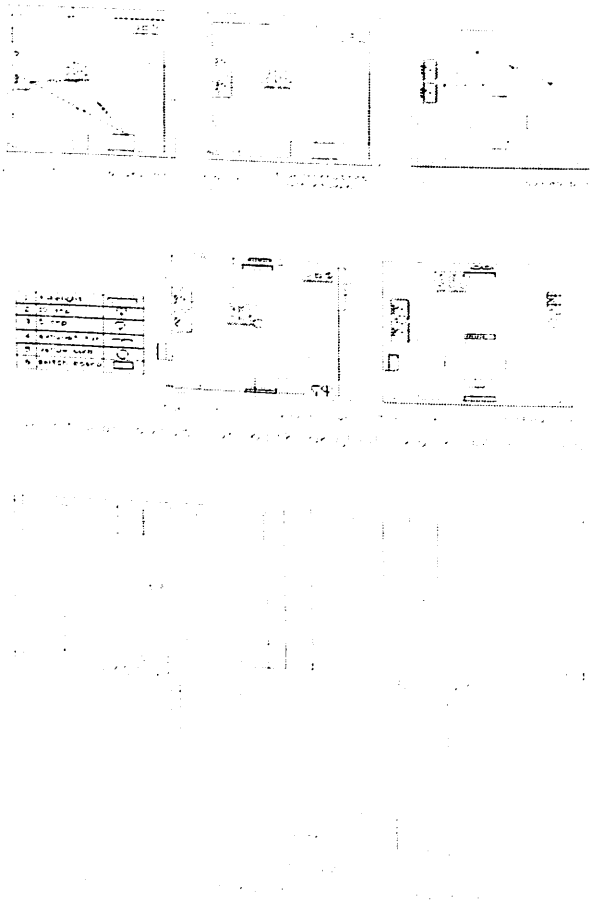
4. The lag in time factors was identified in the specified items of work. It could be cooking of dal / cooking of vegetables / kneading of dough etc.

Step 6 - Analysis of the Modifications made in the existing architectural patterns of all the Kitchens:

The Kitchens were architecturally modified and the modifications can be summed under the various heads as below:

Shifting of doors / shifting of oven position/ increasing the circulation space / re erecting counters wherever needed / extending cabinets wherever needed for less used and rarely used items / most importantly modifying the work triangle and bringing it within the standard range.

The Diagrammatical analysis of the existing and modified floor plan / Sectional Elevation and Electrical Layout of a sample Kitchen (Kitchen type ....) is given below. The exercise was done for all the Kitchens.



Step 7 -The Summary sheet of the Redesigning exercise has been consolidated as follows :

Item	Model kitchen	Kitchen I	Kitchen II	Kitchen III	Kitchen IV	Kitchen V	Kitchen VI
Original shape of counter	Island	L shape	L shape	Parallel	Double alley	U shape	Broken U
Modified shape of counter	U shape	L shape	U shape	Parallel	Parallel	U shape	Broken U
Original area of kitchen	13.23 X 13.25 ft	7 X 9 ft	9.91 X 5.33 ft	15.83 X 7 ft	14.5 X 6.6 ft	10.5 X 6.75 ft	14 X 15.16 ft.
Modified area of kitchen	13.23 X 13.25 ft.	7 X 9 ft	9.91 X 5.33 ft.	15.83 X 7 ft.	14.5 X 6.6 ft.	10.5 X 6.75 ft.	14 X 15.16 ft.
Original size of work triangle	18.15 ft.	7.7 ft.	7.18 ft.	15.66 ft.	11.81 ft.	8.84 ft.	10.79 ft.
Modified size of work triangle	18.38 ft.	14.18 ft.	12.98 ft.	16.24 ft.	17.29 ft.	13.23 ft.	19.65 ft.
Original size of window	3 X 3 ft.	3 X 3 ft.	3 X 3 ft.	3 X 3 ft.	3 X 3 ft.	3 X 3 ft.	4 X 3 ft.
Modified size of window	3 X 3 ft.	3 X 3 ft.	3 X 3 ft.	3 X 3 ft.	3 X 3 ft.	3 X 3 ft.	4 X 3 ft.
Original ht of overhead cabinets	5.2 ft.	7.6 ft.	7.5 ft.	7.16 ft.	5.16 ft.	7.66 ft.	7.6 ft.
Modified ht of overhead cabinets	5.2 ft.	6.5 ft.	4.56 ft.	7.16 ft.	5.16 ft.	7.66 ft.	7.6 ft.
Customer satisfaction before modification	Average	Average	Average	Average	Good	Average	Average
Customer satisfaction after modification	Good	Good	Excellent	Very Good	Very Good	Very Good	Very Good

In all the seven kitchens it has been found that customer satisfaction has increased on an average scale post redesigning considerations .

Conclusion:

It is quite obvious that kitchen design has come a long way and more so with technical advancements. Continual efforts are on to make kitchen work space interesting and kitchen work less consuming. Thus in redesigning the researcher sought an ideal balance between the critical factors of Work Simplification and Time Management / Work Triangle of the Kitchen/ Storage of Kitchen / Anthropometric

Measurements. However a more intensive fulfillment of the initiatives can be achieved by starting the research when the entire building begins as a mere concept in the vision of the designer.

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A Study on Preference of Package Tours Versus Individually Planned Tours

Pooja Lath and Komal Sharma

ABSTRACT

This study related to preference of package versus individually planned tours was conducted in the city of Kolkata, on 100 respondents, from age groups 25-35, 36-45, 46-55 and above 55 years through questionnaire method. 25 respondents from each age group were selected as the sample. The results indicated that leisure was the main purpose of travel and joint decisions by families was more common. Internet was widely used for getting information, ticket and accommodation booking. People preferred more individually planned tours than package tours irrespective of age, marital status, type of family, size of family, educational qualification, occupation, income, and community, the reason being flexibility of time and tailor made itinerary. Those who took international trips, those who traveled alone or those who were getting heavy price discounts mostly preferred package trips as it minimizes risk and uncertainties, it is a comprehensive package where one sees more for less. Majority of the respondents who undertook package trips were satisfied by the tour operators' behavior and the price they paid for the services provided to them.

Keywords: Individually Planned Tours, Package Tours, Questionnaire

Introduction

The concept of tourism is very primitive. Travel in old days was not safe and also difficult. It was time consuming and costly. Inscriptions, seals and cave/ rock paintings etc. are evidences of travel in the early period. During the ancient era, the three significant developments that encouraged travel were the creation of routes and paths used primarily by traders and pilgrims and perhaps adventurers, development of specialized vehicles for travel, growth of urban centre and later along river banks and coastline. With specialization in vehicles there was an improvement of paths and routes.

The basic determinants of success in the field of tourism can be threefold: Attractions, Accessibility and Amenities. An appropriate mix of all the above three components is necessary for the success of tourism and it is the task of the tourism organization to achieve this success[3].

Tourism in India has come into its own as a brand – India tourism. There have been several innovative approaches in the ministry's policy in 2009-10. According to the world tourism organization (2010), the Foreign Tourist Arrivals (FTAs) in India during 2010 were 5.58 million as compared to the FTAs of 2.64 million during 2000 and 5.17 million during 2009, showing a growth of 8.1% and Foreign Exchange Earnings (FEE) from tourism during 2010 is estimated at 64889 crore as compared to FEE of 15626 crore during 2000 and 54960 crore during 2009[4].

Tourism assumes an important role globally because of the following types and factors and processes: firstly Tourism is a discretionary activity, people are not required to undertake it as a basic need to survive, unlike consuming food and water, secondly tourism is of growing economic significance at a global scale, with growth rates in excess of the rate of economic growth for many countries, thirdly many governments see tourism as offering new employment opportunities in a growing sector that is focused on service industries and may assist in developing and modernizing the economy, fourthly tourism is increasingly becoming associated with quality of life issues as it offers people the opportunity to take a break away from the complexities and stresses of everyday life and work – it provides the context for rest, relaxation and an opportunity to do something different in a new environment. Fifthly in some less developed countries, tourism is being advocated as a possible solution to poverty (this is described as 'pro-poor' tourism strategies), with local people benefiting from this form of economic activity. It is also much easier to finance tourism with the rapid rise in credit card spending in developed countries, increasing access to travel opportunities and participation in tourism and lastly technology such as the internet has made booking travel-related products easy and placed it within the reach of a new generation of computer-literate consumers who are willing to get rid of much of the traditional ritual of going to a travel agent to book the annual holiday[8].

The social causes of the rapid growth of tourism are linked with new attitude towards travel and leisure. Traditionally considered a luxury, both are now held to be a normal, virtually indispensable part of the lifestyle and consumption pattern of all but the lowest income groups of the population. The entire concept of pleasure travel has changed quite drastically. The leisure time of present day tourist is much more restricted and, accordingly, he desires to pack into it as much as possible[3].

Shoppers today appreciate choice. One does not just buy a holiday. People will customize the holiday to suit their needs and they won't have to pay

for anything they won't use. By and large, package holidaymakers moderate their expectations according to their past experience and knowledge of the industry and believe that they are realistic in their analysis of what represents good value for money and acceptable levels of product offering.

A tour package is an advertised journey including specific features, arranged and promoted with tour literature by a tour operator and paid for in full by the tourists before starting on the tour.' The package tours are advantageous as they save time, as the tour operator plans and organize the travel details with the principal travel suppliers, for the tourist, which also reduces unnecessary correspondence[9].

As compared to free independent travel, package tours are generally economical as the tour operators get large price incentives from airlines, hotels and other service providers because of bulk (wholesale) business they bring.[2] Although, in recent years, an increase in independent travel has been seen. More and more tourists are experienced travelers with the confidence to make their own vacation arrangements. Furthermore, the Internet has made it cheaper and more convenient for tourists to make their own travel arrangements, without the need for travel agents and tour operators.

There are numerous motivators for independent travelers, most notably, the desire to have a tailor-made itinerary that totally reflects the wishes of the traveler, rather than that of other tourists or tour operators; the pleasure and freedom of travelling alone rather than as part of a group which may contain members who do not get on with each other; the opportunity to visit places which are too inaccessible or inconvenient or unprofitable to be included by tour operators in their itinerary; the wish to visit destinations that are not crowded with tour groups and lastly the idea that sometimes, independent travel can be cheaper than package tours.

Satisfaction associated with vacation travel includes relaxation of tension, which is a strong underlying element to different desires and expectations concerning a vacation[6].

The analysis of consumer behavior requires the consideration of various pro-cesses internal and external to the individual. Hence, to understand the purchasing behavior one needs to examine the complex interaction of many elements, present at different stages, from arousal to decision, as well as from purchase to post-purchase experiences[5].

Methodology

Selection of tool: The questionnaire method was chosen as a tool to carry out the survey. A structured questionnaire schedule was constructed in such a way that multiple-choice questions were provided to the respondents and they were asked to tick whichever option was most suitable. Ambiguous, misleading and confusing questions were avoided.

Selection of the sample: The study was conducted in the city of Kolkata and the sample consisted of 100 respondents. The sample was selected in such a way that 25 respondents were there from each age groups 25-35 years, 36-45 years, 46-55 years and above 55 year. The selection of respondents was done keeping in mind that respondents had availed of both individual and package tours within a period of last three years.

Data interpretation: The data from each questionnaire was accordingly tabulated. A numbering plan was developed for each questionnaire. Tables were constructed showing the background information of the respondents. Frequencies and percentages were calculated accordingly. Bar charts and pie diagrams were the statistical methods used to analyze the data and finally test of significance was used for the main statistical analysis.

Results and Discussions

The study reveals that out of 100 respondents, 68 respondents travelled twice in a year, more than 50% of the respondents travelled twice in a year irrespective of their occupation and type of family.

Majority of the respondents take the travelling decision jointly irrespective of their age group, marital status, and occupation.

More than 55% of the respondents travelled for leisure irrespective of their age and occupation. About 20% respondents in age group 46-55 travelled for educational purpose and about 24% respondents from age group above 55 years travelled for the purpose of pilgrimage.

Majority of respondents from all age groups were motivated by self development factor to travel except age group 36-45, in which majority were motivated by destination pull. It was also found that service class respondents travelled mostly for self development, business class for destination pull while professionals for escaping and relaxing.

Since the research was done on 100 families on their last three trips taken during last three years, out of which 7 families traveled only twice in three years, thus the total number of trips taken by 100 respondents accounted to 293.

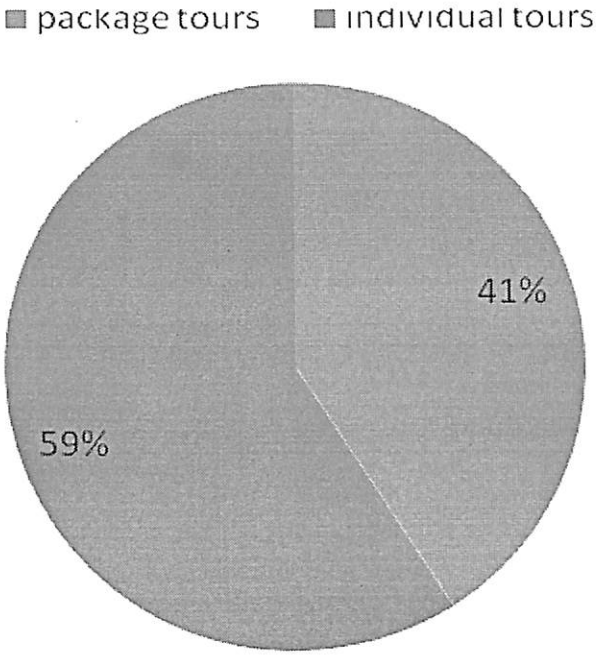

Figure 1: Shows in percentage the number of individually planned and package trips taken by the respondents

Out of the 293 trips taken by the respondents in last three years, 174 (59%) trips were found to be individually planned, while 119 (41%) were packaged trips. (Figure 1)

Out of 174 individuals trips taken by the respondents, 96 (55%) booked tickets through e-booking, 41 (24%) through an agent while 37 (21%) through self. Regarding accommodation, 89 (51%) booked through e-booking, 50 (29%) through self, 24 (14%) through an agent and 11 (6%) through any other method such as through the institute or the company in which they are working.. Majority used Internet to book accommodation irrespective of their educational qualification and occupation except the professionals who booked their accommodation through self. Self-booking for tickets and accommodation was found to be more in the age group 25-35.

It was found that 17% of the total trips taken were international while 83% were domestic. More than about 70% in all age group were travelling to domestic places irrespective of their family type, except in age group 25-35, where 50% respondents from joint families are travelling to domestic places and the remaining to other countries.

Majority from all age groups travelled to domestic places irrespective of their income except in age group 25-35 where 60% respondents from 91000 and above income group travelled to international places.

More than 60% respondents travelled to domestic places irrespective of their age and community.

Majority of the respondents in age group 25-35 who were motivated by destination pull, peer influence and self development took domestic trips, except those who were motivated by price discount, who took international trips only. More than 60% respondents in age group 36-55 took domestic trips irrespective of their motivating factor. In the older age group more than 75% respondents who were motivated by destination pull and price discount took international trips while those motivated by peer influence and self development, more than 78% of them took domestic trips. Thus we see that domestic trips were found to be more popular.

Table 1: Shows in percentage the number of package and individually planned trips taken by respondents of various age groups having different purposes of travelling

Age	Purpose Of Travelling									
	Leisure		Family visit		Business cum family vacation		Education		Pilgrimage	
	PT	IT	PT	IT	PT	IT	PT	IT	PT	IT
25-35	41	59	0	100	0	100	0	0	0	100
36-45	60.3	39.7	0	100	0	100	0	0	0	100
46-55	32.6	67.4	0	100	0	100	100	0	0	100
Above 55	41.4	58.6	0	100	0	100	0	0	50	50

NOTE: The sum of the cells corresponding to each age group and purpose of travelling is 100%.

Table 2: Shows in percentage the number of package and individually planned trips taken by respondents from different communities of various age groups

Age	Community									
	Bengali		Punjabi		Guajarati		Marwari		Others	
	PT	IT	PT	IT	PT	IT	PT	IT	PT	IT
25-35	33.3	66.7	33.3	66.7	33	67	56	45	34	66
36-45	54.2	45.8	33.3	66.7	33	67	33	67	33	67
46-55	56.7	43.3	33.3	66.7	36	64	50	50	47	53
Above 55	33.3	66.7	34.7	65.3	0	0	36	64	33	67
Total	50	50	34	66	34	66	38	62	38	62

NOTE: The sum of the cells corresponding to each age group and community is 100%.

Table 3: Shows in frequency and percentage the number of package and individually planned trips taken by respondents who went for domestic and international trips in various age groups.

Age	Type Of Package Tour									
	Domestic					International				
	N	PT	%	IT	%	N	PT	%	IT	%
25-35	54	15	27.8	39	72.2	20	12	60	8	40
36-45	71	29	40.8	42	59.2	3	3	100	0	0
46-55	61	33	54	28	46	10	1	10	9	90
Above 55	57	13	27.6	44	72.4	17	13	76.4	4	23.6
Total	243	90	37	153	67	50	29	58	21	42

Table 4: shows in percentage the number of package and individually planned trips taken by respondents of various age groups with different motivations of travelling

Age	Motivating Factors Leading To Travel											
	Destination pull		Price discount		Peer influence		As a incentive		Self development		Escape/relax	
	PT	IT	PT	IT	PT	IT	PT	IT	PT	IT	PT	IT
25-35	26.3	73.7	100	0	0	100	0	0	60	40	16.7	83.3
36-45	44.4	55.6	80	20	25	75	100	0	41.6	58.4	25	75
46-55	50	50	0	0	0	100	0	0	84.6	15.4	30.7	69.3
Above 55	75	25	100	0	0	100	0	0	39.1	60.9	25	75

In age group 25-35, more than 50% respondents travelled by self planned trip irrespective of their marital status, income, occupation, and educational qualification, type of family, size of family and purpose of travelling. 56% of the Marwari respondents from this age group took package trips (Table 2); while majority of all the other communities self planned the trip. It was also found that while traveling abroad, 60% of them availed of a package trip (Table 3). 60% of the respondents who were motivated by price discount and self-development availed of a package trip (Table 4).

In age group 36-45, more than 50% respondents travelled by self planned trip irrespective of their marital status, occupation, type of family and size of family. 54.2% of the Bengali respondents (Table 2), 100% of the respondents traveling abroad (Table 3), 52.8% post graduate respondents, 55% from 51,000 – 70,000 income group from this age group took package trips. Those who traveled for leisure (60.3%). (Table 1) and those who were motivated by price discount and incentive, more than 80% availed of a package trip (Table 4).

In age group 46-55, 66.7% unmarried respondents, 52.5% professional respondents, 66.7% respondents from income group 51000-70000, 56.7% Bengali respondents (Table 2), 58% respondents from nuclear family, 54% domestic travelers (Table 3), 100% respondents travelling for education travelled by package trip (Table 1). In this age group traveling by availing package trips was found to be more when compared with other age groups in the above-mentioned variables but it was also found that respondents were taking more of individual trips irrespective of their educational qualification and motivating factors.

In age group above 55, more than 50% respondents travelled by self planned trip irrespective of their marital status, income, occupation, educational qualification, community, type of family, size of family and purpose of travelling. It was found that when this age group travelled abroad, 76.4% availed of a package trip (Table 3). Those respondents who were motivated by price discount and destination pull, more than 75% of them availed of a package trip (Table 4).

In the test of significance the computed value of Z (3.275) was found to be more than the tabulated value of Z (1.645), thus null hypothesis was rejected and it was stated that people prefer to travel more by self planned tours than package tours.

The respondents were asked to rank the advantages of individually planned trips and packaged trips and it was found that *'Flexibility of time' was ranked* as the first, 'tailor made itinerary' as the second, 'freedom to shop' as third while 'no fraudulent traveling companions' as the last advantage of planning a trip individually. 'Minimizes risks and uncertainties' as an advantage of package tours was ranked as highest, followed by 'assured reservation' as the second, 'comprehensive package' as third, 'more travel for less' as fourth 'fixed itinerary' as fifth, 'better for lone travelers' as sixth, 'no skills required to plan a trip' as seventh and 'making new acquaintances' as the last advantage.

All the respondents from all the age groups said that they will take up a package tour if they have to travel all alone in future while more than 50% respondents in age group 25-35, 46 and above favored individually planned trip while traveling with family/friends in future irrespective of their income as well as type of family.

It was found that out of 119 respondents who had availed of package tours in last three years, 87 felt that the services provided by tour operator matched their expectation where as 32 respondents did not find the services as per their expectation.
Figure 2: Shows in percentage the reasons for dissatisfaction of the respondents

Out of the dissatisfied respondents, 44% said their expectation did not match due to failure in providing what the operator claimed, 22% due to bad food, and 13% with low quality service, 12% with negative behavior of the operator and 9% due to misleading information provided by the operator. It was found that majority of the respondents were dissatisfied with failure to provide what was advertised in age group 25-45, while age group above 55 was highly dissatisfied due to bad food. Age group 46-55 was fully satisfied.

It was found that out of 119 respondents who availed of package tours in three years, 93 felt that the services provided by tour operator matched the price paid by the respondent where as 26 respondents did not find the services as per the price paid.

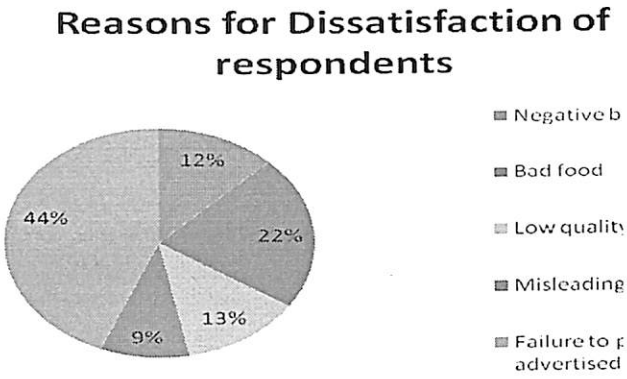

Figure 3 Shows in percentage the reasons for dissatisfaction of the respondents

Out of the dissatisfied respondents 54% said their expectation did not match due to low hotel standards, 27% due to bad food, 15% with low quality service and 4% with failure to provide what was advertised. It was found that age group 25-45 was highly dissatisfied with hotel standards, 100% in age group above 55 was dissatisfied with bad food. Age group 46-55 seemed to be fully satisfied.

Conclusion

People prefer to travel by self planned tours, but findings also suggests that in some cases when people are given heavy price discount or they have to travel all alone or if they have to take an international trip, they prefer to take up a package trip. According to ministry of tourism, India, during 2003, out of a total of approximately 229 million trips made, a mere 3.9 million (about 1.7 %) were organized as package tours[11]. Over the years it has gone up and the tour operator has thus emerged as the key manufacturer of the tourist product. In the year 2009, there were about 415 registered travel agents in India, 552 inbound tour operators, 203 tourist transport operators, 28 adventure tour operators and 48 domestic tour operators which have increased to 467 travel agents, 603 inbound tour operators, 213 tourist transport operators, 33 adventure tour operators and 66 domestic tour operators in 2010 in India[10]. Thus to conclude though there is a growth in tour operators selling tourism product, package trips will take time to capture the Indian market. As the study reveals that even in the urban area of Kolkata, individual trips are still preferred mostly by all the age groups.

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Fortification of Yoghurt Using Ferrous Lactate and Doing the Sensory Evaluation to Judge its Acceptability

Tishya Ghosh and Vipasha Chakraborty

ABSTRACT

Food fortifcation is a well-accepted practice to deal with nutrient deficiency. In the present study yoghurt is fortified with ferrous lactate, a chemical fortificant to increase the iron content of the yoghurt prepared from pasturised milk. The amount of ferrous lactate to be added (70 mg , 47 mg , 35 mg and 30 mg) was decided by experimentally seeing its effect on organoleptic properties of yoghurt and by considering the fact that there will be other iron sources in the diet. Multi-elemental analysis was carried out by X-Ray fluorescence method using the EDXRF spectrometer. Sensory evaluation of the samples with highest concentration of ferrous lactate was done to judge its acceptability. Results show that iron content of yoghurt increased with minute alteration of sensory attributes. Both macro and micro minerals along with iron were also analyzed and the amounts were found to be below their RDA and signs of elemental interaction have been observed.

Keywords: EDXRF, Fortification; Ferrous Lactate; Lyophillization; Pelletizer; Sensory Evaluation; Yoghurt

Introduction

Strategies for combating with iron deficiency include iron supplementation, food diversification and food fortification. Food fortification is being recognized as a sustainable, relatively simple and realistic way to reduce and the prevention of iron deficiency has become even more urgent in recent years with the accumulation of evidence strongly suggesting a relationship between even mild iron deficiency and irreversible brain development. Micronutrient fortification of foods commonly consumed by a given population can be a powerful strategy to combat micronutrient deficiencies in a sustainable manner. By selecting the right food ingredient to act as a carrier (food vehicle) of specific micronutrient(s) (fortificant), the need for encouraging individual compliance or changes in the customary diet will be minimized. In the present study yoghurt has been chosen as the food vehicle. Dairy products show a very promising possibility as a food vehicle [10]. Yoghurt is a fermented dairy – product and is rich in potassium, calcium, protein and B vitamins, including B-12. Research shows yoghurt strengthens and stabilizes the immune system. The *secret to good yoghurt* is that it contains *live* cultures of *L. acidophilus, L. bulgaricus, S. thermophilus, and bifidobacteria.* In yoghurt the process of growth from milk into yoghurt involves the conversion of lactose into lactic acid. In other words, yoghurt provides the enzyme needed to digest milk products. Calcium, which is found in dairy products, needs to enter the body in an acid matrix or your body will not absorb it. So the lactic acid of yoghurt is a perfect medium to maximize calcium absorption[1,6,8]. The four principal iron sources that have had widespread use in food fortification are elemental iron, ferrous sulphate, ferric orthophosphate, and sodium ferric pyrophosphate. Although knowledge regarding vitamin/mineral interactions is limited, it is evident that such interactions reduce impact on nutritional status [9]. To reduce such elemental interaction in the fortified product, ferrous lactate has been used in the present study as a fortificant. Moreover, ferrous lactate is highly water-soluble and researches have shown that bioavailability of iron from water-soluble fortificants (e.g. ferrous sulphate) is about 90-100 %[10].

Methodology

Pasteurized milk was used for the experiment. The amount of milk is first standardized so that it can give one serving of yoghurt. This one serving of yoghurt is then fortified with ferrous lactate. It was observed that 250 ml of pasteurized milk makes 140 gm of yoghurt, which is sufficient for one serving. Commercialized yoghurt culture was used to set the yoghurt. 5 gm of commercialized yoghurt was mixed with 250 ml of milk and then it was incubated at a temperature of 40°C for 12 hours for the curd to set. The sample - setting was carried out with three variations. The first variation was the concentration of the ferrous lactate added. While deciding the concentration of ferrous lactate, the daily requirement of iron in an adult Indian female (30 mg / day) was considered because they are highly susceptible to anemia. It has also been considered that the diet of the individual will have some other iron sources that is why the daily requirement is fractioned and given through one serving of the fortified yoghurt. It was kept in mind that if one serving of fortified yoghurt pro-

vides whole of the daily requirement and there are other iron sources in the diet, it might lead to iron overload. One serving of the fortified yoghurt will give 1/2, 1/3, 1/4, and 1/5 times of 30mg of iron and accordingly the four concentrations of ferrous lactate had been decided which were 70 mg, 47 mg , 35 mg and 30 mg of ferrous lactate. The second variation is the time of boiling the milk. It was 5 minutes , 10 minutes and 15 minutes . While the amount of yoghurt was standardized, these boiling times were carried out, significant difference was seen in the amount of the yoghurt. It varied from 110 gms – 140 gms but this range is sufficient for one serving of yoghurt. The boiling time did not affect any other quality of the yoghurt. The final variation is the time of adding the ferrous lactate. The four different time of addition of ferrous lactate were – when the milk was off the flame , while heating the milk , when the milk was boiling and when the innoculum was added . The fortified yoghurt after being set were dried using freeze-drier or the lyophilizer. After freeze-drying , 15 gms of yoghurt sample resulted in 4 gms of dried yoghurt. Dried yoghurt samples were then ground to powder using mortar & pestle. Pellets were made using the pelletizer from 200 mgs of the powdered sample at high pressure of 150 mm / Hg for 2 minutes. Analysis of concentration of iron and other nutrient elements was done using EDXRF spectrometer. Each experiment was carried out in triplicate for statistical calculations. To judge the acceptability of the fortified yoghurt with the highest concentration of ferrous lactate samples, sensory evaluation was carried out. A 30-member semi - trained panelists of ages between 18-37years and comprising 20 females and 10 males were selected. The sensory evaluation was carried out thrice with a gap of 1 week between each trial. Each attribute was scored based on its intensity scaled on a 5-point hedonic scale (1= Disliked, 2= Slightly disliked, 3= Slightly liked, 4=liked, 5=liked very much) for appearance, texture, odour, taste and overall acceptability . Statistical analysis were done using windows excel spreadsheet.

Results & Discussion

Elemental Analysis

The elemental analysis of yoghurt samples carried out by EDXRF spectrometer has shown the signature of many nutrient elements. The concentration of Fe along with those micro-nutrients like Mn, Cu & Zn and macro-nutrients like Mg, Ca, K, P & S were measured in the yoghurt sample. A significant increase has been observed in concentration iron in yoghurt fortified with ferrous lactate with different variations. Rest of the elements both micro and macro nutrients have shown no or very low significant variation in their concentration w.r.t variations in the ferrous lactate fortification. The concentrations of these nutrient elements are well below their RDA limit. The results documented a wide range of minerals and are discussed below.

Iron Fortification

Addition of ferrous lactate has led to an appreciable increase of iron in all the four groups of yogurt (O group, W group, B group and I group) when compared to that of unfortified yogurt (blank) (Fig.1). The iron content of all the four groups is within the daily requirement of an Indian adult woman (30mg). While the iron content of samples O70, W70 and B70 group are in the range of 14.14 – 14.34 mg/cup, the iron content of sample B70 is less and it is 12.02 mg/cup. This might be because ferrous lactate was added to the B group curd while the milk was being boiled. While boiling, maximum amount of ferrous lactate remained in the container, which led to a loss of the mineral, and thus the iron content was found low in this sample. Similarly in case of 047, W47 and I47 the iron content is in range of 11 – 11.42 mg /cup but in B47 it is less (9.2 mg/cup). I70 has the maximum iron content among all the samples (14 mg / cup). O47 has the maximum iron content (11 mg / cup) when compared to all the samples of 47 category. Although there is a significant increase of iron content in yogurt fortified with low amount of ferrous lactate (35 mg and 30 mg), the variation in iron content among the groups are different from that of yogurt fortified with high amount of ferrous lactate (70mg and 47 mg). Yogurt samples in 35 group have shown a different trend of iron fortification all total, the maximum fortification being in B35 followed by I35, W35 and minimum in O35. In case of B35, the concentration of iron in B35 is 9.3 mg/cup, higher than that of O35, W35 and I35, which varies in the range of 6.7 – 8.4 mg/cup. However, the iron content in yogurt fortified with 30mg ferrous lactate is in the same range in all the groups. In all the four samples i.e. O30, W30, I30 and B30, the iron contents are in the similar range, from 6.2 – 6.5 mg/cup. Such observation at lower concentration can be attributed to various factors such as concentration of ferrous lactate and type of variation while preparing the curd. However it needs further investigation to get the particular explanation for such finding.

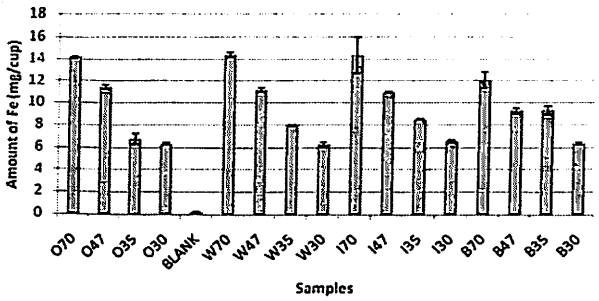

Fig 1 Showing the Iron concentration of fortified yoghurt & normal yoghurt (Blank)

Present study deals with iron fortification of yogurt. However apart from iron there are elements in the body which are also important for the health. Such elements may be required in major quantity like Ca, K , P & S or minor quantity like Mn, Cu, Zn & Mg. The macro and micro nutrient elements are required in a particular concentration and a slight imbalance in that, results in physiological perturbations. The observations confirm that although there is variation in the content of different nutrients in the fortified yogurt w.r.t the amount of ferrous lactate added and the type of variations in the addition of ferrous lactate, the variations are not significant.

Manganese: The concentration of manganese in different groups found to be in the range of 0.02 – 0.06 mg/cup (Fig.2), which is within the RDA of manganese. In the present study it is observed that after fortification, the manganese content of some of the samples, like O70, O47, W35 and I30 remain unchanged when compared to that of blank. An inverse trend of manganese content in the fortified yogurt is observed w.r.t iron content i.e. higher manganese content was found in the groups, which were fortified with lower amount of ferrous lactate. Among different groups the highest concentration of manganese were observed in O30, W47, I35 and B30 in their respective groups. In case of W the manganese concentration is more in W30 than W35 but it is lower than W47. In the O group the concentration of manganese shows a decline with the increasing concentration of ferrous lactate. The I-group shows a similar observation as that of O group except I30. Although there is variation in manganese content within the group w.r.t amount of ferrous lactate added as well as between the group w.r.t variations in ferrous lactate addition, but these variations are not significant.

Copper: The concentration of copper in different groups found to be in the range of 0.07 – 0.11 mg / cup (fig 3), which is within the RDA of copper. In this study the samples O30, W35 and B35 the concentration of copper remain unchanged when compared to that of blank. There is no significant variation of the copper concentration between the I group and the blank. The highest concentration of copper is present in W70 and W47. No significant variation was observed in copper content within the group w.r.t amount of ferrous lactate added as well as between the group w.r.t variations in ferrous lactate addition.

Zinc: In the present study Zinc content of fortified yogurt varied between 0.7 to 0.9 mg/ cup (fig.4), which is within the range of RDA limit. Zinc content remain unchanged in most of the fortified groups w.r.t unfortified yogurt (blank). There is no significant variation in manganese content within the group w.r.t amount of ferrous lactate added as well as between the group w.r.t variations in ferrous lactate addition, but these variations are not significant.

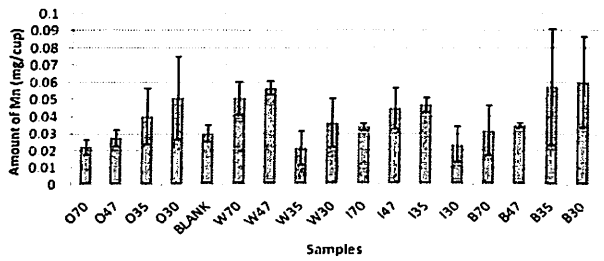

Fig 2 Showing the Manganese concentration of fortified yoghurt & normal yogurt (Blank)

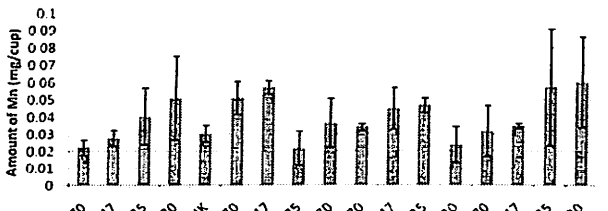

Fig 3 Showing the Copper concentration of fortified yoghurt & normal yoghurt (Blank)

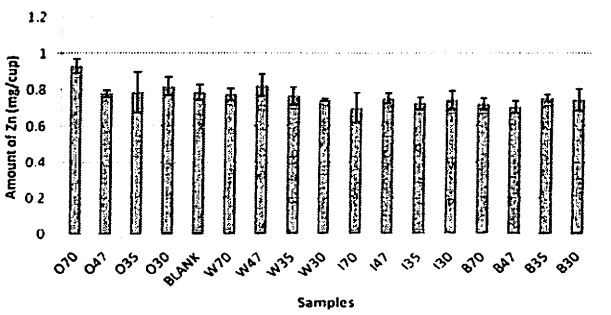

Fig 4 Showing the Zinc concentration of fortified yoghurt & normal yoghurt (Blank)

The Mg, P, S, K and Ca of the I group has been measured for the I group , since the I group has shown the best results in terms of iron fortification.

Magnesium: The daily requirement of magnesium is 300 – 400 mgs. In the present study, the magnesium content is found to be in the range of 12-15 mg/cup (Fig.5). I70 has the highest content of magnesium (15 mg/cup) and the lowest in I30 (12 mg/cup). The magnesium content of all the fortified yogurt samples are below the RDA limit.

Phosphorus: The phosphorus content of the fortified yogurt in I group observed to be in the range of 85-90 mg/cup (Fig.7). The phosphorus content of I30 (89 mg/cup) is highest and that of I70 (85 mg/cup) is minimum in the I group. The daily requirement of phosphorus is 400 mg/ day and the phosphorus content of the I group samples are below the RDA limit.

Sulphur: The sulfur content of the fortified yogurt in I group observed to be in the range of 30-35 mg/cup (Fig.6). The sulphur content of I47 (34 mg/cup) is highest and that of I70 (30 mg/cup) is minimum in the I group.

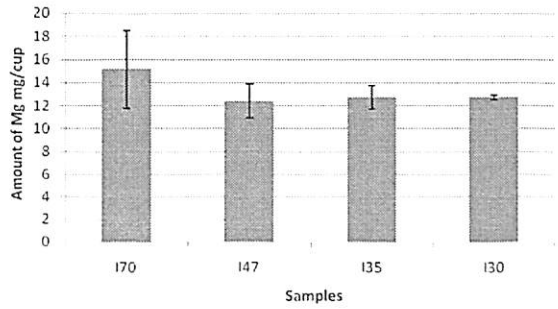

Fig 5 Showing the Magnesium concentration of fortified yoghurt samples of I group

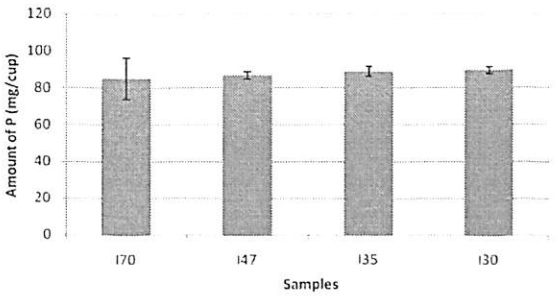

Fig 6 Showing the Phosphorus concentration of fortified yoghurt samples of I group

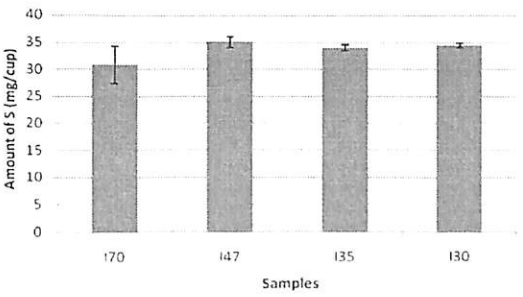

Fig 7 Showing the Sulphur concentration of fortified yoghurt samples of I group

Potassium: The Potassium content of the fortified yogurt in I group observed to be in the range of 115-125 mg/cup (Fig.8). The Potassium content of I30 (121 mg/cup) is highest and that of I70 (116 mg/cup) is minimum in the I group. There is increase in Potassium content with decreasing amount of ferrous lactate added. An Adequate Intake (AI) for potassium is set at 4.7 g (120 mmol)/day for all adults. This level of dietary intake (i.e., from foods) should maintain lower blood pressure levels, reduce the adverse effects of sodium chloride intake on blood pressure, reduce the risk of recurrent kidney stones, and possibly decrease bone loss.Because of insufficient data from dose-response trials demonstrating these effects, an Estimated Average Requirement (EAR), nor Recommended Dietary Allowance (RDA) could be derived for sulfur[3].

Calcium: Calcium helps in bone and tooth formation and its requirement is 400 mg / day . The calcium content of the I group samples are in the range of 130-140 mg/cup (Fig. 9), which are below the RDA limit. The highest calcium content was found in I30 (140 mg/cup) and the lowest in I70 (131 mg/cup). The calcium content of the I group samples have shown the similar patter as in case of potassium content in the fortified yogurt. There is increase in calcium content with decreasing amount of ferrous lactate added.

Variation in the elemental concentration was observed and such observation can be attributed to elemental interactions i.e. both antagonistic and synergistic. Antagonism of iron by the minerals like Mn, Ca, K and P occurs either by inhibiting absorption, compartmental displacement, or interfering with cellular iron enzymes. Iron therapy can also be used in antagonizing the effects of toxic metal accumulation. However, certain elements like Mn, Cu , K and P are listed as both antagonistic and synergistic because of a dual relationship of such elements with iron. As an example, copper is considered synergistic due to its requirement in ferroxidase activity. However, excessive intake of copper competes with iron for absorption.[11][2]. The excess level of Cu may cause a Fe or Zn deficiency and Cu absorption may be decreased by excess dietary Fe or Zn. [4] [5] Thus it can be hypothesized that the presence of the synergistic elements in the yoghurt samples may enhance iron absorption and the vice versa in presence of antagonistic elements. The appearance of fortified yogurt samples was not significantly affected by the variation in addition of ferrous lactate.

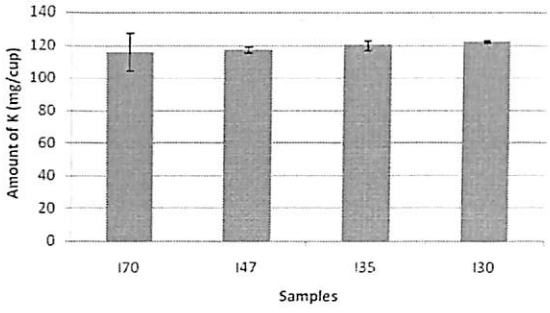

Fig 8. Showing the Potassium concentration of fortified yoghurt samples of I group

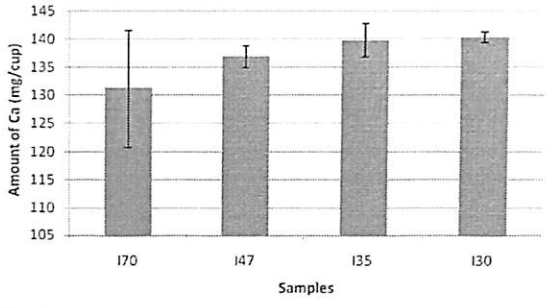

Fig 9 Showing the calcium concentration of fortified yoghurt samples of I group

Sensory Evaluation: The sensory scores for appearance, texture, odour, taste and overall acceptability of fortified yogurt evaluated by the trained panel are shown in (Fig.10) Among fortified yogurts, P5O70 and P5I70 have scored more than P5W70 and P5B70 for texture, odour, taste. The sensory evaluation for overall acceptability done by the trained panel shows the standard unfortified yoghurt is liked by 80 % of panelists (13% liked it and 67% liked it very much). The sample P5O70 is liked by 88% of panelists (34% liked and 53% liked it very much) The sample P5B70 is liked by 77% (27 % liked it and 50% liked it very much). The sample (P5W70) is liked by 68% (13 % liked it and 54% liked it very much). However in case of this sample (P5W70), the panelists complained of a metallic aftertaste, this could be attributed to the high content of iron and copper. The sample P5I70 is liked by 78% of panelists (23% liked it and 54%) liked it very much.

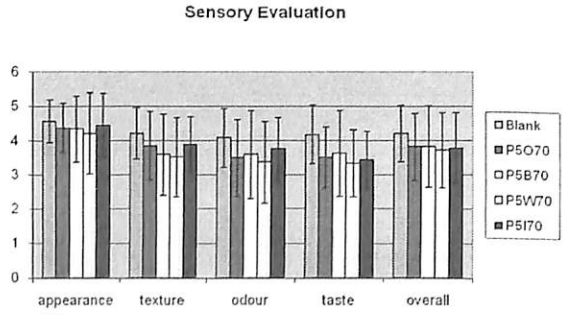

Fig 10 The Sensory Evaluation scores for appearance,texture, odour, taste and overall acceptability

Conclusion

In conclusion , it was seen through this study it has been possible to fortify yoghurt with ferrous lactate to increase its iron content . The research has also shown the variation in the result in different samples and has been able to judge the acceptability. However, the present study highlights the different aspects of fortification which should be delved with more time and resources.

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Iron Fortification of Puffed Rice by using Spirulina Platensis Powder

Richa Mundra and Vipasha Chakraborty

ABSTRACT

Spirulina platensis powder has been used to fortify puffed rice in order to increase its nutritive value, especially iron. Chemical and sensory qualities of fortified puffed rice were evaluated. Iron fortification of puffed rice depends upon the type of puffed rice, amount of spirulina added, time for which puffed rice was steeped in spirulina solution and technique of drying. Out of three types of puffed rice taken i.e. Local market, Hand pounded and Branded, Local market puffed rice showed maximum iron fortification. Steeping time and concentration of spirulina affect iron fortification of puffed rice simultaneously. Thus it was observed that 10mins steeping time and 20gms of spirulina added to 1kg of puffed rice was a perfect combination to iron fortify puffed rice. Out of two drying techniques adopted during the fortification, freeze drying was observed to be more effective than oven drying with respect to both nutrient content as well as sensory evaluation. Sensory score indicated high acceptability for freeze dried iron fortified puffed rice. It is concluded that spirulina is an adequate ingredient to improve the iron content of puffed rice without affecting its sensory traits.

Keywords: Electron Dispersive X-Ray Fluorescence (EDXRF) Spectrophotometer, Freeze Drying, Pelletizer, Puffed Rice, Spirulina Platensis

Introduction

Globally, micronutrient malnutrition continues to affect many populations and exerts a negative impact on health, mortality and human capital. Populations affected by emergencies may be especially vulnerable due to pre existing low intakes of micronutrients and a dependence on international food aid, the micronutrient content of which has been documented to be frequently inadequate[10,15]. This makes such populations prone to developing deficiency disease[16]. Deficiencies of iron, iodine, and vitamin A are considered to be a public health problem worldwide[12].

Iron deficiency anemia is a serious widespread issue throughout the world[13,17] and affects approximately 20% of the world's population, despite the fact that the average daily diet contains iron far in excess of the amount needed for metabolic purposes. This discrepancy is attributed to the low availability of food iron[2], as many foods that are potentially good sources of iron are limited by the bioavailability of iron[1]. Therefore, an accurate assessment of iron availability in the diet is important[12].

Micronutrient fortification of staple cereals has many advantages and has been associated with improvements in micronutrient status in many different contexts[6]. As a rice derived staple food, puffed rice is one of the leading most consumed food in India as a snack[11]. Its almost world wide acceptance is attributed to its low cost, easy preparation, versatility, nutritional qualities, sensory attributes and long shelf life[5]. In particular puffed rice is regarded as a low glycemic index food product[4].

The aim of this work was to iron fortify puffed rice by using Spirulina platensis powder. The cyanobacterium Spirulina platensis (blue green algae) is commercially available for human consumption. Spirulina represents one of the richest protein sources of plant origin (60-70%) and is a good source of vitamins and minerals[7]. These microalgae are now used as a health food source for humans[9]. The simple cultivation technology and the good quality of their protein, as well as the absence of any toxic side effects[18], favor their large scale production.

A most promising technique at present for determining iron and other mineral content of puffed rice is with the help of EDXRF (Electron Dispersive X-Ray Fluorescence). These techniques are powerful tools for rapid multielement nondestructive analyses and enable simultaneous detection of many elements in a solid or liquid with high-detection sensitivities, even in those cases where only small sample amounts are available[14].

Methodology

Three different varieties of puffed rice was collected from different areas of West Bengal. Chattrish was purchased from local market of M.G. Road (Kolkata), Binoy sadhu being hand pounded puffed rice was collected from Birbhum District, West Bengal and Food Bazar being branded puffed rice was purchased from Pantaloons Food Bazar of Kankurgachi (Kolkata). Local market and branded puffed rice was coarse in comparison to hand pounded puffed rice. Spirulina powder was purchased from Meera Exports (Chennai, India). Since, Spirulina powder is highly hygroscopic in

nature so in order to avoid moisture contamination, it was stored inside a vacuum dessicator.

Spirulina's concentrations were designed to provide at least one-third of the RDA of Iron. Ratio of addition of spirulina per kg of puffed rice was varied as 10gm, 15gm and 20gm. Spirulina powder was added in accordance with the mixing ratio. However, to avoid spirulina loss in aqueous phase we added spirulina in small excess which was calculated by unitary method. All the proportion of puffed rice and spirulina was weighed by using micro balance. For the purpose of analysis puffed rice was required to be converted into pellet form and 200 mg of puffed rice was required for making a single pellet. Three pellets of each sample were made for statistical calculation. Iron analysis of puffed rice was done through Energy Dispersive X-Ray Fluorescence (EDXRF) Spectrophotometer.

Sample setting was carried out with four variations namely:

1. Type/variety of puffed rice: Local market, hand pounded and branded puffed rice.
2. Concentration of spirulina: 10gms, 15gms and 20gms of spirulina per kg of puffed rice.
3. Steeping time: Puffed rice was steeped for 10 min, 15 min, 20 min, 25 min & 30 min in spirulina solution.
4. Method of drying: Freeze drying and oven drying.

9 point hedonic scale sensory evaluation technique was performed with the dried samples (both freeze dried as well as oven dried) which had very high iron content. 25 semi trained subjects were taken from under graduate and post graduate section of J.D Birla College, Kolkata. Sensory evaluation was done for three consecutive days in the J.D.Birla College. Every student was given a ballet sheet everyday. In the ballet sheet different sensory traits like color, texture, odour, flavor, appearance and overall acceptability was mentioned and the subjects was asked to rank each trait through 9 point hedonic scale.

Results & Discussion

Mineral Composition

The mineral composition of different varieties of puffed rice is shown in Table 1. Local market puffed rice i.e. Chattrish had higher iron (31.41ppm) and zinc (9.50ppm) content but lower magnesium (8.83ppm) and copper (5.52ppm) content. Branded i.e. Food Bazar puffed rice also had high iron (28.93ppm) and magnesium (9.99ppm) in comparison to hand pounded i.e. Binoy Sadhu puffed rice which had 24.60ppm iron and 9.08ppm magnesium but decreased content of copper (6.3ppm) and zinc (8.26ppm)than hand pounded puffed rice which had 6.41ppm of copper and 9.07ppm of zinc.

Table 1: Mineral Composition of Different Varieties of Puffed Rice

Type Of Puffed Rice	Iron (Ppm)	Magnesium (Ppm)	Copper (Ppm)	Zinc (Ppm)
Local Market	31.41±0.85	8.83±1.62	5.52±0.62	9.50±1.55
Hand Pounded	24.60±0.50	9.08±1.43	6.41±0.55	9.07±1.29
Branded	28.93±1.90	9.99±0.24	6.3±0.41	8.26±1.70

Mean, ±S.D

Drying Techniques

Comparison of iron content in puffed rice before and after drying is taken into consideration. Both freeze drying and oven drying cause iron loss from puffed rice. In case of local market puffed rice iron content after freeze drying is 25.47ppm whereas after oven drying it is 18.35ppm, which shows oven drying causes higher amount of iron loss in comparison to freeze drying. Similar kind of observation is seen in hand pounded as well as branded puffed rice.

Local Market Puffed Rice (Freeze Dried)

IRON LMF

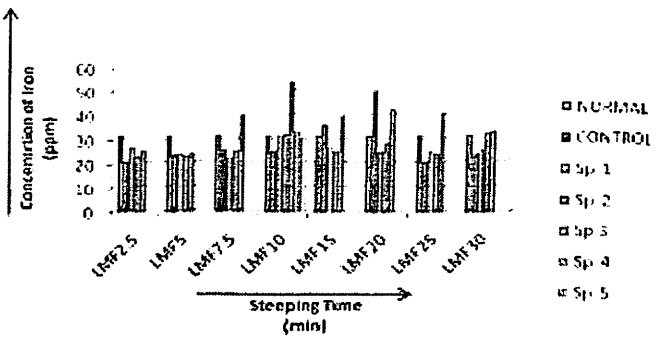

Fig 1 LMF-Iron Concentration

Key; LMF= Local Market Freeze Dried Puffed Rice, Normal = Only local market puffed rice, Control = Local market puffed rice steeped for a particular time period and then freeze dried, LMF2.5 = Local market puffed rice steeped for 2.5min and then freeze dried, LMF5 = Local market puffed rice steeped for 5min and then freeze dried & so on, Sp.1 = 10gms of spirulina/kg of puffed rice, Sp.2 = 15gms of spirulina/kg of puffed rice, Sp.3 = 20gms of spirulina/kg of puffed rice, Sp.4 = 30gms of spirulina/kg of puffed rice, Sp.5 = 40gms of spirulina/kg of puffed rice.

Different variations of iron concentrations were observed in case of local market freeze dried puffed rice (LMF) when different treatments were applied. Figure 1 shows Iron concentrations of LMF. At concentration Sp.1 (10gms of spirulina in 1kg. of puffed rice), maximum iron is seen in LMF20 whereas at concentration Sp.2 (15gms of spirulina

in 1kg. of puffed rice) and Sp.3 (20gms of spirulina in 1kg. of puffed rice), maximum concentration of iron is seen in LMF10. Taking into account all the three concentrations, LMF3-10 (local market freeze dried puffed rice at Sp.3 and steeping time 10 minutes) showed maximum level of iron (53.88ppm). Since LMF3-10 showed best results out of all concentrations, thus concentration of spirulina was increased to 30gms/kg of puffed rice (Sp.4) and 40gms/kg of puffed rice (Sp.5) but iron uptake decreased as concentration increased to 33.54ppm and 30.67ppm respectively.

Initially it was decided to steep puffed rice for 10min, 15 min, 20 min, 25 min and 30 min. In all the cases, Sp.3 showed best results out of all the three concentrations. Since LMF3-10 showed best results, it was decided to decrease the steeping time to 2.5 min, 5 min and 7.5 min. In case of 5 min and 7.5 min Sp.3 showed best result whereas in case of 2.5 min. Sp.1 showed best results.

In majority of cases, iron leaches out when puffed rice was steeped in water. This can be seen in Figure 1; by plotting the difference between normal (iron level of local market puffed rice) and its control (iron level of local market steeped and freeze dried puffed rice).

If the samples of local market freeze dried puffed rice is compared to its control than iron level had increased in almost all the samples which showed that iron level had increased because of iron present in spirulina.

Local Market Puffed Rice (Oven Dried)

IRON LMO

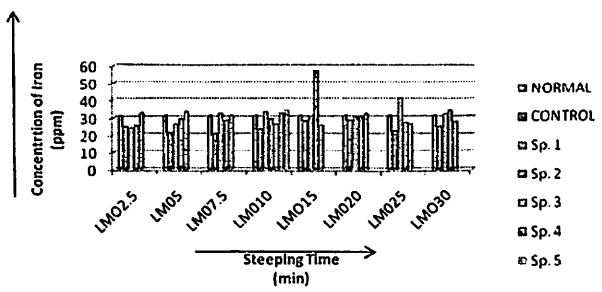

Fig 2 LMO-Iron Concentration

Key; LMO= Local Market Oven Dried Puffed Rice, Normal= Only local market puffed rice, Control= Local market puffed rice steeped for a particular time period and then oven dried, LMO2.5= Local market puffed rice steeped for 2.5min and then oven dried, LMO5= Local market puffed rice steeped for 5min and then oven dried & so on, Sp.1= 10gms of spirulina/kg of puffed rice, Sp.2= 15gms of spirulina/kg of puffed rice, Sp.3= 20gms of spirulina/kg of puffed rice, Sp.4= 30gms of spirulina/kg of puffed rice, Sp.5= 40gms of spirulina/kg of puffed rice.

Different variations of iron concentrations were observed in case of local market oven dried puffed rice (LMO) when different treatments were applied. Figure 2 shows Iron concentrations of LMO. At Sp.1 (10gms of spirulina in 1kg. of puffed rice), maximum iron is seen in LMO25 (40.97ppm) whereas at Sp. 2 (15gms of spirulina in 1kg. of puffed rice) and Sp.3 (20gms of spirulina in 1kg. of puffed rice), maximum concentration of iron is seen in LMO30 (34.3ppm) and LMO10 (57.67ppm). Taking into account all the three concentrations, LMO3-10 (local market oven dried puffed rice at Sp.3 and steeping time 10 minutes) showed maximum level of iron (57.67ppm).

Initially it was decided to steep puffed rice for 10min, 15 min, 20 min, 25 min and 30 min. In majority of cases, Sp.3 showed best results out of all the three concentrations. Since LMF3-10 showed best results, it was decided to decrease the steeping time to 2.5 min, 5 min and 7.5 min. In case of 2.5 min and 5 min iron3 showed best result whereas in case of 7.5 min. Sp.1 showed best results.

In majority of cases, iron leaches out when puffed rice was steeped in water. This can be seen in Figure 2, by plotting the difference between normal (iron level of local market puffed rice) and its control (iron level of local market steeped and oven dried puffed rice). If the samples of local market oven dried puffed rice is compared to its control than iron level has increased in almost all the samples which showed that iron level has increased because of spirulina uptake.

Hand Pounded & Branded Puffed Rice

Hand pounded and branded puffed rice also showed the similar trend of iron uptake as seen in local market puffed rice.

Other Minerals

Along with iron other minerals like Magnesium, Zinc and Copper was looked into the iron fortified puffed rice and less significant variation was observed in their concentration with respect to their respective controls.

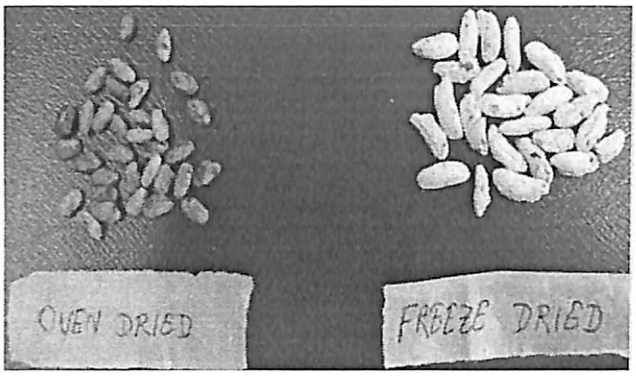

Fig: Fortified Puffed Rice

Sensory Evaluation

The sensory scores of freeze dried (LMF3 10) and oven dried (LMO3 10) puffed rice was evaluated by 30 semi trained panel by using 9 point hedonic scale. 9 point hedonic scale was divided into three categories. 1-4 score belong to dislike, 5 score to neutral and 6-9 score to like. On the basis of this division several sensory traits were scored.

Table 2: Percentage for sensory attributes of puffed rice

Sensory Traits	Freeze Dried (Lmf 3-10)	Oven Dried (Lmo3 3-10)	Sensory Traits	Freeze Dried (Lmf 3-10)	Oven Dried (Lmo3 3-10)	Sensory Traits
Scores	1-4 (%)	5 (%)	Scores	1-4 (%)	5 (%)	Scores
Appearance	2.9	2.9	Appearance	2.9	2.9	Appearance
Color	2.9	2.9	Color	2.9	2.9	Color
Shape	5.88	8.82	Shape	5.88	8.82	Shape
Taste	0	2.9	Taste	0	2.9	Taste
Texture	0	2.9	Texture	0	2.9	Texture
Odour	0	8.82	Odour	0	8.82	Odour
Overall Acceptability	0	2.9	Overall Acceptability	0	2.9	Overall Acceptability

In case of LMF3-10 (local market freeze dried puffed rice in which 30gms of spirulina was added in one kg of puffed rice and was steeped for 10mins), taste, texture and overall acceptability was liked by 97.05% of panel members, whereas 2.9% panel members gave neutral scores. The appearance and color was accepted by 94.11% of panel members, whereas 2.9% of panel members disliked it. Only 91.12% and 85.29% of panel members liked the odour and shape of LMF3-10 puffed rice respectively. Shape of LMF3-10 was disliked by 5.88% of panel members.

In case of LMO3-10 (local market oven dried puffed rice in which 30gms of spirulina was added in one kg of puffed rice and was steeped for 10mins), opposite response was obtained when compared to freeze dried variation. Almost in all the sensory traits more than 50% panel members dislike it.

Thus it could be concluded that local market freeze dried puffed rice was liked more than oven dried puffed rice

Discussion

The daily requirement for iron varies from person to person depending upon age and gender. However, women and children are more prone to iron deficiency anemia. Daily requirement of iron for women is 30mg/day and that of children vary from 12-26mg/day. Puffed rice is the common consumed food in the form of snacks all over India especially in Tripura (88.9%) and West Bengal (67.7%)[11].

In the present study it was observed that the concentration of iron in fortified puffed rice varied from 20.16ppm to 57.17ppm. Hence the fortified puffed rice in the present investigation can be used as perfect source of iron The iron content of Spirulina powder used in the present study was observed to be 463.03mg/kg.

In this study different techniques adopted to fortify puffed rice with iron using spirulina powder have shown differential fortification with respect to unfortified (control) puffed rice. Fortification of iron varied with variation in the concentration of spirulina in which the puffed rice was soaked. The iron absorption into the puffed rice increased with the concentration of spirulina, i.e. up to Sp.3 (20gm of spirulina in one kg of puffed rice) however at higher concentration the iron concentration was observed to be low in comparison to that of puffed rice treated with lower concentration of spirulina. The diffusion of iron from higher to lower concentration may be the probable reason. Initially at lower concentration of spirulina, puffed rice iron concentration was less in comparison to the spirulina liquid in which puffed rice was steeped in. thus there was iron flow from higher to lower concentration. This process of diffusion continued up to Sp.3 (20gm of spirulina in one kg of puffed rice) but as the spirulina concentration increased, diffusion of iron changed from puffed rice to spirulina solution because at that point iron within the puffed rice was more in comparison to the liquid in which it was steeped in. The first initiative of fortifying a cereal product by using a natural fortificant like *Spirulina* was done in case of pasta. Pasta is traditionally made from very hard wheat which is hard in protein and water. [3] A research was done by incorporating *Chorella vulgaris* and *Spirulina maxima* biomass in pasta product. The study concluded that microalgae pastas presented very appellative colors such as orange and green, similar to pastas produced with vegetables, with

nutritional advantages, showing energetic values similar to commercial pastas. An increase in the microalgae concentration (0.5-2.0%) resulted in a general tendency of an increase in the pasta firmness[8].

The steeping time has also been observed to affect the iron absorption in puffed rice. With increase in steeping time the iron absorption increased up to 10 min however receded with the increase in steeping time onwards after 10 min. The probable reason may be that at 10min steeping time maximum amount of spirulina water is absorbed by puffed rice, after as the steeping time more amount of iron start leaching out from puffed rice. Thus it's seen that in each case of puffed rice for Sp.3, steeping time 10mins gave best results. However there is some variation in such observation seen. In case of local markets freeze dried and oven dried puffed at Sp.2, steeping time 30mins gave best results. The effect of spirulina concentration on the absorption of iron may be attributed to the solution chemistry.

Out of two drying techniques adopted during the fortification, freeze drying was observed to be more effective than oven drying with respect to both nutrient content as well as sensory evaluation. The probable reason being during freeze drying the samples were dried under low temperature and vacuum which prevent loss of nutrient by evaporation unlike that in case of oven drying at high temperature (Approx. 35°C).

As the spirulina contains various other nutrient elements, although less significant but elemental interaction has been observed. Most of the nutrient elements required at a particular amount (RDA), a little less amount causes deficiency diseases where as a more may become toxic. Hence such important nutrient elements like magnesium, copper and zinc were analyzed and less significant variation has been observed in their concentration with respect to their respective controls. However such observations need to be confirmed with further experiments.

Freeze-dried puffed rice of all the variants have retained their shape and texture unlike the oven dried which reduced in their size and ill structured because the former was dried in vacuum. Freeze dried puffed rice has an appellative color in comparison to oven dried puffed rice because in the later case spirulina get attached to the surface of puffed rice, which can also be responsible for scoring less scores from panelists in odour. Hence the freeze dried puffed rice has been most liked and well accepted by a little more than 93.36% panelist unlike that of oven dried puffed rice i.e. approx. 23.94%.

Conclusion

Iron fortification of puffed rice using spirulina powder was successfully done. The amount of iron with which the puffed rice has been fortified, makes it a good source of iron. Along with iron other nutrient elements have also been absorbed into the puffed rice adding to its nutrient value. In the present study, it has been observed that freeze drying technique has resulted in better fortification and the products were also accepted by maximum people. From this it can be inferred that it's not only the fortificants, but the preparation techniques also need to be standardized during fortification programme. This iron fortified puffed rice may be used as a source of iron to deal with the problem of iron deficiency related anemia in India in general and in rural areas in particular.

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A study on the Physiological Changes and the Nutritional Status of Menopausal Women

Snehal Kochar and Nandita Das

ABSTRACT

An intensive study on the health and nutrition of menopausal women was carried out in Kolkata in two hospitals. consisting of 70 menopausal women. An attempt was made to relate the dietary habits of the women to the various physiological changes that occur in menopause. An analysis of their dietary habits revealed that the women consumed about 1500 Kcal/ day, where proteins averaged 43g and fats averaged 50g in the diet. Calcium and phosphorus intakes were lower than the ICMR recommended values especially in the non vegetarian group. Although, anthropometric measurements indicated that the subjects' dietary intakes were deficient in nutrients and they had inadequate energy reserves, they were not suffering from postmenopausal diseases such as osteoporosis. According to the data, menopausal women on a non vegetarian diet were more prone to insomnia and restlessness whereas, hot flashes and vaginal dryness was more frequent in women on a vegetarian diet. It was observed that itching, was more common in the vegetarian obese group while it was totally absent in the non vegetarian normal group. On the other hand, the ability to deal with stress was better in the vegetarian group.

Keywords: Diet, Menopause, Nutritional Status, Physiological Changes, Stress Levels

Introduction

Menopause takes place when a woman permanently stops ovulating and menstruating and can no longer conceive a child; it is generally considered to have occurred one year after the last menstrual period. In 4 out of 5 women, this happens between ages 45 and 55; on average, at about 50 or 51 years[3].

Natural menopause occurs when essentially all follicles are used up from a woman's ovaries. This eliminates the body's most productive estrogen source and results in a substantial decrease in circulating levels of the hormone. Without an adequate estrogen stimulus, endometrial proliferation ceases and there is insufficient tissue to produce a slough from the uterus. In this way, the number of follicles that are available within the ovaries and the mechanism by which they are lost determine when menstrual activity ends. Clinically, amenorrhea of 6-12 months' duration during the fourth or fifth decade of life suggests the onset of menopause.

Menopause is derived from the Greek word 'men' which means 'month' and 'pauo' which means 'to stop' ie. the cessation of menstruation. The word climacteric is derived from the Greek word 'klimakter' or 'rung of the ladder' meaning critical period of life.

Nutritional requirements during the menopausal years neither fall in the adult category nor proper old age. So, the requirements are to be considered very carefully under these conditions. The nutritional requirements are based on the physiological changes that take place in the body as the body ages. Generally, nutrient requirements change after the age of 30 years.

Methodology

A survey was conducted with the help of a detailed questionnaire for the assessment of physiological changes and the nutritional status of menopausal women. The questions pertaining to the topic were asked and a 3-day diet recall was taken of the subjects.

Standardization Of The Food Items And Instruments:

Results of the weighment method employed at household/institutional level, were usually expressed as intake of foods in grams per consumption unit or per person per day. Foods were converted to nutrients by referring to Food Composition Tables, which provide information on quantities of different nutrients, such as proteins, vitamins, minerals, calories, etc per 100g of edible portion of food.

The weighment method was used for both raw and cooked food. In this method, as the name implies, foods were actually weighed using the accurate balance. Grocer's balance with standard weights and measures from the main equipment and a structured diet survey schedule is the study instrument. The method was implied for weighing both raw and cooked foods. The raw foods were first weighed and then, the foods were cooked. The cooked quantities were again weighed.

Construction Of The Questionnaire:

A multiple choice questionnaire was formulated for the respondents for this study and the answers were noted down.

A 24 hour recall method for 3 consecutive days was taken with the help of an oral questionnaire.

The dietary data was obtained from the respondents using a set of "standardized cups" suited to local conditions. A specific questionnaire was designed which had 3 different sub-sections.

The 1st section included personal information details and questions on the nutritional status. The respondents were asked about the types of food preparations made according to the meal pattern and consumed during breakfast, lunch, afternoon teatime and dinner. An account of the raw ingredients used for each of the preparations was obtained. Information on the total cooked amount of each preparation was noted in terms of standardization. The intake of each food item was assessed.

The 2nd section dealt with the physiological changes which involved some detailed questions regarding the symptoms experienced during the process, some personal experiences of the respondents were asked.

The 3rd section dealt with the stress responses of the subject which had various sections on the particular symptoms experienced by the individual particularly designed for assessing stressful conditions experienced by the patient.

From a huge population, a sample was drawn and a survey was made on the sample units.

Table 1 : BMI Classification

BMI class	Presumptive Diagnosis
18.5-20.0	Low weight- Normal
20.0-25.0	Normal
25.0-30.0	Obese grade-I
›30.0	Obese grade-II

Table 2 : Stress Score

SCORE LEVELS	REMARKS
00-20	It is unlikely that your stress is so low. Perhaps, you interpreted the question incorrectly.
21-45	You cope effectively with stress. Your level of stressis below average.
46-70	You do not experience stress more than the average person.
71-90	You exhibit an average level of stress. You must find it difficult to cope in certain circumstances. You can benefit from active coping strategies.
91+	You exhibit high stress levels. It is recommended that you learn to identify causes of stress as well as active ways in dealing with these causes.

Results & Discussion

Nutritional Status: 63.85% of the subjects consumed a total of 3 major meals in a day, 35.28% consumed a total of 4 meals in a day

52.85% consumed food within 2 hrs, 42.85% within 3 hrs, and 4.27% ate within 4 hr intervals.

54% people consumed rice as the major form of cereal, 66% consumed cereals in the form of chapatis, 2.84% consumed in the form of parantha.

91% of the respondents liked to having pulse whereas, the remaining 7% had a certain aversion towards pulse consumption.

53% did not consume non vegetarian food, 29% consumed fish, 11% consumed chicken, 9% consumed egg mostly and 2.85% consumed meat.

90% of the respondents consumed milk products.

77.1% of the subjects did not suffer from any type of an allergy, 7.41% had an aversion to brinjal, 7.14% had milk\ lactose intolerance, 2.85% were allergic to eggs and mushrooms.

67. 14% were not taking any form of nutritional supplements.

81% of the respondents didn't notice any visible change in their dietary pattern post menopause.

62.8% of the subjects did not consume any multivitamin pill, 35.71% consumed multivitamin supplements.

Calcium supplements were also taken by 64.28% of the respondents.

Both the groups have registered low calorie intake as compared to the RDA guidelines. The vegetarian group had a better score given the fact that oil is the main cooking medium for foods and serves to be the major source of calorie intake in the vegetarian group. Though, the actual intake was much lower than recommended. The vegetarian group had a 61.5% lower intake than recommended while the non-vegetarian group fared better with the difference accounting to 58.2% when compared with the RDA for individual groups. This could be attributed to the high variability in the calorie intake amongst the non vegetarian group.

There was a significant difference regarding the actual protein intake of the subjects. Though, the intake of protein was lower in both the groups, it was more lower in the vegetarian group than the non vegetarian group. This may be hypothesized from the fact that a non vegetarian diet is more richer in animal protein.

The mean carbohydrate intake was almost half of the dietary requirements in both the groups. There was a difference of 49.6% between the actual intake and the recommended intake in the vegetarian group. On the other hand, 45.4% difference was recorded in the non vegetarian group between the RDA and the actual intake. The intake was better in the non vegetarian group comparatively.

There was a slight difference in the fat intake between the two groups as per the recommendations. For the vegetarian group, the actual fat intake was greater than the recommended

intake. On the other hand, for the non vegetarian group, the actual intake was a little less than the recommended intake.

The average daily intake of calcium ranges from 1200-1500 mg. The data indicates that the actual intake of calcium in both the groups was lower than expected. On the other hand, the non vegetarian group had a much lower intake of calcium comparatively. This may be attributed to the less consumption of milk products comparatively.

The recommended intake of phosphorus was 1200 mg per day. The average daily intake did not meet the recommended values. The difference was more prominently seen in the non vegetarian group.

Menopausal Changes: For 82.8% of the respondents, menopause occurred at an age of 40-50 yrs.

71.42% of the respondents experienced a natural menopause, whereas, 28.57% had hysterectomy.

49% came to know about the menopause through missed periods, 1% experienced heavy bleeding, 9% experienced night sweats.

66% came across the thinning of hair more frequently.

Breast tenderness was also observed in 61.42% of the subjects.

88.57% of the subjects did not undergo any HRT treatment.

Stress Score of the Groups:

Among the vegetarian group consisting of 38 subjects, 39.47% of the subjects had a stress level score of (21-45). The scale value for the score indicates that :

The level of stress experienced by the patients was way below average. They were able to cope effectively with the stress levels.

Among the non-vegetarian group also consisting of 32 subjects, 34.37% of the subjects had a stress score level of (46-70)

From the above results, it can be said that both the groups of individuals did not experience stress levels way above or below the average individuals. But still, the vegetarian group was able to deal with stress more effectively.

The stress levels were at a minimal level in the vegetarian group as compared to the non vegetarian group.

Blood Pressure Levels: In the vegetarian group having a normal BMI, the mean blood pressure levels were around 118/73 mm Hg as the systolic and diastolic pressures, respectively. Whereas, in the non vegetarian group having individuals with a normal BMI, the mean blood pressure values were around 118/74 mm Hg. There was no difference seen between the two groups.

In the vegetarian group consisting of persons having a BMI greater than the normal index, it was observed that the mean blood pressure levels averaged around 122/75 mm Hg. On the other hand, the non vegetarian group experienced a mean of 122/74 mm Hg respectively.

So, it can be concluded that the dietary pattern did not affect the blood pressure levels of the individuals.

Levels of physical activity: In the vegetarian normal group, 50% of the patients were not involved in any kind of physical activity. In this group since the subjects were seen to maintaining a healthy weight, therefore, there was no significant relationship seen between the blood pressure levels and the degree of physical activity practiced by the patients.

Primary symptoms: The incidence of hot flashes was common in all the groups. The pattern also indicates a trend of obese people having a greater risk of suffering from hot flashes. It was seen that the degree of incidence of hot flashes was most prominent in the vegetarian obese group, followed by the non vegetarian obese group. Thus, it can be said that the risk of obesity increases the chances of occurrence of hot flashes. In both the non vegetarian groups, the incidence of hot flashes was far less in comparison.

It can be concluded that vaginal dryness was absent in subjects who had a healthy body mass. There was no incidence of vaginal dryness reported in these two groups. As can be seen, the degree of incidence was greater in the obese individuals that too in the vegetarian group. This shows that non vegetarian diet helps in reducing the incidence of vaginal dryness.

Secondary symptoms: The highest level of insomnia was seen in the vegetarian obese group followed by the non vegetarian obese group. It was lower in the non vegetarian group with a normal BMI. This indicates that the incidence of insomnia increases with a definite increase in weight.

The incidence of restlessness was greater in the vegetarian (obese) group and the vegetarian normal group. It was totally absent in the non vegetarian group. Thus, it can be proposed that vegetarian diet is more prone towards increasing the chances of restlessness.

The incidence of itching was also higher in the vegetarian obese group as compared to the rest of the groups. It was absent in the non-vegetarian normal group and here also the incidence increased considerably with an increase in weight. So, it can be said that vegetarian people are more prone to experiencing these symptoms along with an increase in the BMI.

For the vegetarian normal BMI group i.e. group I and non vegetarian normal group i.e. group III, it was found that the tabulated value of t at 1% level of significance was 2.921. Compared with the observed t value i.e. 0.6, it was found significant reason to accept the alternative hypothesis and conclude that the dietary intake influences the severity or degree of occurrence of menopausal physiological changes.

For the non vegetarian obese group and the vegetarian obese group, i.e. group II and IV respectively, it was found that the tabulated value of t at 1% level of significance was 2.660. Compared with the observed t value i.e. 0.03, it was found that the tabulated value was greater. Thus it can be said that the dietary intake influences the variability of occurrence of menopausal changes.

Conclusion

From the above results the alternative hypothesis confirms that dietary pattern has an effect on the susceptibility of certain changes experienced by the menopausal women. Though the stress levels and blood pressure levels were independent of the dietary intake, the insomnia levels were higher in the obese groups of both dietary patterns i.e. vegetarian and non vegetarian diet. It was also observed that obese people were more prone to experiencing hot flashes. In the vegetarian group, hot flashes together with vaginal dryness was seen to rise with a consequent increase in BMI

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Study of the Nutrient Adequacy of School Lunch of Children Belonging to Low and High Middle Income Groups

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ABSTRACT

A study was carried out to evaluate the nutrient adequacy of packed lunches of 130 school children, 10-12 years of age from the LIG and HMIG schools in Kolkata. 50 girls from LIG and 50 girls and 30 boys from HMIG were selected for the study. A three day dietary survey of packed lunches and the whole day's nutrient intake revealed that the mean protein, carbohydrate, energy, calcium and iron intake in both the income group schools were deficient compared to RDA (Recommended Daily Allowance) requirement. The deficiency was more in LIG compared to HMIG and there was a significant difference in the nutrient intake between the two groups. The fat intake was higher in both the income groups compared to the RDA requirement but there was no significant difference between the two income groups for the intake of fat. Clinical deficiencies like sparse hair, brittle nail and rough skin were observed in LIG children and they did not have normal height and weight for their age compared to the HMIG children. To improve the nutrient intake of packed lunches in LIG girls, an intervention programme was carried out and two healthy snacks (Soya cutlet and Chirwa) were prepared and given to them to meet 1/3rd of the caloric requirement in the packed lunches

Keywords: Nutrient Adequacy, Packed Lunch, Recommended Daily Allowance (RDA)

Introduction

Although by school age, children have established a particular pattern of meal intake, they continue to be affected by the influences of their peers and the mass media[4]. At the same time; they are burdened by heavy school work, class competition and proneness to communicable diseases. Malnutrition can have severe long-term consequences. Children who suffer from malnutrition are more likely to have slowed growth, delayed development, difficulty in school, and high rates of illness, and they may remain malnourished into adulthood[7]. 85% of children affected by stunting or wasting live in Asia. More than 35 percent of all preschool-age children in developing countries are underweight. "The risk of being underweight is 1.5 times higher in Asia than in Africa and 2.3 times higher in Africa than Latin America[8]." In some ways, these indices also enable an indirect understanding of the societal factors in these regions that contribute to malnutrition[8]. Packed lunch plays an important role in preventing malnutrition in the school going children. Since children spend a lot of time in school, it is important that they carry packed lunches or eat a healthy meal in school to avoid malnutrition. Packed lunch or a school lunch should provide 1/3rd of the daily requirement of calories and protein of the child[2,6]. 'Parents are often misled by marketing for these lunchbox products which make health claims like "high in vitamins" but also turn out to be high in salt, fat or sugar as well.' There is now an even stronger case for giving importance to packed lunch which really will start to change our food culture[5].

Methodology

The collection of data for the research was done by a questionnaire and interview method. 130 children were selected from two different socio economic backgrounds in Kolkata. Out of this 50 girls and 30 boys were selected from the high middle income group school and another 50 girls from the low income group school. The age of the children ranged from 10-12 years.

To carry out the dietary assessment, the most common recipes were standardized in terms of measuring cups, glasses and spoons in the food laboratory of J.D Birla Institute. A three day dietary recall method was carried out and to conduct the survey the standardized cups, glasses, spoons and the different shapes and sizes of chapatti, parathas cut out on paper were shown to the children from which they could select, the one similar to the amount they had consumed. Eating pattern of the children was probed to find out the kind and the quantity of food consumed. The type and the quantity of food in the lunch boxes were checked by the investigator. This was done, to make an accurate appraisal of the quantity of food consumed by the children. To analyse the results, t-test was carried out to see the difference of the nutrient intake of the school children belonging to the two different income groups.

Anthropometric measurements were taken, where height was measured with the help of a measuring tape and body weight of the child was taken by a portable human weighing machine with an accuracy of 0.5 kg[1]. The height and weight measurements were taken to check the growth of the

children as per their age and the Standard NCHS values (National Centre for Health Statistics) and thus, determining the degree and grade of malnutrition in children.

Formulation of the intervention programme

An intervention program was planned for the mothers and their children, if the nutrient intake was found to be inadequate in either of the schools. For this, two nutrient rich recipes which would meet 1/3rd of the daily caloric requirement were standardized in the college food laboratory. The, two recipes that were standardized were soya cutlet and Chirwa enriched with soya granules. These products prepared were rich in protein, calories and iron and were cost effective and easily available. An evaluation form would be framed and the girls would be asked to tick the preferred product on the basis of colour, taste, appearance and overall acceptance.

Results & Discussion

The results of the study were interpreted with the help of the responses drawn from the data collected. After the survey was completed, it was seen that 24%, 20% and 4% of girls in the low income school suffered from Grade I, Grade II and Grade III malnutrition, this was attributed to the low intake of food and socio economic background ,whereas only 20% of the girls of the high middle income school suffered from Grade 1 malnutrition.

Table I: Comparison of the mean nutrient intake of packed lunch in the girls of the low and the high middle income groups with the RDA

Income group	Sex	Protein gms	Fat gms	Carbo-hydrate	Energy Kcals	Calcium mg	Iron gms
Beltala Girls (Low income school)	Girls	8.34	7.94	50.44	300.86	77.1	2.91
Apeejay (High middle income school)	Girls	14.32	8.69	99.58	504.2	154.2	4.5
RDA Values	Girls	19	7.3	114.7	656.6	200	6.3

The above table (I) shows the mean nutrient intake of the packed lunch consumed by the girls of the low and the high middle income schools. There were significant differences in the nutrient intake patterns of the two groups. The table indicated the inadequacy of the packed lunch carried by the girls of both the income groups and did not meet 1/3rd of the caloric requirement, but the nutrient intake of the packed lunch in the high middle income group girls was marginally better when compared to the low income school.

The intake of protein was inadequate in the packed lunches, it was seen that only 43.68% and 75.36% of the RDA for protein in the packed lunch was met by the girls of the low and the high middle income school respectively. Though, the girls of the low income school belonged to the Bengali community and consumed fish at least thrice a week, they still did not meet the protein requirement. This was because they consumed aloo puri, biscuits, chapatti, parwal or noodles in their packed lunches which were low in the protein content. The girls of the high middle income school usually got food items which were rich in protein like paneer, cheese bread and they also had the accessibility to the school canteen which served protein rich food like chola bhatura, egg roll and paneer patties. The t- test value for protein intake between the two socio-economic schools is 12.41, which is greater than the tabulated value 2.63 and there is a significant difference at 0.01 level of significance in the intake of protein between the two income group school girls. It may be said that the intake of the nutrient protein was inadequate in the low income school girls.

The intake of fat in the packed lunch was higher than the RDA requirement for both the income groups. The girls belonging to the two different income groups had fried items which were rich in the fat content. 8.2% and 17.8% of the fat intake in the packed lunches of the girls of the low and the high middle income school respectively was higher than the RDA, and the girls of the low income school were seen to have puri with potato which was deep fried and the girls of the high middle income school had French fries and fried snack from the canteen. The t- test value for fat intake between the two socio-economic schools is 1.78 is less than the tabulated value 2.63 and there is no significant difference at 0.01 level of significance in the intake of fat between the two income group school girls.

Only 44.30% of the RDA for carbohydrate was met in the packed lunches by the girls belonging to the low income school. Whereas, 87.46% of the RDA for carbohydrate was met in the packed lunches by the girls in the high-middle income school. The t- test value for the carbohydrate intake between the two socio-economic schools is 14.87 which is greater than the tabulated value 2.63 and there is a significant difference at 0.01 level of significance in the intake of carbohydrate between the two income group school girls. It may be said that the intake of

the nutrient carbohydrate was inadequate in the low income school girls.

The girls of the low income school met 45.82% of the RDA for energy in the packed lunch which were not calorie dense and their packed lunches mostly included of items like biscuits, muri and noodles which were not sufficient to meet the energy intake. The girls of the high middle income school met 76.88% of the RDA for energy in the packed lunch and had healthy packed lunches like cheese, butter, and mayonnaise sandwich, stuffed parathas, mixed pulao which were calorie dense foods.

38.5% of the RDA for Calcium was met by the girls of the low income school in the packed lunches which was not sufficient and did not meet 1/3rd of the requirement for calcium. The girls of the high middle income school had adequate intake of calcium in their packed lunches and included snacks made out of cheese, paneer and at times had sweets made out of milk products and met 77.1% of the RDA for calcium.

Girls of the low income school met 46.03% of the RDA for iron and usually got the same packed lunch practically every day which included chapatti with potato or parwal, being deficient in the nutrient iron, whereas 75% of the RDA for iron was met by the girls of the high middle income group who got healthy lunches from home which included poha enriched with peanuts. The t- test value for the iron intake between the two socio-economic schools is 9.3 which are greater than the tabulated value 2.63 and there is a significant difference at 0.01 level of significance in the intake of iron between the two income group school girls. It may be said that the intake of the nutrient iron was inadequate in the low income school girls.

Thus, from the data analysis it was found that the low income school girls had poor nutritional status and required an intervention programme to emphasize the importance of having proper packed lunch which would meet 1/3rd of the daily requirement. For this purpose the two standardized recipes namely soya cutlet and chirwa were prepared and distributed to the girls of the low income school and their mothers were taught the preparation of the recipes. It was seen that the girls preferred soya cutlet to chirwa in terms of colour and taste.

A similar survey was carried out for 30 boys who belonged to the high middle income group who came from families where the parents were educated and had appropriate knowledge about nutrition. The nutrient adequacy of their packed lunch was assessed and compared with the RDA.

80% of the boys of the high middle income school were growing normally and had normal weight for age and did not show any sign of malnutrition. Whereas only 20% of the boys suffered from grade 1 malnutrition. The boys of the high middle income school showed less signs of brittle nails, sparse hair and rough skin. 77% of the boys had normal height for their age. 23% of the boys were found to have marginal malnutrition that is they did not have standard height for their age.

Table II: Comparison of the mean nutrient intake of packed lunch by the boys of the high middle income school with the RDA.

Income group	Sex	Protein gms	Fat gms	Carbo-hydrate	Energy Kcals	Calcium mg	Iron gms
Apeejay School (H.M.I.G)	Boys	14.71	7.73	98.32	577.13	161.33	6.91
RDA Values	Boys	18	7.3	127.6	730	200	11

The above table (II) shows the mean nutrient values of the packed lunch consumed by the boys of the high middle income school. Except for the intake of the nutrient fat the boys did not meet 1/3rd of the daily caloric requirement in their packed lunches, though the nutrient intake was seen to be better as compared to the girls of the two different income schools.

81.72% of the RDA for protein was met in the packed lunches by the boys of the high middle income school. The protein intake in the packed lunch was met from the foods consumed like paneer, chola, and soya sticks. The boys were seen to have bean toast and ice-cream from the school canteen which was again rich in the nutrient protein. The fat intake in the packed lunch was higher than the RDA value. The packed lunches of the boys consisted of fried items like besan pakora, stuffed puri and they also depended on the food served in the canteen which was again seen to be rich in fat. 77.05% of the RDA for carbohydrate and 79.05 % of the RDA for energy was met in the packed lunch by the boys. Many of the boys after finishing their packed lunch also ate food provided by the canteen. They were seen to have ice-creams, beverages and chocolates which were all calorie dense foods. The packed lunches met 80.66% and 62.81% of the RDA for calcium and iron respectively and consisted of calcium and iron rich snacks made out of paneer, cheese toast, banana muffins, peanuts, poha and chocolate biscuits.

Conclusion

The nutrient intake of the children in both socio-economic groups was inadequate when compared to the RDA requirement, but the nutrient intake in the high middle income was better when compared to the low income group. Interestingly the fat intake of the girls and boys in both schools were higher when compared to the RDA requirement. An intervention programme was carried out in the low income group to educate the mothers and their children to emphasis the need for having sufficient intake of nutrients in their packed lunches

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Effect of Flaxseed Incorporated Recipes on Glycemic Index and Glycemic Load

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ABSTRACT

The effect of flaxseed incorporated recipes on glycemic index and glycemic load was evaluated on 10 healthy subjects. Flaxseed was incorporated at levels of 5g, 10g and 15g to each of three cereal based standard recipes traditionally consumed in India i.e., Uttapam, Missi Roti and Semolina Upma. On the basis of conducted sensory evaluation, the most acceptable variation from each recipe was chosen to determine the glycemic response. The control recipes (without flaxseed) and experimental recipes (with flaxseed) containing 50 g of available carbohydrate each was fed to the subjects, after measuring their fasting blood glucose level. The post prandial blood glucose response of the recipes (control and experimental) at 30, 60 and 120 minutes was compared to the post prandial blood glucose response of the reference food i.e., glucose (containing 50g of available carbohydrate) in order to calculate the glycemic index and glycemic load of the recipes. It was found that the glycemic index as well as the glycemic load of experimental recipes was significantly (significant at 5% level) lower than its respective control recipes. The protein, fat, energy and fibre content of the experimental recipes were also evaluated and found to be higher than that of its respective control recipes

Keywords: Flaxseed, Glycemic Index (GI), Glycemic Load (GL).

Introduction

Carbohydrates have been classified as 'simple' and 'complex' based on their degree of polymerization; however, their effects on health may be better described on the basis of their physiological effects (i.e., ability to raise blood glucose). According to Jenkins et al[16], the GI value of a food is a percentage of the 2-hour area under the blood glucose response curve of a reference food, typically glucose. Since the GI is determined for a particular quantity of carbohydrates in the food being tested and since the actual amount of carbohydrates consumed in a meal or snack varies greatly, the GI concept was expanded to include the concept of Glycemic Load (GL). The GL is determined by multiplying the GI of a food by the grams of carbohydrates in a serving. The GL value incorporates the amount of digestible carbohydrates in a serving in order to better gauge the impact of a meal or snack on postprandial glucose response[13]. The dietary Glycemic Index (GI) provides an indication of the rate at which carbohydrate foods are digested[6]. It allows ranking of foods from those which give rise to the highest blood glucose responses (high GI food) to those associated with the lowest blood glucose responses (low GI foods). The reference food could be white bread or glucose with a GI set at 100. Evidence suggests that high GI or GL diets may increase the risk for cardiovascular disease (CVD) and type II diabetes. In contrast, a low GI diet has been reported to have health benefits. A low GI diet has been shown to improve glycemic control, aid in weight loss, and reduce some CVD risk factors[1].

Flaxseeds are one of the richest sources of the α -linolenic acid (omega-3 fatty acid) and lignans. Dietary omega-3 fatty acid protects against thrombosis, heart attack, atherosclerosis, arthritis, asthma, osteoporosis, etc. The major lignan in flaxseed is called secoisolariciresinol diglucoside (SDG), which plays a role in prevention of estrogen – dependent cancers. Flaxseed is also a good source of dietary fibre and known to improve glucose metabolism and is correlated to decrease risk of colorectal cancer. Consumption of flaxseed has shown to reduce total and LDL cholesterol and platelet aggregation[2]. It can be incorporated in various recipes and thus can be expected to lower the glycemic index of such recipes.

Methodology

Development of Different Rice and Wheat Based Recipes Incorporated with Flaxseed:

Three standard rice and wheat based recipes namely; Uttapam, Missi Roti and Semolina Upma were selected for the study. They were incorporated with 5, 10 and 15 gm of flaxseed powder and were Coded as A, B and C, respectively. The development of recipes was carried out in the food laboratory of J. D. Birla Institute. The recipes with flaxseed incorporation were used as experimental recipes and recipes without flaxseed incorporation were used as control recipes.

Sensory Evaluation of the Developed Recipes:

All developed flaxseed incorporated food preparations were evaluated for acceptability using nine-point Hedonic Scale [12] by panel of 20 members. The sample with maximum score in each recipe

was identified as the most acceptable variation. The most acceptable variation from each recipe along with the control recipes (without flaxseed) was selected for the GI and GL study.

Study of Glycemic Index (GI) and Glycemic Load (GL):

The GI and GL of the experimental and control recipes were estimated by feeding selected subjects with the recipes and measuring the blood glucose response.

For the experiment, healthy, non-diabetic, young adult male subjects were selected on the basis of a structured questionnaire which dealt with personal details of the subjects, anthropometric measurements, their medical history and blood glucose levels. The blood glucose levels were determined by drawing capillary blood through finger-pricking, Accu- Check Go meter and its test strips.

The nutrient composition such as energy, carbohydrate, protein, fat and fibre, content per serving of the both control recipes (without flaxseed) and most acceptable experimental recipes (with flaxseed) were calculated from the values given by Gopalan et al[8]. The appropriate and accurate serving size of each recipe was determined based on the carbohydrate content required for the study i.e., 50 gm of carbohydrate. Glucose which was selected as reference food in the present study provided same amount of carbohydrate as the test recipes i.e., 50g.

The reference food (glucose), 3 control recipes (without flaxseed) and 3 experimental recipes (with flaxseed), was fed to the subjects on separate days, after measuring their fasting blood glucose level. The post prandial blood glucose response of the recipes (control and experimental) at 30, 60 and 120 minutes was compared to the post prandial blood glucose response of the reference food i.e., glucose (containing 50g of available carbohydrate) in order to calculate the GI. The collected data of blood glucose responses for all ten subjects was plotted on graphs and the Incremental Area Under Curve (IAUC) was estimated from the curves thus obtained. The calculated value of IAUC was used for GI calculation using the standard formula [16] given below:

$$GI = \frac{\text{Incremental area under blood glucose response curve (IAUC) for a food}}{\text{Corresponding area after equicarbohydrate portion of a reference food}} \times 100$$

GL was calculated based on the approximate quantities of the recipes per serving and the respective available carbohydrate content. The GL of the recipes were determined using the formula given by Miller et al [10].

$$\text{Glycemic Load (GL)} = \frac{\text{GL x available carbohydrate content per serve size}}{100}$$

Statistical Analysis:

In order to find out whether all the three variations of each recipe were equally acceptable or not to the respondents, a two way ANOVA (Analysis of Variance) Technique has been used. Since the ANOVA technique resulted in unequal acceptance of the variations of the recipes, pair wise comparison was done to find which one is the most acceptable among the three. Further, in order to find that whether incorporation of the flaxseed lowers the Glycemic Index and Glycemic Load of the food or not, t-test for equality of the means was applied on control and experimental recipes.

Results & Discussion

All the collected data was tabulated and various statistical tests were applied. Following were the main observations:

Acceptability of the Formulated Recipes by Sensory Evaluation:

On the basis of conducted ANOVA (significant at 5% level) on three types of variations for each recipe, there was a significant difference between the overall score of all the three variation of all three recipes. Overall score and results of applied paired comparison "F" test for all 3 experimental recipes indicated that Flaxseed Uttapam variation C (containing 15g flaxseed), Flaxseed Missi Roti variation A (containing 5g flaxseed) and Flaxseed Semolina Upma variation B (containing 10g flaxseed) was most acceptable.

Selection of Subjects for Glycemic Index Testing:

For the experiment, 10 healthy adult male subjects were selected through a structured questionnaire. Exclusion criteria included being overweight, dieting, outside the normal fasting glucose range, illness or food allergy, or regular use of prescription medication. The mean Body Mass Index (BMI) of all subjects were 21.81 ± 1.16 kg/m^2 i.e., within the normal range (18.50-24.99kg/m^2)[15]. The fasting blood glucose level of subjects fall within the normal range (d"110 mg/dl) and varied between 84-98 mg/dl and they

had no record of illness in the past 2 months or were under any medication.

Nutrient Composition of the Recipes:

The nutrient composition of the actual amount of test food (control and experimental) served to the subjects is given below in Table 1.

Table 1: Nutrient composition of the recipes (per serving)

Recipe	Type	Actual Weight Per Serving (g)	Energy (K.cal)	Carbohydrate (g)	Protein (g)	Fat (g)	Fibre (g)
Uttapam	Uttapam (Control)	162.86	274.33	50	7.43	5.03	0.6
	Flaxseed Uttapam (Experimental)	166.8	319 18	50	9.39	9.28	1.15
Missi	Missi Roti (Control)	110.86	381.2	50	10.30	15.54	1.35
	Missi Roti (Experimental)	120.63	421.05	50	12.13	19.14	1.87
Semolina	Semolina Upma (Control)	215.2	282.05	50	8.31	6.16	0.84
	Flaxseed Semolina Upma (Experimental)	222.52	324.15	50	9.81	9.40	1.25

The amount of carbohydrate in the actual amount per serving was adjusted to 50g in all the recipes because the amount of available carbohydrate from reference food (glucose) was also taken as 50g. Level of flaxseed incorporation in the Experimental recipes i.e., Flaxseed Uttapam, Flaxseed Missi Roti and Flaxseed Semolina Upma was 7.5 %, 10.63 % and 4.34 % respectively. Keeping the carbohydrate content (per serving) of all the recipes as 50 g, it was found that in all the experimental recipes (with flaxseed), protein, fat, fibre as well as the energy content were higher when compared to its respective control recipes. According to Gannon[7], a high protein diet lowers the blood glucose post prandially in persons with type II diabetes and improves overall glucose control. Flax fiber supplement provides the benefits of soluble and insoluble fiber i.e; laxation and glycemic response, respectively[4]. Also, flaxseeds are one of the richest sources of á-linolenic acid (omega-3 fatty acid)[11]. Insulin resistance is a common feature of obesity and diabetes and is affected by the nature of dietary fat[3].

Blood Glucose Response:

The Blood Glucose Response of a food is thought to directly reflect the rate of digestion and entry of glucose into the circulatory system [14]. Figure 1 (a, b & c) shows the variation in the glycemic response of glucose and test food (control and experimental recipes).

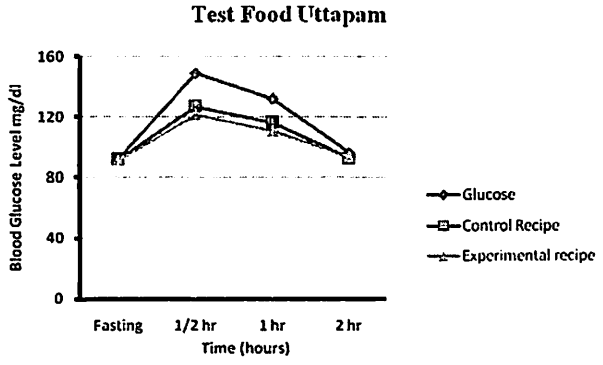

Figure 1(a) Curve Showing Glycemic Response of Glucose and Uttapam (Control and Experimental Recipe)

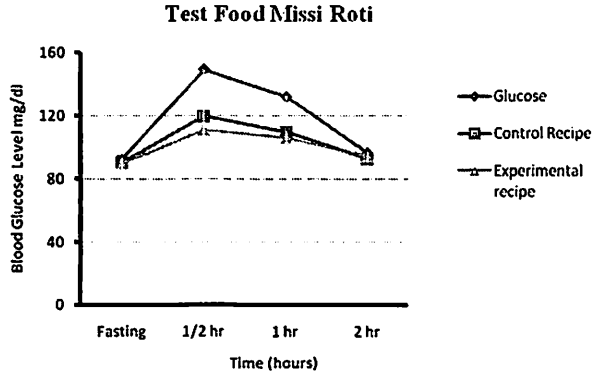

Figure 1(b) Curve Showing Glycemic Response of Glucose and Missi Roti (Control and Experimental Recipe)

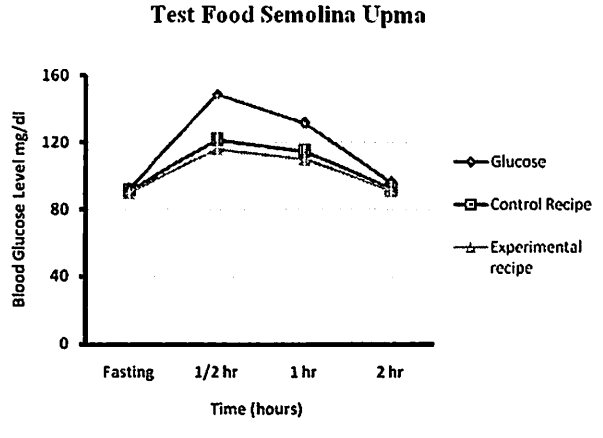

Figure 1(c) Curve Showing Glycemic Response of Glucose and Semolina Upma (Control and Experimental Recipe)

The fasting blood sugar levels of selected subjects varied from 84-98 mg/dl. The peak values were observed at 30 minutes after ingestion of the reference or test foods. Thereafter the levels showed a reducing trend. The reference food (glucose) recorded the highest response. All the control recipes (recipes without flaxseed) recorded lower re-

sponses. The flaxseed incorporated recipes recorded the lowest.

Glycemic Index (GI):

The GI of the test foods was estimated for all 10 subjects and the mean GI was calculated using the standard formula[16].

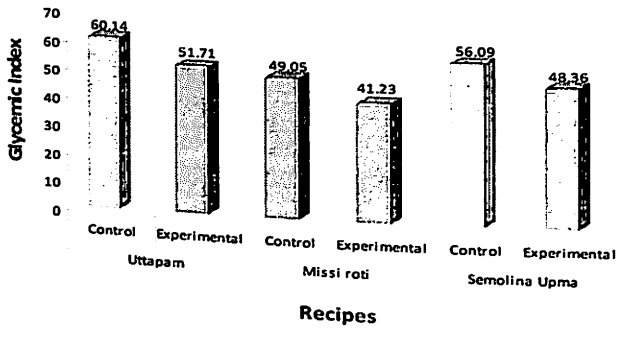

Fig 2 Glycemic Index of Recipes

It is clearly observed that flaxseed added to the three experimental recipes has brought down GI. Figure 2 indicates that there is a drop in GI of the experimental recipes (with flaxseed) namely; Uttapam, Missi Roti and Semolina Upma by 14.01%, 15.94% and 13.78%, respectively, when compared to control recipes (without flaxseed). The control recipe of Missi Roti registered lower glycemic response compared to control recipe of Uttapam and Semolina Upma. This could be due to high fibre content of wheat flour than rice and semolina [8]. The results of applied t test (significant at the 5% level) to glycemic index values for test food showed that there was significant reduction in the GI of the experimental recipes (with flaxseed) when compared to respective control recipes (without flaxseed). The level of postprandial blood glucose is influenced by quality and quantity of carbohydrate in the meal [17]. Though the carbohydrate content is same in all the recipe, adding flaxseed fibre and protein to carbohydrate slows digestion and absorption and hence reduces the peak of the glucose response.

Glycemic Load (GL):

GI ignores how much of the food a person eats. The GL is the product of the dietary GI and total dietary carbohydrate.

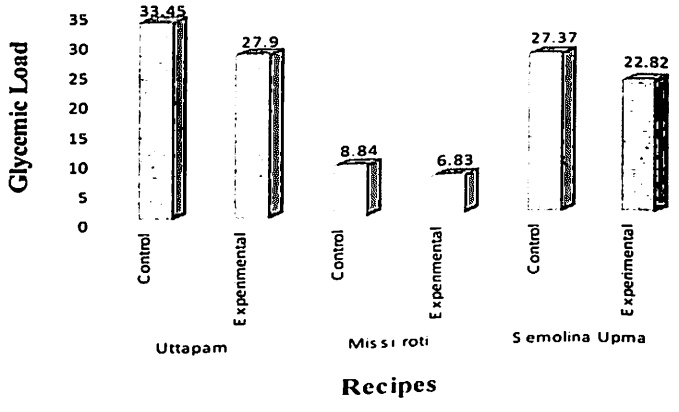

Fig 3 Glycemic Load of Recipes

The figure 3 indicates that there is a drop in GL of the experimental recipes (with flaxseed) namely; Uttapam, Missi Roti and Semolina Upma by 16.59%, 22.73% and 16.62% when compared to control recipes (without flaxseed). According to the GL classification [5], the flaxseed incorporated recipes recorded lower GL when compared to its respective control recipes. The results of the applied "t" test (significant at 5% level) confirms the above observation and shows that there was significant reduction in the GL of the experimental recipes (with flaxseed) when compared to respective control recipes (without flaxseed).

Conclusion

Incorporation of flaxseed in recipes has lowered the GI and GL of food. Thus it can be concluded that it is possible to identify food preparations in the habitual Indian diet having attributes of desired glycemic effect, i.e. delayed peak rise and low glucose response curves. Three of the foods studied, Uttapam, Missi Roti and Upma showed the desired attributes when incorporated with flaxseed. There is increasing evidence to suggest that the immediate glycemic response to a food may be a predictor of its effect in the longer term [9]. The GI concept is useful in classifying foods; however, the importance of choice of carbohydrate should be specified and also appropriate dietary guidelines have to be formulated for people suffering from chronic diseases

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Studies on Nutritional and Anti-nutritional properties of Tannins present in Fresh and Packed Fruit juices

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ABSTRACT

Fresh and packed juices of guava and pineapple were investigated for preliminary phytochemical analysis and characterization by various techniques. The total phenol and true tannin content was determined. Fresh guava (0.499%) showed highest percentage of tannin and packed pineapple PKD3 (0.231%) showed the lowest. The type of tannins, like hydrolyzable or condensed tannin were also determined. Guava juices had highest level of condensed and hydrolyzable tannin compared to pineapple juices. The components present have been confirmed from chromatographic studies of the fruit juices. The capacity of fruit juice on protein precipitation was evaluated as a marker for their anti-nutrition effect. PKD2 and PKD3 of guava showed maximum affinity (> 50%) in comparable to standard tannins. Further the juices were investigated for their antioxidant activity. Fresh and packed guava juice showed potential reducing effect than pineapple juices. Antibacterial activity was evaluated employing disc diffusion susceptibility followed by MIC/MBC values. Based on the experimental out come, fresh guava and pineapple were the most potent (IZD 1.2-1.9 cm; MIC 20 µl/ml; MBC 40 µl/ml), followed by packed pineapple (IZD 1.0-1.7 cm; MIC 40 µl/ml, MBC 160 µl/ml) and least were packed guava juice (IZD 0.7-1.5 cm; MIC 80 µl/ml, MBC >160 µl/ml).

Keywords: IZD: Inhibition Zone Diameter; MIC: Minimum Inhibitory Concentration; MBC: Minimum Bactericidal Concentration; PKD: Packed

Introduction

"Tannin" was originally coined by Seguin[30] to describe the substances present in vegetable extracts, which are responsible for converting animal skin into leather. They are abundant in many plant parts including the fruit, cortex, leaves, roots and other parts[3]. Bate-Smith and Swain defined vegetable tannin as water-soluble phenolic compounds having a molecular weight between 500 and 3000 D. These polyphenols contain a large number of hydroxyl or other functional groups (1 to 2 per 100 D), and therefore are capable of forming cross-linkages with proteins and other macromolecules[1].

Tannins can be classified into two categories: hydrolyzable and non-hydrolyzable or condensed tannins. Condensed tannins are structurally more complex than hydrolyzable tannins. Important examples of hydrolyzable tannins are Chinese tannin (tannic acid), Turkish tannin, Tara tannin, Acer tannin, and Hamamelis tannin. Condensed tannins are widely distributed in fruits, vegetables, forage, plants, cocoa, red wine, and certain food grains, such as sorghum, finger millets, and legume[3]. In human diets, tannins are present in plant's beverages, legumes, some cereals, fruits and berries, herbs and condiments. Humans have a unique "taste" for tannins. Although the astringency associated with dietary tannins can be harsh and unpleasant, modest astringency levels have a pleasurable effect on human palate[2]. The unpleasant astringent sensation is due to tannin binding to proline-rich salivary proteins and proteins lining the oral cavity.

The presence of tannins has been associated with lower nutritive value and lower biological availability of macromolecules like proteins and carbohydrates, amino acids, vitamins, and minerals[4]. Most of the early studies related to the anti-nutritional effects of tannins were centered on tannic acid and other hydrolyzable tannins. However, as hydrolyzable tannins are present only in trace amounts in commonly consumed foods, the more predominant condensed tannins are of more concern when discussing the antinutritional effects of tannins[3]. Addition of condensed tannins to diets of experimental animals usually results in diminished weight gain, lowered efficiency of feed utilization and increased fecal nitrogen.

On the other hand, tannins defend plants from herbivores, control bloat, and improve protein utilization in ruminants. Epidemiological studies[16] have showed that decrease in the incidence of chronic diseases in some populations was related to the consumption of fruits and vegetables.

Plant phenolics have been reported to have multiple biological effects, including antioxidant activity. It is well known that aerobic organisms are constantly exposed to reactive oxygen species (ROS) that are produced mainly as a consequence of aerobic respiration in mitochondria and substrate oxidation. In healthy organisms, their production is counter balanced by the antioxidant defense system. The activity of phenolics is mainly due to their redox properties, which allow them to act as reducing agents, hydrogen donators, and singlet oxygen quenchers. In addition, they have a metal che-

lation potential[27]. Studies have shown that by increasing the daily consumption of fruit and vegetables, lipid peroxidation can be partly inhibited [22]. Nowadays, there are many types of fruit and vegetable juices available commercially in the market. The consumption of the fruit juices is increasing rapidly as they are convenient, nutritious and ready-to-drink. Emerging evidences suggests that fruit and vegetable juices may be a more effective alternative, and a recent review has concluded that drinking fruit and vegetable juices may well be as effective as consumption of whole fruits and vegetables in relation to a reduction in the risk of chronic disease[13].

Exploration of biodiversity particularly plant diversity in search of newer therapeutic principles is now a strong strategic consideration worldwide including India[8]. Also recent public concern about the use of numerous compounds in human diets to enhance performance and health and welfare issues, coupled with changes in regulations on the use of synthetic medicaments, has stimulated interest and research into the use and effects of phytochemicals and plant secondary metabolites in the diet of humans.

Tannins have attracted the attention mainly because of two contradictory reasons: their negative effect on quality of food source and their bio functional health promoting properties. This piece of work is revolving around implications of naturally occurring tannins and their association with human health. Thus determination of phytochemicals in fruits such as pineapple and guava was considered for this study with highlighting their major nutritional and anti-nutritional properties.

Methodology

Materials

Fresh and packed juice of pineapple and guava were employed for this study. All varieties were acquired from the local market. Fruits and juices were kept refrigerated (-18°C) until used. Experimental fruits were homogenized before the juice was extracted. All these procedures have taken place at room temperature and in absence of light.

Prussian blue assay for total phenols[5]

160 µl of each sample was added to different test tubes followed by addition of 5 ml of distilled water. 0.3 ml of ferric ammonium sulphate was added to the above solution and mixed thoroughly. Additions were timed. After 20 minutes of addition, 0.3 ml of potassium ferricyanide was added. Further after incubating for 20 minutes, the absorbance was read at 700 nm using colorimeter.

Titration[33]

Potassium permanganate was standardized against oxalic acid by titration. In 1 ml of each sample indigo carmine solution (2.5 ml) and water (75 ml) were added. This mixture was titrated against standardized potassium permanganate solution until colour changed to golden yellow. Non-tannin compound was determined by the volume of potassium permanganate used for another set of sample. 10 ml of each sample was mixed with 5 ml of the gelatin solution, 10 ml of the acidic sodium chloride solution and 1 gm of powdered kaolin. After shaking the mixture for 15 minutes, it was decanted through Whatman filter paper. Filtrate (2.5 ml) was mixed with 2.5 ml of indigo carmine and 75 ml of water. This mixture was titrated against potassium permanganate solution until colour changed to golden yellow.

Iodate reaction of hydrolyzable tannins using potassium iodate[5]

The test tubes containing potassium iodate were placed in a 25° C water-bath. 0.12 - 0.60 ml of the standard and fruit juices were made up to 1 ml by addition of distilled water. It was added to each of the test tubes containing 5 ml of potassium iodate. The test tubes were vortex mixed. After 5 minutes of addition of standard and fruit juices, the absorbance was measured at 550 nm using colorimeter.

Acid butanol assay for proanthocyanidins[5]

0.12 - 0.60 ml of the standard and fruit juices was made up to 1 ml by addition of distilled water. 6 ml of acid butanol reagent was added followed by 0.2 ml of iron reagent and vortexed thoroughly. The test tubes were caped and were put in a boiling water bath for 50 minutes. The test tubes were cooled and absorbance was measured at 550 nm using colorimeter.

Vanillin assay for proanthocyanidins[5]

0.12 - 0.60 ml of the standard and fruit juices was made upto 1 ml by addition of distilled water. 5 ml of the working vanillin reagent was added and the test tubes were kept in water bath for 20 minutes. Then the absorbance was measured at 520 nm using colorimeter.

Thin layer chromatography (TLC)[5]

Silica plates were prepared using silica gel G. Samples were spotted corresponding to the standards. Both the samples and standards were spotted 2 cm above the tip of the silica plate. The spots were air dried and was kept in solvent chamber for 45-60 minutes. After running the samples plates were dried. A spray of 50% Folin-Ciocalteau reagent was sprayed on silica plates and air dried. The sample run were calculated in comparison with the standard run.

Paper chromatography[5]

Whatman filter paper was taken and samples were spotted corresponding to standards spotted 2 cm above the tip of the paper. The spots were air dried and was kept in solvent chamber. It was so placed that the solvent touched the tip of the paper. After running the samples papers were dried. A spray of 50% Folin-Ciocalteau reagent was sprayed on dried paper and again air dried. The sample run were calculated in comparison with standard run.

Protein precipitating assay[5]

0.12 - 0.60 ml of the standard and fruit juices was made up to 1 ml by addition of distilled water. 2 ml of bovine serum albumin was added and mixed immediately and allowed to sit for 15 minutes. It was centrifuged at 3000 rpm for 15 minutes to form pellet and the supernatant was discarded. The pellet was washed in acetate buffer (pH 4.9) and dissolved in four ml of sodium dodecyl sulphate-triethanolamine (SDS-TEA) solution. 0.2 ml of ferric chloride reagent was added and immediately mixed. The absorbance was measured after 15 minutes at 520 nm using colorimeter.

Reducing antioxidant power[6]

0.12 - 0.60 ml of the standard and fruit juices was made upto 1 ml by addition of distilled water. 2.5 ml of phosphate buffer (pH 6.6) was added followed by addition of 2.5 ml of 1% potassium ferricyanide. This mixture was incubated at 50° C for 20 minutes. After incubation, 2.5 ml of 10% of trichloroacetic acid was added and then it was centrifuged at 3000 rpm for 10 minutes. 2.5 ml of the supernatant was mixed with 2.5 ml of distilled water and then 0.5 ml of 0.1% of ferric chloride was added. The solution was vortexed and the absorbance was measured at 700 nm using colorimeter.

Disc diffusion susceptibility assay

For microbial susceptibility testing of unknown samples, an assay format was developed for screening of crude samples like fresh and processed fruit juice. Standardizations of methods and protocols were carried out essentially according to Glupczynski (1996) as described elsewhere[9]. Basically, 0.5 ml innoculum (~10^8 cfu/ml) for each of the bacterial strain tested was flooded on freshly prepared nutrient agar plates. Excess culture was removed and the plates were dried for 2-3 minutes. Sterilized disks (5 mm diameter), each containing a test sample, or a standard antibiotic, was placed on the agar surface. The plates were incubated for 24 h in a B.O.D. incubator at 37°C. At the end of the incubation period, the diameter of the zone of inhibition was measured in cm. For comparison; sensitivity of each bacterium was also tested against a commercial antibiotic amoxicillin and standard tannins (tannic acid, gallic acid and catechin).

MICs and MBCs by Macrobroth dilution assay

Two-fold serial dilutions of the samples (fresh, processed and standard antibiotic) were prepared in a test tube containing 240 µl nutrient broth supplemented. A 1-day old liquid culture (~10^8 cfu/ml) was diluted 10 times in Nutrient broth and 100 µl of such culture was inoculated into each tube to give a final concentration of ~$5X10^5$ - $1X10^6$ cfu/tube. The tubes were inoculated for 24 h in a B.O.D. incubator at 37°C. Following incubation, the tubes were examined visually and the lowest concentration showing complete inhibition of growth was recorded as the MIC of the respective sample[11].

Aliquots (10 µl) of 24 h culture in which no growth had been detected were taken from the tubes of the above test tubes and used to streak on fresh nutrient agar plates. MBCs were determined by visual inspection of such plates after further incubation for 24 h at 37°C. The titre-point where no growth (less than 10 colonies) appeared was considered as MBC.

Results & Discussion

Content of total phenolics

Total phenolic content of guava and pineapple juice (fresh and packed) were evaluated using Prussian blue assay. From Table 1, it was observed that the phenolic content of guava juices is more than pineapple varieties. PKD3 of pineapple juice had less of phenolic groups compared to other varieties. This may be due to removal of polyphenols during industrial processing. Packed varieties of guava showed abundant phenolic content along with the experimental juice. This finding reveals that the phenolic content increased with processing of fruit pulp with modernized techniques.

Table 1: Contents of total phenolics and tannin in fruit juices

Sample	Total phenolics (%)	Tannin (%)
Pineapple		
Fresh	70±4.5	0.378
PKD1	68±3	0.348
PKD2	75±2	0.357
PKD3	30±2.5	0.231
Guava		
Fresh	80±1.5	0.499
PKD1	82±2	0.432
PKD2	85±3	0.424
PKD3	90±1.5	0.403

Tannin content

The tannin content of the juices was determined by titration method. From Table 1, it is observed that that the tannin content is almost higher in all varieties of guava than in pineapple. Out of the eight samples, fresh guava (0.499%) had the highest percentage and PKD3 of pineapple (0.231%) had lowest. Irrespective of industrial processing, the tannin content was equivalent in experimentally extracted and packed varieties of both fruits. On comparing phenolic and tannin content data, it was found that PKD3 of pineapple had less phenolic groups which get reflected in its tannin content. These observations clearly indicate the robustness, reliability and sensitivity of the experimental methods.

Content of hydrolyzable and condensed tannins

The composition of fruit juices were examined simultaneously for hydrolyzable and condensed tannin. From Fig. 1, it is clearly observed that, the hydrolyzable tannin content of guava juice (fresh or packed) was comparably more than pineapple varieties (Fig 1a). Among the pineapple juices, PKD2 contained the maximum hydrolyzable tannin. Pineapple juice (fresh and packed) also showed less of condensed tannin in comparison with guava juices (Fig 1b). Overall the guava juices had maximum percentage of hydrolyzable and condensed tannin even after industrial processing.

Fig 1a Hydrolyzable tannin content of fruit juices

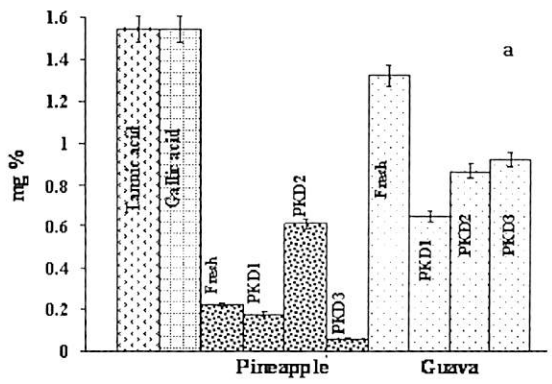
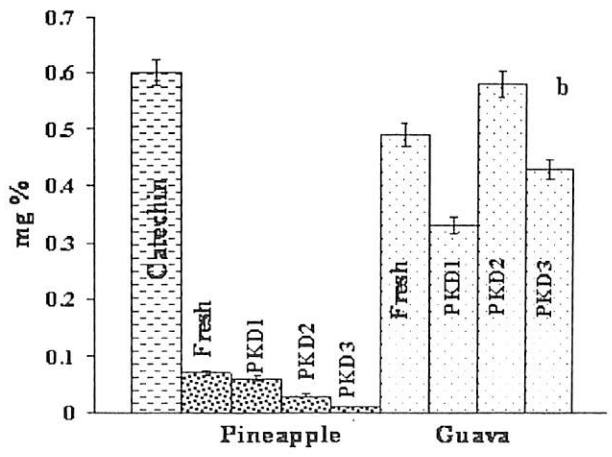


Fig 1b Condensed tannin content of fruit juices



The total phenolic phytochemical content in plant foods varies greatly. Their presence in plant is largely influenced by genetic factors and environmental conditions. Other factors, such as cultivar, variety, maturity, processing, and storage, also influence the content of plant phenolics[7]. World wide several studies have been carried out to see the effects of processing and storage on the changes and content of polyphenols in different fruit juices[14]. From the above studies, it can be indicated that irrespective of industrial processing, there is abundant of condensed and hydrolyzable tannin in guava juices than pineapple varieties.

Chromatographic analysis

Chromatographic techniques were employed to study the characteristics of the phenolic groups present in the above fruit juices. A typical one-way thin layer chromatogram of the juices is illustrated in Fig. 2, the size of the ovals indicating the relative intensities of the spots. Panel a shows the standard tannic acid, gallic acid and catechin movement, followed by panel b and c for pineapple (fresh and packed) and guava (fresh and packed) respectively. From the control chromatogram, it was observed that tannic and gallic acid showed a trailing spot, whereas catechin showed a clear spot. In panel b, irrespective of processing, the pineapple juices showed one similar spot on the chromatogram with a tail fading away. In Panel c, one spot with tail fading towards the origin was observed with each corresponding juice of guava. It was clearly observed that catechin is not present in any of the juices, whereas there may be chance of tannic and gallic acid to be present in traces (compare panels a, b and c).

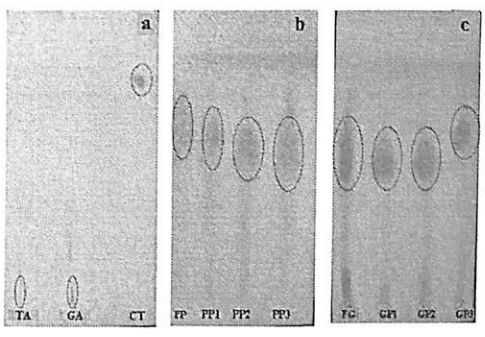


Fig 2 Thin layer chromatogram of fruit juices. FP– fresh pineapple; PP1, PP2 & PP3 – packed juices; FG – fresh guava; GP1, GP2 & GP3 – packed juices; GA – gallic acid; TA – tannic acid; CT – catechin

Further, paper chromatography was also employed to elucidate the reliability and sensitivity of the experimental data. As observed from panels a and b of Fig. 3, pineapple and guava juices are com-

pared with gallic acid. The distinct spot by gallic acid is not present in the samples. Instead, they showed typical long trailing spot. In panel a, the spot in PP1 and PP2 are much prominent followed by PP3 and fresh pineapple (FP). The intensity of the spot increased with processing of fruit juice for commercial production. It is clearly observed from chromatogram a, c and e that the spots get intensified with industrial processing. There is clear distinct profile of each fruit juice to one another and also comparable to that of standards (see panels a to f).

Fig 3 Paper chromatogram of fruit juices. FP– fresh pineapple; PP1, PP2 & PP3 – packed juices; FG – fresh guava; GP1, GP2 & GP3 – packed juices; GA – gallic acid; TA – tannic acid; CT – catechin

In guava juice there are many spots with very long trailing ends. The spots of the processed juice were very prominent than the fresh. There is no trace of catechin in both fruit juices. There are chances of trace of tannic acid in both. But this statement is doubtful since tannic acid leaves a spot on the starting point followed by a fade trail away from the origin. Associated with a decrease in the intensities of the individual spots, there is rather a diffuse area at and near the origin. This diffuse area is probably to be identified with the various other polyphenols which need to be studied further. Thus it may be concluded that the above fruit juices are the mixture of various polyphenolic compounds including tannic acid.

Protein precipitation

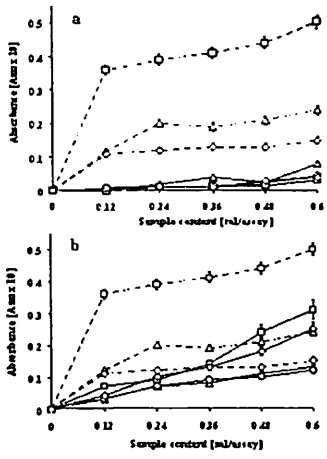
Tannins form complexes with protein, starch and digestive enzymes to cause a reduction in nutritional values of foods[3]. Protein with compact globular structures such as ribonuclease, lysozymal enzymes exhibit low affinity for tannins, whereas conformationally open proteins such as gelatin and albumin readily forms complexes with tannins. The protein precipitating assay developed by Hagerman and Butler (1978) was selected for quantification of precipitating potential of tannins from fruit juices.

From Table 2 it was observed that, PKD2 and PKD3 of guava showed maximum affinity (> 50%) towards the protein molecule. On the other hand pineapple (fresh and packed) showed less affinity. Tannic and gallic acid showed highest binding capacity followed by catechin. Earlier studies showed that hydrolyzable tannin are present only in trace amount in commonly consumed foods; the more predominant ones are the condensed tannin[8]. It was also found that binding of macromolecules are predominantly observed with condensed tannins. The present experimental data also well correlated with the above findings that guava juice contained more of condensed tannin and that gets reflected in their relative affinity for protein binding (Fig. 1b with Table 2).

The fruit juices were thereafter evaluated for potential affinity as a function of concentrations by sequentially increasing the volume of the sample (0-0.6ml/assay). Figure 4 depicts the amount of protein or tannins precipitated as a protein-tannin complex with increasing quantities of sample added to a solution containing a known amount of protein (2 ml/assay). From the titration curve, it was observed that, fresh and packed juice of guava (panel b) showed maximum precipitation than pineapple juices (panel a). Among the standard, precipitation capacity of gallic acid was maximum followed by tannic acid and catechin. There was increase in protein binding with increase in concentration of the juices. Irrespective of industrial processing, packed pineapple juice showed similar binding affinity as that of fresh juice. Overall, polyphenols from guava formed more protein complexes than pineapple. Analyzing the data, it was observed that PKD2 and PKD3 of guava contained maximum of condensed and hydrolyzable tannin (Fig. 1). This may be the reason behind strong linking between polyphenols of guava juice with the protein molecule.

Table 2: Protein precipitation and antioxidant activity of fruit juices

Sample	Relative affinity (%)	Reducing capacity (%)
Pineapple		
Fresh	16±4	25±2
PKD1	10±6	15±4
PKD2	6±2	30±5
PKD3	8±3	5±2
Guava		
Fresh	26±2	76±4
PKD1	24±1	70±2
PKD2	62±0.5	68±4
PKD3	50±3	66±3
Tannic acid	96±5	85±5
Gallic acid	100±0.5	95±2
Catechin	78±3	80±5

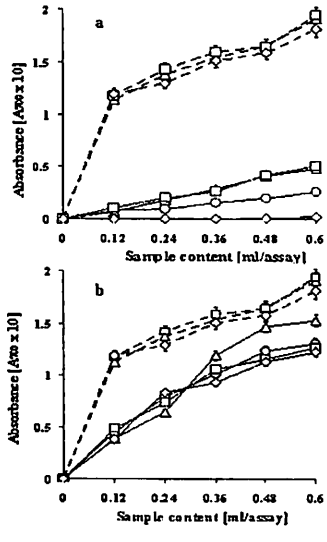


Δ – Fresh, ○ – PKD1, □ – PKD2, ◊ – PKD3, --□-- gallic acid, --Δ-- tannic acid, --◊--catechin

Fig 4 Concentration dependent protein precipitation of fruit juices

Ferric reducing antioxidant power

Phenolic phytochemicals including tannins, due to their phenolic ring and hydroxyl substitute, can function as effective antioxidants due to their ability to quench free electron and reduce them. The antioxidant activity was evaluated by using the ferric reducing antioxidant assay of the fruit juices in comparison with standard tannins (Table 2). Juices of guava showed equipotent reducing capacity (~ 65%), whereas juices of pineapple (~ 30%) showed less reducing potential. The activity of the commercial fruit juices in comparison with experimental juice supports that the method of juice extraction has an important role in this activity.



Δ – Fresh, ○ – PKD1, □ – PKD2, ◊ – PKD3, --□-- gallic acid, --Δ-- tannic acid; --◊--catechin

Fig 5 Concentration dependent antioxidant activity of fruit juices

Further, the potential reducing antioxidant effects of the samples were studied as a function of concentration (Fig. 5). Among the standard tannins, gallic acid showed maximum effect followed by tannic acid and catechin. There was a significant dose dependent increase in reducing antioxidant capability of guava and pineapple juice. Among guava juice, experimental variety showed maximum reducing effect followed by PKD1, PKD2 and PKD3 (Fig. 5b). The effect of PKD1, PKD2 and fresh pineapple was considerably potential than PKD3 (Fig. 5a). While analyzing the experimental outcome, it was observed than both experimental and commercial guava juices showed equipotential reducing effect to that of well-known tannins.

Antibacterial activity

Tannins were reported to be bacteriostatic and bactericidal against various microbial pathogens. The antimicrobial property of tannin has been well documented. Since antimicrobial activity is also accounted as a property for nutritional effect of tannins, therefore the fruit juice were examined for their antibacterial effect employing disc diffusion susceptibility assay followed by determination of the MIC/MBC values against an array of bacterial strains. Antibiotic amoxicillin was used as control along with tannic acid, gallic acid and catechin.

Table 3: Inhibition Zone Diameter (IZD) of the samples against five bacterial strains.

Samples (μg/disc)	Inhibition Zone Diameter (cm)				
	S. aureus	E. coli	B.subtilis	P.aeruginosa	S.abony
Tannic acid (50/100)	1.4/1.9	1.3/1.8	1.7/1.8	1.4/1.7	1.6/1.8
Gallic acid (50/100)	1.2/1.5	1.1/1.5	1.4/1.7	1.3/1.5	1.2/1.4
Catechin (50/100)	1.2/1.5	1.2/1.7	1.5/1.7	1.3/1.5	1.3/1.5
Amoxicillin (1/2)	1.9/2.2	1.5/2.0	1.7/2.1	1.7/2.1	1.5/1.9
20/40 (μl/disc)					
Fresh Pineapple	1.5/1.7	1.7/1.9	1.0/1.4	1.5/1.4	1.4/1.5
PKD1	1.2/1.2	1.7/1.9	0.8/1.0	1.4/1.5	1.2/1.2
PKD2	1.3/1.4	1.6/1.8	0.6/1.1	1.5/1.0	1.0/1.3
PKD3	1.4/1.5	1.3/1.9	1.0/1.0	0.9/1.2	1.0/1.2
Fresh Guava	1.3/1.9	1.4/1.7	1.4/1.7	1.0/1.2	1.2/1.4
PKD1	0.6/1.1	1.4/1.7	1.4/1.6	0.7/0.9	1.2/1.2
PKD2	0.7/1.2	1.6/1.5	1.0/1.0	0.9/0.9	1.2/1.3
PKD3	0.9/1.2	1.1/1.2	0.8/1.0	0.9/0.8	1.1/1.1

From the table, it is indicated that fresh juice of pineapple and guava showed IZD around 1.0-1.7 cm and 1.2-1.9 cm at dose range 20-40 μl/disc. The packed juices of pineapple showed IZD around 0.6-1.7 cm range, whereas packed guava juices showed IZD in the range 0.6-1.4 cm at 20 μl/disc and 0.8-1.7 cm at 40 μl/disc. PKD1 of guava showed maximum effect (IZD 0.6-1.7 cm) whereas PKD2 and PKD3 showed less potential against the bacterial

strain (IZD 0.7-1.5 cm). Among the standard, tannic acid showed the maximum (IZD 1.3-1.9 cm) followed by gallic acid and catechin (IZD 1.1-1.7 cm). Guava juices did not inhibit the growth of *P. aeruginosa* even at higher concentrations, while the pineapple juices did not inhibit the growth of *B. subtilis*.

Table 4: Antibacterial spectrum of fruit juices in terms of MIC

Samples (µg/disc)	Inhibition Zone Diameter (cm)				
	S. aureus	E. coli	B.subtilis	P.aeruginosa	S.abony
Tannic acid	25	25	12.5	50	50
Gallic acid	50	50	50	50	100
Catechin	50	25	50	50	100
Amoxicillin (µl/ml)	2.5	5	10	10	20
Fresh Pineapple	40	20	80	80	80
PKD1	80	20	80	80	80
PKD2	80	20	80	160	80
PKD3	80	20	80	80	80
Fresh Guava	20	40	40	80	80
PKD1	80	40	40	160	160
PKD2	80	40	80	160	160
PKD3	80	80	80	160	160

The antibacterial potential of the fruit juice were further assessed in terms of bacteriostatic (MIC) and bactericidal (MBC) values employing macrobroth dilution assay (Tables 4 and 5). The most potent fruit juices (MIC 20 µl/ml; MBC 40 µl/ml) were found to be fresh guava and fresh pineapple, followed by packed pineapple juices (MIC 40 µl/ml, MBC 160 µl/ml). The least potent were the packed guava juice (MIC 80 µl/ml, MBC >160 µl/ml). These data corroborates the contention that, fresh pineapple and guava juice have significant potential as antibacterial agents. The decreased potential of packed varieties may be due to the industrial processing which had modified the inhibitory action of the fruit polyphenols.

Conclusion

From the present studies and observations, it is reasonable to state that juices of guava and pineapple certainly contain effective antioxidant and antimicrobial principle(s) that can be exploited for the therapeutic management of various diseases related to microbial and free radical attack. Summarizing, the bulk of the experimental evidence tends to suggest that the pineapple and guava polyphenols would be very useful in free radical scavenging as well as eradicating the common pathogenic bacterial strains, although the precise mechanism of action in terms of target(s) could not be delineated at this stage. Since these fruits can be taken in the form of juices and are readily available in the market, it can very well take a faster route in developing as an alternative for fast foods which are hazardous to human health in the long run.

Table 5: Antibacterial spectrum of fruit juices in terms of MBC

Samples (µg/disc)	Inhibition Zone Diameter (cm)				
	S. aureus	E. coli	B subtilis	P.aeruginosa	S.abony
Tannic acid	50	50	25	100	100
Gallic acid	100	100	100	100	200
Catechin	100	50	100	100	200
Amoxicillin (µl/ml)	5	10	20	20	40
Fresh Pineapple	80	40	160	160	160
PKD1	160	40	160	160	160
PKD2	160	40	160	>160	160
PKD3	160	40	160	160	160
Fresh Guava	40	80	80	160	160
PKD1	160	80	80	>160	>160
PKD2	160	80	160	>160	>160
PKD3	160	160	160	>160	>160

In conclusion, it can be said that to get the positive health effects of fruit polyphenols and avoid their negative effects; it is advised to use plants of high-tannin content in moderation. Due to the variability in tannin contents of the studied fruits and the fact that potential effects of their tannins on health have not been documented, it is recommended to investigate and evaluate such effects.

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A study on the Incorporation of *Hygrophila Spinosa* (Kulekhara) in various food products and its acceptability

Nikata Bansal and Indrani Biswas

ABSTRACT

Iron deficiency is a serious and widespread public health problem[21]. Popular regional foodstuffs with high iron content are of specific interest, as they can be used to combat anemia in populations with low iron reserves, or high iron requirements, such as growing children and women of childbearing age[2]. The nutritional content[4,7,13,14,17] and functional activity[1,6,9,10,11,15,18] of Asteracantha longifolia *(Kulekhara) locally available in West Bengal, makes it desirable as a dietary supplement. The iron content (per 100 grams) of fresh leaves of Kulekhara was found out to be .056 mg. Though there is a decrease in the iron content (0.025mg/100gms) after cooking, but since studies have shown an increase in the bioavailability of iron[20] after cooking, thus the incorporation of the 5 products was carried out. Sensory evaluation of the products showed that there was a decrease in the physical attributes with an increase in the level of incorporation. As a result though an increase in the iron content was seen but over all acceptability of the products decreased. Thus it can be inferred from the present study that the sensory quality of the product influences its acceptability irrespective of its nutrient content.*

Keywords: *Hygrophila Spinosa*, Iron Deficiency Anemia, Overall Acceptability, Sensory Evaluation

Introduction

Micronutrient malnutrition (MNM) is widespread in the industrialized nations but even more so in the developing nations of the world. MNM has many adverse effects on human health not all of which are clinically evident. Even moderate levels of deficiency (which can be detected by biochemical or clinical measurements) can have serious detrimental effects on human functions[2]. Worldwide, the three most common forms of MNM are iron, vitamin A and iodine deficiency. Of the three, iron deficiency is the most prevalent[2].

Iron or Nutritional Deficiency Anaemia is a pathological condition in which the level of haemoglobin in the blood[5], the haematocrit or the number of red blood cells[8] becomes abnormally low.

India has the highest prevalence of iron deficiency anaemia in the world[12] affecting more than 320 million people in India of which 50% are adolescent girls[23]. Anaemia among adolescents have gained more importance, as they are the most crucial segment of the population, whose well-being influences the future generation as today's young girls are future mothers[12].

Asteracantha longifolia (AL) Nees. (syn. *Hygrophila spinosa* T.Anders. *Hygropihila auriculata* [K. Schum.] Heine, Family Acanthaceae) known as Kokilaksa in Sanskrit and Talmakhana in Hindi is widely distributed in India and used by local population[16]. It is considered to be a medicinal plant and has been found to be useful in treating diseases of the blood[16]. Furthermore, the plant has been reported to have anti pyretic[15], anti tumor[1], anti inflammatory[15], antimicrobial[6], antinociceptive[19], antioxidative[11,12], hypoglycemic[9], hepatoprotective[18] and diuretic[10] activities.

The nutritional content and functional activity of *Asteracantha longifolia* makes it desirable as a dietary supplement. Moreover, Kulekhara being locally and widely available in West Bengal and Bihar and is very cheap and thus, affordable by all groups of population.

Hence the study was undertaken to develop food products by incorporating *H.spinosa* and evaluating its acceptability.

Methodology

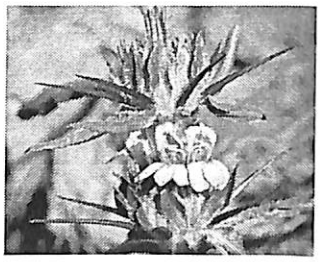

Fig 1 and 2 – *Hygrophila spinosa* (Kulekhara)

Source of raw materials

Asteracantha longifolia (AL) Nees. (syn. *Hygrophila spinosa*) is a common weed growing in marshy and water logged areas.

The nutritional content of *Asteracantha longifolia* such as flavonoids[4], alkaloids[14], minerals (iron, copper, cobalt)[7], sterols[17], triterpenes (lupeol, hentricotane, betulin, luteolin, luteolin-7-0-retinosides)[13] and essential oils[14] makes it a desirable dietary supplement.

Pre-preparation of the raw materials

H.spinosa (kulekhara) was purchased from the local market in Kolkata. It was washed thoroughly under running tap water and deleafed. It was then sun dried and chopped finely to make it suitable to be incorporated in various food products at different concentrations.

Product development

5 standardised recipes viz. Nachos, Sweet biscuits, Salt biscuits, Mathris and pakoras were chosen for the development of food products with incorporation *H.spinosa* in the laboratory of J.D.Birla Institute. Most of the products chosen had a long shelf life and all were easy to prepare. The products were prepared in bulk prior to the 3-day sensory evaluation.

Chemical Analysis

*H.spinosa (*Kulekhara) leaves have been reported to have a positive effect on the hematological parameters in the body and in correcting blood disorders, like anemia[16] which indicate the presence of iron in the herb. An attempt was made to estimate the iron content in the biochemistry laboratory of J D Birla Institute.

In all living organism iron is present in the form of a conjugate with a protein. For this reason, the organic compound is first converted into ash by heating at 600°C in a muffle furnace so as to convert all minerals into their oxides, while the carbon, hydrogen and nitrogen are converted into volatile oxides. The ash is then dissolved in 15 N Hydrochloric Acid (HCl) which converts the oxides into Ferric chloride ($FeCl_3$). When treated with any reducing agent such as Hydroxlyamine-hydrochloride or Vitamin E, it is converted to $FeCl_2$. α,α-Dipyridyl form a co-ordination complex with $Fe2^+$ ions which is measured at 490nm.

Sensory Evaluation Of The Food Products

Sensory evaluation was performed with a panel of 25 semi-trained panelists consisting of staffs and students selected from the J.D.Birla Institute. The panelists were requested to record the degree of liking and disliking using a 9-point hedonic scale, ranging from 9 as " like extremely " to 1 as " dislike extremely" as outlined by Austin and Ram[3]. A mean score of 5 was used as the acceptable limit.

Table 1: Organoleptic Assessment Score Sheet Used By The Taste Panel

Extremely dislike	Dislike very much	Dislike moderately
Dislike slightly	Neither like nor dislike	Like slightly
Like moderately	Like very much	Like extremely

For the sensory evaluation, each product was presented on a coded plate to the panelists. The panelists were asked to rinse their mouth with plain water in between the samples. The number of samples tasted at one sitting was limited to 3 to minimize taste fatigue.

The scores of the sensory attributes viz. colour, flavor, taste, shape, texture, odour and overall acceptability were recorded. Panelists were given an opportunity to make additional comments. The sensory evaluation of each product was carried in triplicate on 3 consecutive days.

Statistical Analysis

The mean values and the standard deviation were determined for the obtained results using MS office Excel program for WINDOWS XP software.

Paired t test was done to see the difference between the values obtained for the change in iron content before and after the cooking process.

Least Significane Difference was done to see any significant difference in the mean scores of overall acceptability of the products

Results & Discussion

Data on the iron content of H.spinosa

The iron content of sun dried fresh *Hygrophila spinosa* (Kulekhara) was found to be 0.056 mg per 100 gms. The processed and cooked (oven) *H.spinosa* (kulekhara) was also analyzed for its total iron content. The iron content of the processed leaves was found to be 0.025 mg per 100 gms. A change in the total iron content observed was found to be significantly different (t=0.005).

Though there is a decrease in the iron content after cooking but some studies have shown that the bioavailability of iron in plants after the cooking process increases as the anti-nutritional factors like phytates and oxalic acid are destroyed[20]. Thus, *Hygrophila spinosa* (Kulekhara) was processed and incorporated in commonly eaten snack items.

Effect of incorporation of H.spinosa on the physical properties of the products

The sensory quality of food product affects its acceptability. Hence the effect of incorporation of *H.spinosa* (Kulekhara) on the physical properties of the product such as appearance, colour and texture was studied.

It was seen that with an increase in the level of incorporation of *H.spinosa* (Kulekhara) in the food products, the physical attributes with respect to appearance, colour and texture of the product decreased. The products with the highest concentration of *H.spinosa* (Kulekhara) scored the least, and the same trend was seen in all the five food items.

Sensory characteristics of the products

Sensory attributes such as appearance, taste, flavor, texture, shape, crust, odour and overall acceptability were evaluated to adjudge the most acceptable product. Panel members scored all factors on a 9-point hedonic scale. A mean score of 5 was used as the acceptable limit. The mean scores of sensory evaluation of the products incorporated with processed *H.spinosa* (Kulekhara) are given in Table 2.

It was observed that mostly all the snack items incorporated with *H.spinosa* (Kulekhara) were organoleptically acceptable. The mean sensory scores ranged from 5.42 to 7.61 for all the products.

Though a decrease in the acceptability of the food products, with respect to the sensory attributes was observed with an increase in the level of incorporation of H.spinosa (Kulekhara).

A significant difference in the mean scores of overall acceptability were seen in the products with the lowest level of incorporation with *H.spinosa* (Kulekhara) and in the products with highest level of incorporation of *H.spinosa* (Kulekhara).

It was seen that with the increase in the level of incorporation of *H.spinosa* (kulekhara) the acceptability decreased. The efficacy of the herb was then reduced. The sensory quality of a product influences its acceptability irrespective of the nutritive value.

Table 2: Sensory Characteristics Of Products Incorporated With H.spinosa

Products	Appearance	Colour	Shape	Taste	Texture	Crust	Odour	OAA
Nachos : Flour: Makki: Herb								
1 : 0.5 : 0.75	7.15±0.93^a	7.27±0.82^a	7.28±0.93^a	7.04±1.12^a	7.09±0.87^a	7.26±0.89^a	6.61±1.13^a	7.18±1.08^a
1 : 0.5 : 1.5	6.77±1.09^b	6.94±1.06^b	7.16±0.90^b	6.92±1.01^b	7.04±0.91^b	7.09±0.87^b	6.54±1.19^b	7.06±0.98^b
1 : 0.5 : 2.25	6.32±1.29^c	6.09±1.41^c	6.88±0.96^c	6.28±1.33^c	6.80±0.78^c	6.98±0.84^c	6.24±1.15^c	6.48±1.11^c
Salt biscuits : Flour: Herb								
1 : 1	6.58±0.78^a	6.57±0.76^a	6.74±0.77^a	6.22±1.37^a	6.61±0.80^a	6.45±1.02^a	6.10±0.88^a	6.53±1.15^a
1 : 1.5	6.68±0.71^b	6.73±0.61^b	6.68±0.81^b	6.21±1.22^b	6.65±0.83^b	6.32±0.91^b	5.88±1.12^b	6.40±1.17^b
1 : 2	5.68±1.51^c	5.68±1.40^c	6.34±1.12^c	5.32±1.51^c	6.04±1.23^c	6.21±1.36^c	5.54±1.48^c	5.69±1.56^c
Sweet biscuits : Flour: Sugar : Herb								
1 : 0.33 : 1	7.26±0.73^a	7.20±0.81^a	7.09±0.93^a	7.45±0.75^a	7.36±0.54^a	7.33±0.62^a	7.04±0.77^a	7.41±0.50^a
1 : 0.33 : 1.5	7.12±0.63^b	7.00±0.72^b	7.05±0.87^b	7.12±0.82^b	7.20±0.66^b	7.13±0.75^b	6.70±1.06^b	7.20±0.78^b
1 : 0.33 : 2	6.93±0.96^c	6.84±1.05^c	7.10±1.05^c	6.60±1.42^c	6.82±1.18^c	6.92±1.18^c	6.56±1.36^c	6.89±1.18^c
Mathris : Flour : Herb								
1 : 0.5	7.18±0.85^a	7.24±0.87^a	7.18±1.08^a	6.80±1.32^a	6.84±1.07^a	6.76±1.22^a	6.73±1.06^a	7.05±1.18^a
1 : 1	6.41±1.26^b	6.22±1.39^b	6.78±1.22^b	6.13±1.50^b	6.57±1.15^b	6.57±1.22^b	6.17±1.38^b	6.37±1.34^b
1 : 0.5	6.36±1.58^c	5.13±1.72^c	6.48±1.05^c	5.24±1.73^c	6.06±1.08^c	6.10±1.02^c	5.72±1.50^c	5.42±1.62^c
Pakoras : Besan: Onion: Herb								
1 : 1 : 1	7.57±0.71^a	7.58±0.71^a	Not noted	7.52±0.82^a	7.32±0.66^a	Not noted	7.06±1.01^a	7.61±0.76^a
1 : 1 : 1.5	7.17±0.88^b	7.16±0.92^b	Not noted	7.16±1.02^b	7.32±0.86^b	Not Noted	6.86±1.19^b	7.22±0.95^b

Further, the data on the iron content of the products were compared with the overall acceptability.

Table 3: Comparison Between The Overall Acceptability (OAA) And The Iron Content

PRODUCTS	Iron Content (mg)	Iron content Per 100 gms	OAA
Nachos			
Flour: Makki: Herb	For 75 pieces		
1 : 0.5 : 0.75	4.85mg	1.29mg	7.18±1.08
1 : 0.5 : 1.5	4.90mg	1.30mg	7.06±0.98
1 : 0.5 : 2.25	4.95mg	1.32mg	6.48±1.11
Salt biscuits			
Flour: Herb	For 25 pieces		
1 : 1	5.20mg	1.68mg	6.53±1.15
1 : 1.5	5.32mg	1.70mg	6.40±1.17
1 : 2	5.38mg	1.72mg	5.69±1.56
Sweet biscuits			
Flour: Sugar : Herb	For 25 pieces		
1 : 0.33 : 1	5.36mg	1.71mg	7.41±0.50
1 : 0.33 : 1.5	5.41mg	1.73mg	7.20±0.78
1 : 0.33 : 2	5.47mg	1.75mg	6.89±1.18
Mathris			
Flour : Herb	For 25 pieces		
1 : 0.5	2.99mg	1.19mg	7.05±1.18
1 : 1	3.02mg	1.20mg	6.37±1.34
1 : 0.5	3.06mg	1.22mg	5.42±1.62
Pakoras			
Besan: Onion: Herb	For 25 pieces		
1 : 1 : 1	6.45mg	2.58mg	7.61±0.76
1 : 1 : 1.5	6.47mg	2.59mg	7.22±0.95
1 : 1 : 2	6.51mg	2.60mg	6.69±1.34

The above data reveals the decrease in the acceptability of the products with an increase in the nutrient value. Hence the data confirms the hypothesis that the sensory quality of the products influences its acceptability irrespective of the nutritive value.

Conclusion

Iron deficiency is a serious and widespread public health problem[21]. Popular regional foodstuffs with high iron content are of specific interest, as they can be used to combat anemia in populations with low iron reserves, or high iron requirements, such as growing children and women of childbearing age[2].The nutritional content[4,7,13,14,17] and functional activity[1,6,9,10,11,15,18] of *Asteracantha longifolia* (Kulekhara) locally available in West Bengal, makes it desirable as a dietary supplement.

Sensory evaluation of the products incorporated with *H.spinosa* (kulekhara) showed that there was a decrease in the physical attributes with an increase

in the level of incorporation. As a result though an increase in the iron content was seen but over all acceptability of the products decreased. Thus it can be inferred from the present study that the sensory quality of the product influences its acceptability irrespective of its nutrient content. Hence studies are required with development of products with higher iron content without affecting the physical attributes.

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A study on the reusability of locally available unbranded vegetable oils

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ABSTRACT

Vegetable oil contains polyunsaturated fatty acids which makes it more prone to rancidity especially after a deep fry operation. Hence to determine the reusability of this kind of oil, change in its quality characteristics was studied. Items like piyaji and dal vada were fried separately for seven successive times at an interception of two days in a locally processed mustard oil obtained from Batanagar. Evaluation of the thermal stability was done on basis of colour, refractive index, viscosity, saponification value, iodine value, acid value, peroxide value, p-anisidine value, thiobarbituric acid value, hehner value, conjugated diene-triene value, total polar material and organoleptic evaluation. The increase in values of the parameters (except hehner value) on subsequent frying occurred maximum in piyaji indicating lesser thermal stability of piyaji-fried oil. It also accumulated sulphur due to transfer across the barrier. Malonaldehyde, a non-volatile aldehyde was surprisingly decreasing in piyaji-fried oil with each frying, while the others positively correlate with peroxide value. The frying stability of oil was found to be dependent on constituent of food items along with-moisture. Formation of off-flavour and smoky flavour with bitter taste was reported by organoleptic evaluators, after 3rd and 7th frying respectively.

Key Words: Conjugated Diene-triene, Fatty Acids, Hydrolytic Rancidity, Lipid Oxidation, Malonaldehyde, Sulphur Accumulation, Thermal Stability, Total Polar Material.

Introduction

Vegetable oils obtained from various parts of a plant like seeds, leaves[14] etc. basically constitute triglycerides of fatty acids which are mostly unsaturated in nature. On exposure to different conditions like high temperature, light, metals, salts, moisture, long storage, these oil undergo deterioration[4].

Deep fat frying is a complicated thermo-chemical process which leads to certain deteriorative changes[5]. This undesirable change in the fat is termed as 'rancidity'[4,5]. Rancidity or spoilage of fats and oils occur because of various reactions like hydrolysis, oxidation and polymerization reaction.[7] There are basically of two types – hydrolytic and oxidative rancidity. Hydrolytic rancidity occurs in presence of moisture and produces different fatty acids and glycerol whereas oxidative rancidity occurs in presence of oxygen producing hydroperoxides[1]. This further decomposes into a wide range of secondary compounds, including alkanes, alkenes, aldehydes (both volatile and non volatile), ketones, alcohol, esters, acids of low molecular weight and hydrocarbons.[1] The second kind of rancidity occurs mostly in unsaturated compounds bearing the structure of cis-pentadiene which is accompanied with double bond isomerisation leading to formation of conjugated diene-triene[1,13]. Spoilage of oils is associated with change in colour, viscosity, refractive index and formation of off-flavour and foul odour.

Mustard oil is a vegetable oil used as a popular cooking medium in India[11]. It is extracted from the seeds of Brassica nigra plant. Of two types of mustard oil - black (light colour) and white (yellow colour) the former is used for culinary purposes. Mustard oil contains an enzyme myrosin, a glucosidase, which yields on hydrolysis – allyl isothiocyanate, a pungent tasting but almost odourless oil[12]. It contains 0.30-0.35% of allyl isothiocyanate. which acts as a preservative. Mustard oil contains 80% unsaturated fatty acid of which 21% is polyunsaturated fatty acid consisting 6% of α-3 alpha-linolenic acid and 15% α-6 linoleic acid. Mustard oil also has a good balance of α-6 and α-3 fatty acids in the ratio of 10: 1 which is rarely found in any other oil[11].

While frying different snacks food vendors in unorganized sector often reuse heat-abused oil in batch processes without replenishing with fresh oils. Since deep frying ensures presence of substantial amount of excess oil, which has been already subjected to high temperature and is leftover in the fryer at end of each frying. This surplus oil is often used for next day's frying along with fresh oil top-ups whenever required. Thus though served hot and just fried these food items still has a potential threat to the consumer public health owing to the abuse of the frying. In the present investigation, quality deterioration of this locally used non-branded mustard oil was determined with repeated frying of the two popular evening snack of Bengal viz. piyaji and dal vada.

Methodology

Selection of oil

After a brief survey in five areas of Kolkata mustard oil was found to be a popular frying medium of 'Telebhajas'. Hence this selected non-branded

oil was procured from the local market of Batanagar, Kolkata.

Selection of Items to be fried

Piyaji

Piyaji is prepared from onion which contains many organic sulphur compounds that are unstable and undergo further decomposition. Onion was chosen as one of the food item to be fried since the transfer of sulphur across the barrier and its accumulation in the oil contributing to rancidity of oil could be determined.

Dal vada

Dal vada is made from urad dal which being a second class protein contains some unused amino acids. Hence its contribution towards rancidity could be determined.

Preparation of samples for frying

Piyaji

Onion of weight 15 grams were taken, peeled, thin sliced. It was mixed with 6 grams of besan, 3 grams of salt, 3 grams of chili powder and 6 ml of water. The mixture was then shaped into three pakoras and deep fried for 2 minutes during each frying.

Dal vada

Powdered urad dal weighing 15 grams were taken and mixed with 6 grams of salt, 3 grams of chili powder and 6 ml of water,. The batter was prepared and shaped into three pakoras, which were deep fried for 2 minutes during each frying.

Frying operation

For deep frying, two sets of 1 litre of mustard oil was heated to smoke point and respective items were fried in it. The process was repeated 7 successive times for each item with an interception of 2 days.

Oil without the food sample was heated for 7 successive times to smoke point with addition of measured amount (6ml) of water each time to judge the role of moisture in the spoilage of the fat. This acted as a control.

After each frying, the samples were allowed to cool to room temperature and stored in glass bottles filled up to the brim ensuring no head space oxygen. The lid were sealed with paraffin wax and kept in dark and refrigerated to stop the diffusion of gas across as well as any further chemical reactions.

Physical properties and various parameters associated with rancidity of the frying oil before and after heat treatment were determined following standard procedures.

Physico-chemical Tests

Smoke Point

Smoke point was recorded with a mercury thermometer before each frying.

Colour Index

Absorption of the oil samples at 420 nm was determined on a UV–Spectrophotometer (U–2000, Hitachi, Tokyo, Japan) and the values were taken against water as blank.

Viscosity

Viscosity was measured by using Ostwald's Viscometer.

Refractive Index

Refractive Index of the oil samples were measured using an Abbe's Refractrometer.

Sulphur Test

It is done for only for the oil in which piyaji was fried.

Chemical Tests

Saponification value

Saponification value was calculated using IUPAC method 2.202.

Acid value

Acid value was calculated using IUPAC method 2.201.

Ester value

Ester value is the derived value from the Saponification and acid value and is expressed as:

Ester value = Saponification value - Acid value

Peroxide value

Peroxide value was calculated using IUPAC method 2.501.

Thiobarbituric acid number

Thiobarbituric acid value was calculated using IUPAC method 2.531.

para-anisidine value

para-anisidine value was calculated using IUPAC method 2.504.

Kries test

To 5 ml of oil 5 ml of conc. hydrochloric acid was added. The tube was stoppered and shaken vigorously for 30 seconds. To it was added 5 ml of ether solution of phloroglucinol, re-stoppered and shaken for 30 seconds. A pink or red colour in the acid layer will indicate rancidity.

Taufel and Sadler test

Equal quantity of ice–cold conc. hydrochloric acid was mixed with 2 ml of oil in a test-tube. The upper dry part of the tube was plugged with cotton wool moistened with 1 ml of 0.1% phloroglucinol in alcohol and 10 drops of 20% conc. hydrochloric acid. The tube was shaken for 1–2 minutes. A red coloration on the lower surface of the cotton wool indicates rancidity.

Total Polar Material Estimation

It was done by column chromatography and distillation. The recovered substance was verified by thin layer chromatography.

Total Oxidation value

Total Oxidation value was calculated as follows:

Total Oxidation value = 2 x Peroxide value + *para*–anisidine value

Hehner value

In a conical flask, 2 grams of oil was weighed and saponified with alcoholic potassium hydroxide. After complete saponification the soaps were dissolved in hot water and treated with conc. hydrochloric acid. The mixture was filtered and residual fatty acids were weighed in a weighed filter paper. The difference in the weight is Hehner value.

Iodine value

Iodine value was measured using IUPAC method 2.205.

Conjugated diene and triene value

These values were calculated using IUPAC method 2.505.

Organoleptic evaluation

Organoleptic evaluation was done on the basis of 5 point hedonic scale consisting of 10 semi-trained panel members. The evaluation was carried out on the piyaji and the dal vada within one hour of each of seven times frying done at an interception of two days. The 5 point hedonic scale was 1: like very much, 2: like moderately, 3: neither like nor dislike 4: dislike moderately, 5: dislike very much.

The fried items were served separately to the judges to avoid communication among them during evaluation and they were asked to evaluate on basis of taste, colour, flavour, texture.

Results and Discussion

The heat-abused frying oil was then evaluated for following quality parameters.

Loss of weight in the items after frying

Though both of them was treated with same amount of water for making the batter, piyaji was found to suffer greater loss in weight on frying (table no.5). This loss of weight in piyaji may be accounted for higher water content of onion (84.3%) than the urad dal (10.9%).

Smoke Point

The smoke point of mustard oil recorded a gradual decrease after each frying of each item. Maximum reduction occurred in piyaji (table no.2).

Physico-chemical parameters

Colour index

The colour index value was highest in control, though the increase in the colour index range was highest in piyaji. In control, colour index from the 1st frying to the 7th frying showed a difference of 0.01, whereas a difference of 0.13 and 0.07 was observed in piyaji and dal vada respectively between the 1st frying and 7th frying (table no.4). Presence of sulphurous compounds in the onion, which was getting transfer in the frying medium, might contribute to higher gradient in colour index values of piyaji oil. Darkening of oil colour during deep fat frying is mostly due to unsaturated carbonyl compounds and nonpolar compounds. Maillard browning products are also the major contributors of discolouration of the oil. Colour changes are also related to the formation of hydroperoxides, aldehydes and ketones[1]. Additional cause of colour changes are the presence of pigments present in the oil[6].

Viscosity

Increase in the viscosity of the frying oil was found to be directly proportional to the number of frying operation. Maximum viscosity with a difference of 182.06 between the 1st and 7th frying was observed in case of Piyaji, with a sudden leap in value between 1st and 2nd frying. Similar differences recorded for dal vada and control were 138.58 and 137.48 respectively (table no.4). Viscosity of frying oil increases as a consequence of formation of high molecular weight polymers[3]. Oxidation of frying oils is also responsible for increasing viscosity due to the accumulation of oxidized lipids[7].

Refractive index

Refractive Index in both food items illustrated a gradual increase in the value with successive frying. It recorded a difference of 0.51 in piyaji, 0.52 in dal vada and a low value of only 0.10 between 1st and 7th frying (table no.4). An abrupt change occurred in piyaji between 1st and 3rd frying whereas control showed a gradual increase in refractive index. Change in the refractive index may be attributed to accumulation of sulphur in piyaji and unused amino acids in dal vada.

Table 1: Variation in the quality characteristics of mustard oil majorly due to hydrolytic rancidity.

Tests	Original oil values	Number of frying						
		Food items	1st	2nd	3rd	4th	5th	6th	7th
Saponification value (mg/g)	22.56	Piyaji	39.83	41.51	44.03	50.20	56.66	57.50	58.62
		Dal vada	57.50	58.62	59.18	60.02	60.58	62.27	63.39
		Control	50.49	52.17	53.57	54.97	56.66	59.74	62.27
Acid value (mg/g)	0.84	Piyaji	1.96	4.20	5.32	8.69	10.65	11.78	12.90
		Dal vada	1.40	1.52	3.64	3.64	5.04	5.89	8.41
		Control	1.12	2.24	3.64	5.04	5.61	6.45	7.01
Ester value (mg/g)	21.72	Piyaji	96.64	91.58	90.41	82.68	81.20	79.51	77.99
		Dal vada	97.56	95.70	93.78	93.96	91.61	90.57	85.71
		Control	97.78	95.70	93.20	90.83	90.09	89.20	88.74

Sulphur tests

Sulphur presence test indicated the presence and accumulation of sulphur in the frying medium from the onion with increase number of frying (table no.4). The presence of sulphur in the oil might play an important role in increasing the viscosity of the frying oil[4].

Chemical parameters

Saponification value

Both the items along with the control showed a gradual increase in saponification value (table no.1). On saponification, piyaji showed a maximum rise of 18.79, followed by control with 11.78 and dal vada with 5.89. Oil undergoes both hydrolytic and oxidative rancidity which leads to formation of more amounts of free fatty acids and fatty acids of low molecular weight which leads to increase in saponification value[15].

Acid value

The acid value measures the amount of carboxylic acid groups in free fatty acids generated in the oil after frying. It could also be used as an indicator of reusability of oil since increase in this value leads to formation of off-flavour as a result of degradation of oil.[8,11] In piyaji fried mustard oil the acid value showed a total increase of 10.94 with a sudden change between the 1st and 2nd frying. In case of dal vada and control this difference in acid value recorded a magnitude of 7.01 and 5.89 respectively (table no.1).

Ester value

Since during a frying process oil is exposed to high temperature, the fatty esters are broken down to free fatty acids[9,8,15]. The ester value which is an empirical value calculated from saponification and acid value indicates the amount of residual triglycerides esters. The decrease of this value with increased number of frying is quite evident from the gradually increasing acid values of the two deep fried products.

Peroxide value

Peroxide value measures the degree of oxidative rancidity of the oil and the amount of oxidized substance formed during lipid oxidation[1,6]. The peroxide value of mustard oil in which piyaji was fried showed a rise of 102mEq/kg between 1st and 7th frying whereas dal vada and control increased by 100 and 80 mEq/kg respectively (table no.3). Thus the food ingredients definitely contribute to greater amount of oxidative rancidity.

Thiobarbituric acid value

Thiobarbituric acid value measures the rate of oxidative rancidity by the formation of oxidized lipids – malonaldehyde which is a non-volatile aldehyde.[15,18] It should be highlighted here that unlike other oxidative rancidity parameters amount of malonaldehyde decreased and was least in piyaji with a reduction of only 0.16 between 1st and 7th frying. While the amount of malonaldehyde increased with number of frying in dal vada and control. Malonaldehyde is unstable and itself may undergo decomposition to form newer products depending on time, reagent concentration and pH[17]. Especially in neutral and acidic solutions, it yields 1,3,5-benzentricarbaldehyde which exists as a cyclic structure[18]. Moreover presence of antioxidants in onion might have been a reason for this reduction.

para–anisidine values

para-anisidine value reflects the magnitude of aldehydic secondary oxidation products and rate of formation of these products[14]. Para–anisidine increased most in the piyaji oil (15.30), followed by dal vada (8.55) and control (5.4) respectively (table no. 3). These values thus indicated that formation of volatile carbonyl compounds or aldehydes/ ketones, during oxidative cleavage of the oil[3,4] was highest in piyaji.

Kries Tests and Taufel and Sadler (Colour) tests

All the oil obtained from different batches of frying as well as the control responded positively to colour developmental tests (table no.3). Since this test is a marker of oxidative rancidity, indicating the occurrence of non-volatile epihydrinaldehyde[5,10] as a result of oxidative cleavage of the oil.

Total Polar Material

Total polar material is a reliable indicator of the quality of frying oil than the free fatty acid value[4,5]. A frying life is considered to come to an end if the TPM value reaches 24%[6]. In the two samples and control the TPM showed a proportional rise in value with subsequent frying process (figure no.3).

Total Oxidation value

Total Oxidation value is an empirical parameter since it corresponds to two different parameters with two different units. Highest increase in total oxidation rate of piyaji fried mustard oil was attributed to increased peroxide value and para-anisidine values. The obvious TOTOX values were calculated and depicted in the following (figure no.3).

Hehner value

Unlike most of the other parameters Hehner value of the food items revealed a gradual reduction in values with subsequent frying. The value dropped down to minimum in piyaji, compared to control and dal vada respectively (table no.3). Since piyaji oil undergoes higher rate of thermal deterioration, the high molecular weight fatty acid breaks down to form fatty acids of low molecular weight containing lesser number of carbons. Such fatty acids are mostly soluble in water. This was also manifested in the saponification value discussed before.

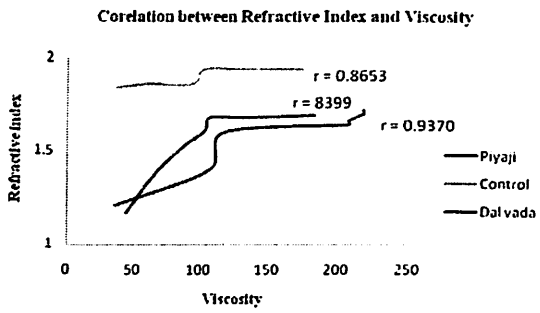

Figure No.1: Graphical Representation of correlation between viscosity and refractive index

From Figure no. 1, we find that there is a high positive corelation (~ r = 0.937) in between refractive index and viscosity in case of piyaji, while dal vada and control exhibit a corelation of (~ r = 0.839) and (~ r = 0.865) respectively.

Iodine value

Iodine value measures the degree of unsaturation of oil[10]. Iodine value in the piyaji oil recorded a total increase of 5.46 units with a peak rise between 3rd to 4th frying (table no. 3). The rise in value was comparatively more gradual in dal vada and control.

Conjugated diene and triene value

The formation of conjugated dienes and trienes as a result of deep-fat frying requires presence of unsaturated fatty acids with at least two double bonds and with more than two double bonds respectively[13,16] in the lipid samples. The UV absorbance measurement indicates the formation of conjugated dienes and trienes. The amount of conjugated double bonds and conjugated trienes was highest in piyaji, than in the control and dal vada (table no. 3).

Table 2: Variations in the smoke temperature with the progression of frying process

Piyaji	Dal vada	Control
160 °C	160 °C	160 °C
146 °C	150 °C	158 °C
140 °C	140 °C	152 °C
132 °C	136 °C	144 °C
122 °C	130 °C	140 °C
108 °C	118 °C	126 °C
92 °C	104 °C	108 °C

Table 3: Variation in the quality characteristics of mustard oil majorly due to oxidative rancidity

Tests	Original oil values	Food items	Number of frying						
			1st	2nd	3rd	4th	5th	6th	7th
Peroxide value (mEq/Kg)	7.00	Piyaji	7	10	15	20	30	50	115
		Dal vada	10	40	55	75	80	100	110
		Control	15	25	45	55	80	80	95
Thiobarbituric acid value (mg malonaldehyde/Kg)	0.06	Piyaji	0.67	0.64	0.60	0.60	0.56	0.54	0.51
		Dal vada	0.24	0.31	0.42	0.47	0.53	0.56	0.65
		Control	0.50	0.56	0.61	0.67	0.69	0.70	0.74
Para – anisidine values	0.66	Piyaji	4.82	5.27	7.22	7.97	11.12	17.12	20.12
		Dal vada	1.07	3.32	4.37	5.75	6.47	7.52	9.62
		Control	0.75	1.5	1.95	2.4	2.7	4.95	6.15
Colour tests	No colour	Piyaji	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve
		Dal vada	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve
		Control	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve
Total polar material (gm)	Not found	Piyaji	0.26	0.42	0.56	0.82	0.90	0.90	0.90
		Dal vada	0.27	0.46	0.54	0.57	0.62	0.67	0.75
		Control	0.26	0.31	0.39	0.41	0.50	0.50	0.56
Total Oxidation value	Not found	Piyaji	18.82	25.27	37.22	47.97	71.92	117.12	250.12
		Dal vada	21.07	83.32	114.37	155.75	166.47	207.52	229.62
		Control	30.75	51.50	91.95	112.40	162.70	164.95	196.15
Hehner value (gm)	0.75	Piyaji	0.128	0.12	0.117	0.017	0.014	0.0115	0.0057
		Dal vada	0.6	0.58	0.50	0.48	0.46	0.39	0.32
		Control	0.50	0.43	0.38	0.37	0.24	0.18	0.10
Iodine value (gm of iodine/ gm of fat)	6.11	Piyaji	11.65	11.92	12.49	14.72	15.48	17.00	17.19
		Dal vada	8.75	9.39	9.70	10.84	11.23	12.30	12.43
		Control	7.67	8.75	8.81	9.20	9.51	9.77	10.08

Conjugated dienes value	—	Piyaji	0.2898	0.2911	0.2915	0.2928	0.2928	0.2931	0.2951
		Dal vada	0.2766	0.2768	0.2775	0.2776	0.2781	0.2796	0.2805
		Control	0.277	0.278	0.279	0.280	0.281	0.282	0.282
Conjugated trienes value	—	Piyaji	0.287	0.288	0.289	0.291	0.291	0.291	0.291
		Dal vada	0.277	0.277	0.278	0.281	0.281	0.282	0.284
		Control	0.252	0.252	0.253	0.254	0.257	0.257	0.257

Table 4: Physico-chemical variations of mustard oil occurred during deep fat frying of food items and control for seven successive times

Tests	Original oil values	Food items	Number of frying						
			1st	2nd	3rd	4th	5th	6th	7th
Colour index	0.156	Piyaji	0.177	0.179	0.180	0.185	0.187	0.188	0.190
		Dal vada	0.183	0.185	0.187	0.188	0.188	0.190	0.190
		Control	0.488	0.495	0.497	0.498	0.500	0.503	0.504
Viscosity (centipoise)	20.05	Piyaji	36.82	107.70	118.12	208.46	208.46	218.88	218.88
		Dal vada	45.16	66.01	87.87	103.85	107.85	131.81	183.74
		Control	37.06	61.32	94.34	103.78	132.08	150.95	174.54
RefractiveIndex	1.10	Piyaji	1.21	1.40	1.60	1.64	1.66	1.70	1.72
		Dal vada	1.17	1.37	1.52	1.61	1.68	1.68	1.69
		Control	1.84	1.86	1.86	1.94	1.94	1.94	1.94
Sulphur (gm %)	Not found	Piyaji	0.16	0.17	0.17	0.17	0.17	0.18	1.74

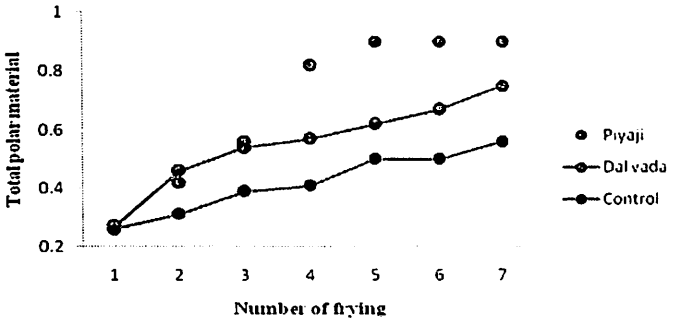

Fig 2 Graphical representation of Total polar material of three deep fried varieties

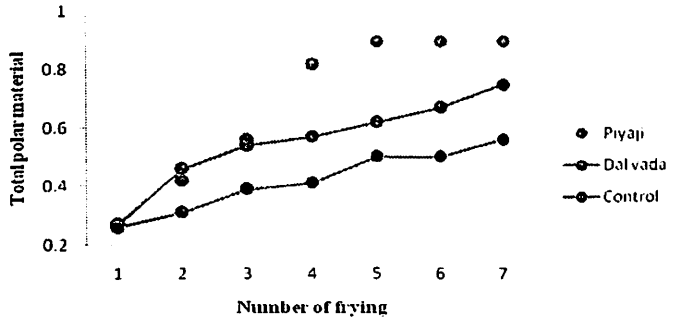

Fig 3 Correlation between thiobarbituric acid value and peroxide value

From Figure no. 3, we find that there is a high positive corelation (~ r = 0.98) between thiobarbituric acid value and peroxide value in case of dal vada and control while piyaji showed an equally high corelation (~ r = 0.85) but negative in nature.

Organoleptic Evaluation

The organoleptic evaluation of piyaji & dal vada suggests that their appearance, colour, flavour and taste started deteriorating noticeably from the 3rd frying. At the end of the frying process there was a marked alteration of colour and taste along with generation of a smoky flavour coming from both the product.

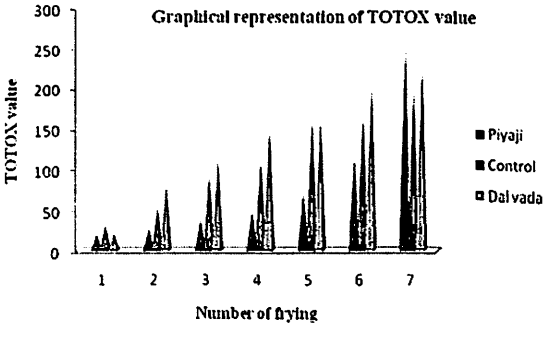

Fig 4 Graphical representation of TOTOX value of three deep fried varieties

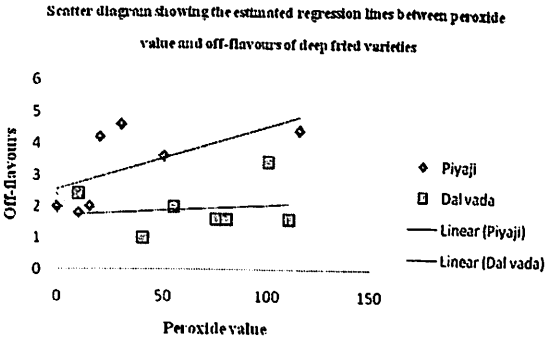

Fig 5 Scatter diagram of estimated regression lines of total polar material and off- flavours of deep fried varieties

The estimated lines are y = 0.317 + 4.282 x and y = 1.822 + 0.2169 x for piyaji and dal vada.

From the scatter diagram in figure no. 7, we find that the accumulation of total polar material increases the off flavours more in piyaji than in dal vada as evident from the slopes ($b_{piyaji} = 4.28$) and ($b_{dal\ vada} = 0.216$).

Table 5: Variation in weight before and after frying of deep fried food varieties

Food items	Initial weight (gms)	Final weight (gms)	Water added (ml)	Reduction in weight (gms)
Piyaji	11	6	2	5
Dal vada	10	8	2	2

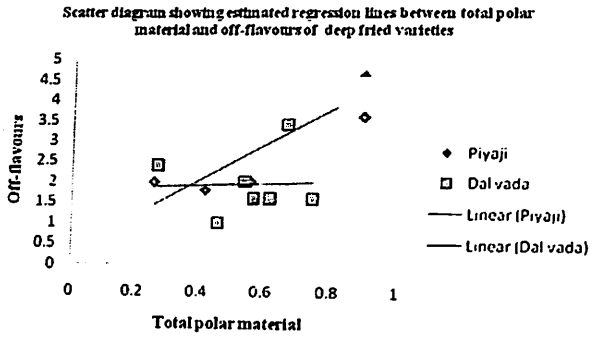

Fig 6 Scatter diagram of estimated regression lines of peroxide value and off-flavours of deep fried varieties

The estimated lines are $y = 0 + 0.0198\ x$ and $y = 1.714 + 0.0034\ x$ for piyaji and dal vada. From the estimated regression lines in figure no. 8, it is revealed that increase in peroxide value leads to occurrence of off flavours to a much higher extent in piyaji ($b_{piyaji} = 0.019$) than in dal vada ($b_{dal\ vada} = 0.003$).

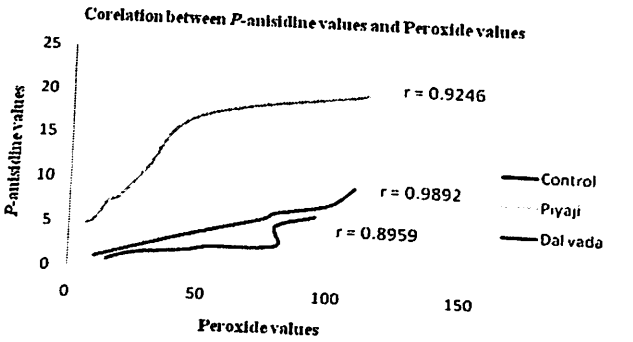

Fig 7 Corelation between peroxide value and *p*-anisidine values

From Figure no. 4, we find that there is a high positive corelation ($\sim r = 0.989$), ($\sim r = 0.924$) and ($\sim r = 0.895$) between p-anisidine values and peroxide values in case of dal vada, piyaji and control respectively.

Conclusion

In the present study it was found that locally processed unbranded mustard oil on exposure to high temperature due to repeated deep fat frying of two food items for 7 successive times had undergone substantial deteriorative changes. Out of the two samples studied piyaji oil showed a greater degradation trend than dal vada and also accumulation of sulphur in the frying medium. All parameters showed an increase in values which indicated higher accumulation of free fatty acids, aldehydes (except malonaldehyde), conjugated diene and triene. Decreasing hehner value manifested the reduction of insoluble saturated fatty acid as those were converted to unsaturated fatty acids. An interesting and exceptional finding was decrease of malonaldehyde in piyaji whereas it maintained the usual upward trend in dal vada and control. Finally it was concluded that the food items has a predominating effect than water on the stability of oil. All these values obtained from the different evaluatory tests indicate rancidity and hence non-reusability of the oil just after the first frying.

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Nutritional assessment of pregnant woman with vegetarian and non-vegetarian dietary habits in their third trimester

Briti Chatterjee and Indrani Biswas

ABSTRACT

Adequate maternal nutrient intake during pregnancy is important to ensure satisfactory birth outcomes. The objectives of the paper were to assess the nutritional status of pregnant woman in their third trimester with vegetarian and non vegetarian dietary habits. In this study, it was seen whether the maternal energy-adjusted intake of macronutrients is associated with either maternal weight gain or birth-size parameters. 65 pregnant women in their third trimester were selected by purposive sampling method. Pregnant women from non vegetarian food group were taken from Asansol sub division hospital and ISC Sale Hospital (Burnpur) while pregnant women from vegetarian food group were taken from Bhagirathi Neotia Woman and Child Care Centre. Of the total respondents (n=65), 32 respondents were from vegetarian food group and 33 respondents were from non-vegetarian food group. General information, pregnancy related information, 24 hour dietary recall for 3 consecutive days was collected. An average of the three consecutive day's meal consumption was calculated and the macronutrient adequacy was assessed comparing with the RDA given by ICMR. The results indicated that the group (vegetarian group) having a higher energy intake had a higher weight gain and the infant's birth weight were also seen to be higher. Thus it can be inferred from the present study that, the macronutrient intake is positively associated with maternal weight gain and birth weight.

Keywords: Dietary Habits, Infant's Birth Weight, Macronutrient Intake, Maternal Weight Gain, Pregnancy

Introduction

An adequate availability of nutrients during gestation is probably the single most important environmental factor influencing pregnancy outcome. Although physiological adjustments in nutrient utilization and metabolism are geared to improve the utilization of dietary nutrients during pregnancy, these adjustments may be insufficient to meet the demands for pregnancy and lactation if the woman is in poor nutrient status at conception. An inadequate supply will cause a state of biological competition between the mother and the conceptus in which the well-being of both organisms is at serious risk. The consequences of this undesirable situation on the fetus are well known; but the consequences of under nutrition on the mother are less well documented.

Birth weight is an important correlate of neonatal and infant health and has been recently associated with adult onset diseases, including cardiovascular disease· non-insulin dependent diabetes mellitus and breast cancer· Several studies have examined socio-demographic, reproductive and anthro-pometric factors in relation to birth-size of the infant. In particular, birth weight was seen to be higher, among women of higher as compared to lower socioeconomic status.

To a considerable extent, the well-being of a newborn depends on the health of the mother. In developing countries, a mother's death in childbirth means almost certain death for her newly born child. When mothers are malnourished, sickly, or receive inadequate prenatal and delivery care, their babies face a higher risk of disease and premature death Thus, the value of ade-quate nutri-tion and an active preg-nancy is evi-dent in the results: a healthy, well-developed infant and a healthy mother.

Methodology

65 pregnant women in their third trimester were selected by purposive sampling method. Of the total respondents (n=65), 33 respondents from non vegetarian food group were taken from Asansol sub division hospital and ISC Sale Hospital (Burnpur) while 32 respondents from vegetarian food group were taken from *Bhagirathi Neotia* Woman and Child Care Centre.

Standardization of the common recipes was carried out for the dietary assessment in the Food and Nutrition laboratory of J.D Birla Institute. General information, pregnancy related information, 24 hour dietary recall for 3 consecutive days was collected.

An average of the three consecutive day's meal consumption was taken outs the macronutrient adequacy was assessed comparing to the RDA given by ICMR. Further, the average intake of proteins, fats, carbohydrates consumed by the respondents were estimated and percent RDA for the same was calculated.

The results were adjusted using the "reference pregnant woman" method [*1992 National Nutrition Survey*] to permit comparisons with the dietary intake reported in the 2002 NNHS.

After obtaining the mean values, the standard deviation was calculated for all the macronutrients in the two groups. Percentages were calculated for analysis of the clinical sign and symptom of the

pregnant woman. Statistical analysis was done by using T- tests to accept or reject the formed hypothesis. The results were represented in the form of tables, pie charts and bar graphs.

Results & Discussion

Demographic details of the respondents

The demographic details of the respondents taken from Asansol Sub Division Hospital, ISC Sale Hospital (Burnpur) and *Bhagirathi Neotia* Woman and Child Care Centre.

The mean age of the respondents was found to be 27.61 ± 3.72 years. The respondents differed in their educational qualification. It was seen that all vegetarian group respondents were either graduates or postgraduates 46.87 %(n=15) while only a quarter of the respondents (n=8) from the non-vegetarian group was either a graduate or a postgraduate. Both the groups studied, (non-vegetarian and vegetarian) showed a higher trend towards a joint family (78.78%, 62.5% respectively).

Mean Macronutrient Intake of the Respondents

Macronutrient deficiency, whether clinical or subclinical, may affect growth, cognition, and reproductive performance. However, though the negative effects of diets low in energy on pregnancy outcome are well documented; less clear are the effects of diets that are low in one or more essential macronutrients. The mean intake of macronutrients among the respondent of non vegetarian group and vegetarian are given in Table-1:

Table 1: Mean Intakes of Macronutrients among the Respondents

Macro-nutrients	Vegetarian N=32	Non Vege tarian N=32	Total N=65	Mean RDA N=65	T-Test
Energy Kcal/day ±SD	1757.20± 267.11	1319.91± 75.42	1511.44± 297.99	2316.00± 358.98	12.55*
Protein Gram/day ±SD	65.76± 9.86	47.59± 7.20	55.70± 11.89	68.87± 9.58	6.23*
Carbo-hydrate Gram/day ±SD	283.91± 31.77	236.55± 36.88	255.42± 39.73	405.30± 62.82	5.48*
Fat Gram/day ±SD	40.61± 18.52	20.46± 3.37	39.09± 16.4	47.42 ±9.3	6.23*

When the 24 hour dietary recall was analyzed an extremely deficient intake of all the macronutrients was seen (table 1). The mean energy and macronutrient intake was found to be lower amongst the respondents having non vegetarian food pattern as compared to the respondents having a vegetarian food pattern. Further it was found to be significantly different ($t < 0.01$). This discrepancy seen may be because of the difference in their educational qualification and awareness regarding nutrition in the two groups. Respondents belonging to the vegetarian group knew the importance of good nutrition and had knowledge about healthy eating habits. While majority of the non vegetarian group respondents were not so aware about proper nutrition. A similar observation was seen by Knudsen *et al* in a study on the 'Western diet' and the 'health conscious' patterns among pregnant woman.

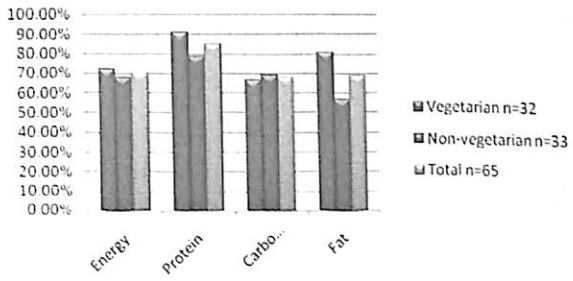

Fig 1 Percent Recommended Dietary Allowance

The data showed that the respondents met about 85% of the RDA for protein as compared to other macronutrients. The respondents having vegetarian food pattern met 91% of the RDA for protein, which was higher than the protein intake of the non vegetarian food pattern. This difference may be because maximum respondents belonging to the vegetarian group took protein supplements (e.g. proteinex etc) in their diet as advised by their dietician. The above observation is supported by several studies which indicate that awareness and education are stronger predictors of nutrient intake.

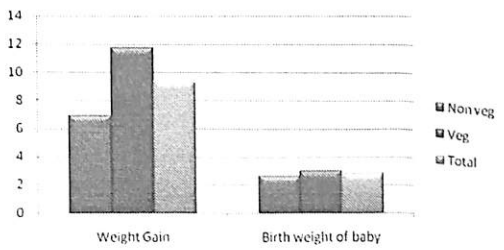

Fig 2 Weight Gain (Kg) During Pregnancy and Birth Weight (kg) of the Infant

From figure 2 it can be seen that respondents of vegetarian had higher maternal weight gain (11.74±3.27 kg) and birth weight of the infant (3.05±0.28 kg) as compared to respondents of non vegetarian (6.91±3.32kg and2.62±0.26 kg respectively). Similar results of maternal weight gain being positively associated with birth weight have been shown by other studies.

Maternal nutrition with Mean Weight Gain during Pregnancy and Birth Weight (g) of Infant

Adequate maternal calorie and protein consumption are the primary concerns in assuring sufficient

nutrition to create a healthy baby[3]. Thus, the energy and protein intake was correlated with mean weight gain (kg) during pregnancy and mean birth weight (kg) of infant (table 2a and 2b).

Table 2a: Energy intake with Mean Weight Gain (Kg) During Pregnancy And Mean Birth Weight (kg) of Infant

Groups	Energy intake Kcal/day± SD	Weight Gain (Kg)	T-Test	Birth weight of baby (Kg)	T-Test
Non-vege tarian n=33	1319.91± 175.42	6.91± 3.32	-6.21	2.62± 0.26	-7.87
Vegetarian n=32	1757.20± 267.11	11.74± 3.27		3.05± 0.28	
Total n=65	1511.44± 297.99	9.33± 4.06		2.83± 0.33	

It was seen that the group (vegetarian group) having a higher energy intake (1757.20±267.11) had a higher weight gain and the infant's birth weight was also seen to be higher. Thus it can be inferred that, energy intake is positively associated with maternal weight gain and birth weight. Similar observations have been shown by studies indicating that a reduction in maternal energy intake is associated with reduced pregnancy weight gain and birth weight.

Table 2b: Macronutrient intake with Mean Weight Gain (Kg) During Pregnancy and Mean Birth Weight (kg) of Infant

Groups	Protein Gram/ day± SD	Carbo-hydrate Gram/ day±SD	Fat Gram/ day ± SD	Weight Gain (Kg)	T-Test	Birth weight of baby (Kg)	T-Test
Non-vege-tarian n=33	47.59 ± 7.20	236.55 ± 36.88	20.46 ± 3.37	6.91 ± 3.32	-6.21	2.62 ± 0.26	-7.87
Vege-tarian n=32	65.76 ± 9.86	283.91 ± 31.77	40.61 ± 18.52	11.74 ± 3.27		3.05 ± 0.28	
Total n=65	55.70 ± 11.89	255.42 ± 39.73	39.09 ± 16.4	9.33 ± 4.06		2.83 ± 0.33	

It was seen that respondents of vegetarian group having a higher protein intake had higher maternal weight gain and higher birth weight as compared to respondents of non vegetarian group.

Further, studies have shown that maternal protein intake is positively associated with pregnancy weight gain and birth weight or both. A study by Levy & Jackson (1993) showed that protein intake during pregnancy is positively associated with pregnancy weight gain and birth weight. Thus a protein intake was correlated with maternal weight gain and birth weight of the infant. Studies have also indicated maternal intake of fat and carbohydrates to be positively associated with birth weight of the infant.

Birth Weight of the Infants

Adequate maternal snutrition are essential to prevent low birth weight, small for gestational age (SGA) baby, preterm delivery and a number of other conditions

	Vegetarian n=32	Non-vegetarian n=33	*Total n=65*
Under Weight(<2.5)	—	28.12% (n=9)	13.84% (n=9)
Normal Weight(>2.5)	100% (n=32)	72.72% (n=24)	86.15% (n=56)

Table 3: Birth Weight (kg) of Infants

The data of present study (table-3) showed that more than half of the respondents gave birth to babies having a normal birth weight.

General dietary problems during pregnancy

General dietary problems during pregnancy affect the electrolyte balance, energy intake, nutritional status and maternal weight gain Thus, the general dietary problems suffered by the respondents were looked into. The table below illustrates the prevalence of dietary problem during pregnancy.

Table 4: General Dietary Problems during Pregnancy

Dietary problems	Vegetarian n=32	Non-vegetarian n=33	Total n=65
Nausea	64.52% (n=20)	30.30% (n=10)	47.41% (n=30)
Vomiting	51.61% (n=16)	42.42% (n=14)	47.02% (n=30)
Heart burn	9.68% (n=3)	75.76% (n=25)	42.72% (n=28)
Morning sickness	29.03% (n=9)	39.39% (n=13)	34.21% (n=22)
Fatigue	45.16% (n=14)	36.36% (n=12)	40.76% (n=26)
Constipation	29.03% (n=9)	27.27% (n=9)	28.15% (n=18)
Anorexia	3.23% (n=1)	21.21% (n=7)	28.15% (n=8)

It was seen that maximum respondents suffered from nausea (47.41 %, (n=30) and vomiting (47.02 %, (n=30) followed by heart burn. A greater percentage of pregnant women of non vegetarian food pattern were found to be suffering from heart burn (75.76%, (n=25) amongst the pregnant women of non vegetarian. While a maximum number of pregnant women from vegetarian food pattern suffered from nausea (64.52%, (n=20).

Food habits and dietary pattern of respondents

It was seen that the foods that were included in diets by the respondents of non vegetarian pattern during pregnancy were fruits and milk while the

respondents of vegetarian other group reported inclusion of coconut water, green leafy vegetables, sprouts, dates, soymilk and other nutritional supplements. On an average, maximum respondents avoided spicy and oily foods, papaya, all types of junk foods and salty foods like pickle

Conclusion

The respondents differed in their educational qualification. It was seen that all vegetarian group respondents were either graduates or postgraduates while only a quarter of the respondents from the non-vegetarian group was either a graduate or a postgraduate. Maximum respondents suffered from nausea and vomiting followed by heart burn when the dietary problems during pregnancy were taken into account. An extremely deficient intake of all the macronutrients was seen in both the groups studied. The mean energy and macronutrient intake was found to be lower amongst the respondents having non vegetarian food pattern as compared to the respondents having a vegetarian food pattern. Further, it was seen that the group (Vegetarian) having a high maternal macronutrient intake had a higher weight gain during pregnancy and also gave birth to a normal birth weight infant. More than half of the respondents had a normal birth weight baby and all the vegetarian group respondents gave birth to a baby having normal weight. Thus it can be inferred from the observed data in the present study that, energy intake is positively associated with maternal weight gain and birth weight.

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Effect of tender coconut water on hypertensive men and women belonging to the age group of 60-80 years

*Saloni Goyal and Lilu Mancha**

ABSTRACT

The study was carried out to evaluate the effect of tender coconut water (TCW) consumption for 21 days on 60 hypertensive elderly subjects (males and females) in the age group of 60-80 years of age. They were divided into experimental group & control group consisting of 15 females & 15 males each, receiving 250 ml of TCW & drinking water respectively for 21 days. Blood pressure was recorded on the 1st day of supplementation, 22nd day after supplementation and 3 weeks aft.er post supplementation period. On applying the statistical tests it was found that there was significant reduction in both systolic and diastolic blood pressure in both females and males in the experimental group, while there were no significant changes in the systolic & diastolic blood pressure in the control group. Three weeks after post supplementation period there was a significant increase in both systolic & diastolic blood pressure for both males and females belonging to experimental groups while no significant changes were observed in the control group. A three days diet recall showed a deficiency of protein, carbohydrate and energy while consumption of fat was higher than the recommended dietary allowance. It was also found that hypertensive subjects had a very high intake of sodium (6 times higher than RDA) & very low intake of potassium (4 times lower than RDA) in their diet.

Keywords: Recommended Dietary Allowance (RDA), Tender Coconut Water (TCW)

Introduction

The incidence of hypertension in the geriatric population is very high and is a significant determinant of cardiovascular risk in this group[1], since the progression of hypertension is related to complex and interrelated aetiologies[2]. Hypertension also has a strong relationship with obesity, insulin resistance and dyslipidemia, the co-existence of these disorders gives rise to the Metabolic Syndrome.[3] Metabolic syndrome has been also associated with higher density of low density lipoprotein- cholesterol (LDL-C) particles, high levels of inflammatory risk markers, reduced fibrinolysis[4], heightened magnitude of oxidative stress[5,6] and resultant endothelial dysfunction that initiates the vicious cycle that maintains high blood pressure in hypertensive individuals. Components present in tender coconut water like potassium, magnesium, calcium, vitamin C and certain amino acids like L-arginine has been studied extensively for their role in blood pressure regulation[7,11]. Human studies have also shown that coconut water is effective in reducing high blood pressure and increasing circulation.[8] Thus, tender coconut water possesses antihypertensive properties owing to its various components and their synergistic effect on blood pressure.

Methodology

Selection of place: In order to conduct the study 60 hypertensive subjects in the age group of 60-80 years were selected from "St. Joseph's home, an old age home in Kolkata. The hypertensive subjects consisted of 30 male and 30 female with blood pressure more than 120/80 mmHg.

Survey: A survey was conducted and data was collected by a questionnaire and interview method. The questionnaire dealt with personal information, medical history and lifestyle of the patient. A three day dietary recall method was also included in survey questionnaire to assess their nutrient intake of protein, fat, carbohydrate, energy, sodium and potassium To carry out the dietary assessment, the most common recipes were standardized in terms of measuring cups, glasses and spoons in the food laboratory of J.D. Birla Institute. To ascertain the amounts of food consumed survey the standardized cups, glasses, spoons and the different shapes and sizes of chapatti cut out on paper were shown to the elderly from which they could select, the one similar to the amount they had consumed. Eating pattern of the subjects was probed to find out the kind and the quantity of food consumed.

Study design: The male and female subjects were further divided into control and experimental group consisting of 15 men and 15 women each. The control group was given 250 ml of drinking water for 21 days while the experimental group was given 250 ml of tender coconut water for 21 days.

Measurement of blood pressure: Blood pressure was measured by Ausculatory methods of blood pressure measurement using an Aneroid Sphygmomanometer[9] Blood pressure were recorded for three days consecutively before starting supplementation to select hypertensive subjects. Blood pressure was measured on the first day of the supplementation and on twenty second day after the supplementation and also three weeks after the supplementation period was over.

Statistical analysis: To analyse the changes in the blood pressure readings the statistical tests namely "t" test and sign "z" test was applied to difference between the blood pressure readings.

Results & Discussion

The results of the study were interpreted with the help of the data collected.

Table 1: Test results for the difference between bloodpressure readings of Day 1 & Day 22nd

Description	Gender	"t" values		Sign "Z" test	
		Systolic blood pressure	Diastolic blood pressure	Systolic blood pressure	Diastolic blood pressure
Experimental	Female	5 21**	3 86**	3 4**[1]	3 16**
group	Male	11 73**	9 11**	3 88**	3 74**
Control	Female	5 45**[1]	0 88	2 14*	0 53
group[1]	Male	1 05	0 55	1 0*	0 58

** extremely significant beyond 0 01 value for df 14
**[1] increase in blood pressure was observed for all control groups
**$_1$ extremely significant for z >1 96

Table 1 shows values obtained after applying the statistical tests (t &z test) to the difference between blood pressure readings of Day 1 & Day 22nd.

There was a significant reduction in blood pressure (systolic and diastolic blood pressure) for both experimental groups (females & males) and this may be attributed to consumption of tender coconut water for 21 days. Tender coconut water reduces blood pressure as it is a rich source of potassium, magnesium; calcium and L-arginine. All of these components regulates and reduce blood pressure.

In the experimental groups consuming tender coconut water for 21 days, 80% females & 100 % males showed reduction in systolic blood pressure in the range of 8-48 mmHg & 6-44 mmHg respectively. 66.7% females &100% males showed reduction in the diastolic blood pressure in the range of 4-30 mmHg & 8-22 mmHg respectively.

On the other hand in control groups 66.7% females & 53.3 % males showed an increase in systolic blood pressure in the range of 1-33 mmHg and 2-24 mmHg respectively, while 60 % females& 53.3% males showed no changes in diastolic blood pressure The applied statistical tests (Table 1)showed no significant changes in diastolic blood pressure readings for males and females. A significant increase was observed in systolic blood pressure for females belonging to control group which may be attributed to factors like stress or not taking medications regularly.

Post supplementation changes was also calculated in order to check whether discontinuing the tender coconut water supplementation has any effect on blood pressure of the selected subjects after three weeks of stopping the supplementation

Table 2: Test results for the difference between blood pressure readings of Day 22nd & 3 weeks after stopping the supplementation.

Description	Gender	"t" values		Sign "Z" test	
		Systolic blood pressure	Diastolic blood pressure	Systolic blood pressure	Diastolic blood pressure
Experimental	Female	5 1**	1 88	6 3**$_1$	1 26
group	Male	5 32**	3 09**	3 36**$_1$	2 84**$_1$
Control	Female	1 5	1 61	0 9	1 51
group[1]	Male	1 1*	0 46	1 60	0 58

** Extremely significant beyond 0 01 value for df 14
** Increase in blood pressure was observed for all control groups
**$_1$ Extremely significant for z >1 96

The above table shows the values obtained after applying the statistical tests (t &z test) to the difference between blood pressure readings of Day 22nd & 3 weeks after stopping the supplementation.

In the experimental group it was seen that 86.7% female & 93.3% males showed an increase in systolic blood pressure in the range of 2-46 mmHg & 2-20 mmhg respectively. While for diastolic blood pressure 46.7 % females & 87% males showed an increase in diastolic blood pressure in the range of 2-4 mmHg & 2-14 mmHg respectively. On applying the statistical tests (table 2) a significant increase in the systolic blood pressure was observed in both females and males belonging to the experimental group, indicating that there was a clear increase in systolic blood pressure after three weeks of stopping the tender coconut water supplementation. While in case of diastolic blood pressure only males belonging to experimental group showed a significant increase in diastolic blood pressure this may be due to the fact that diastolic blood pressure is less responsive to tender coconut water supplementation and it follows a age regulated pattern independent of the short term changes.

In control groups 46.7% females & 53.3% males showed no changes in systolic blood pressure after three weeks thus no significant changes were observed on applying statistical tests (table 2).While in the case of diastolic blood pressure 40% females &46.7% males showed no changes in the diastolic blood pressure and thus on applying on statistical tests no significant changes were observed.

The three days dietary recall was done in order to calculate the average intake of various macronutrients namely protein, fat, carbohydrate and energy in the daily diet of hypertensive subjects and when it was compared with RDA requirements following were the main observations made:

It was observed that mean protein intake was lower in males than females when compared to the RDA requirements as the same low protein diet was consumed by females and males but the protein requirement for males is higher than females.

Overall fat intake for men and women was higher than RDA in all the groups. In particular fat intake of women was much higher (by 18 & 25.5 grams) than RDA requirements as fat requirement of females were much lower than males yet they both consumed same amount of fats in their diet.

On comparing the carbohydrate intake with the RDA requirement it was seen that both males and females were consuming low carbohydrate diet as they consumed high fat content diet with higher satiety value making them eat lesser carbohydrates in their diet.

Mean energy intake for males was deficient when compared to RDA whereas mean energy intake of females belonging to older age group (70-80 yrs) was little higher than RDA as all subjects were consuming same amount of calories from the diet which did not meet the higher energy requirements for males but at the same time provided more calories to females belonging to 70-80 yrs group with lesser energy requirements.

Micro nutrients namely sodium and potassium was also calculated through three days dietary recall method Overall sodium intake for men and women was 6 times higher than RDA (table 3). It was observed through their dietary recall that the hypertensive elderly were consuming salt in their food along with high sodium processed foods like biscuits, cheese, salted butter, bhujia, pickles and papads on a regular basis.

Mean potassium intake for women and men was 4 times lower than RDA as they did not consume fresh fruits and vegetables in their daily diet. Thus selected hypertensive elderly were consuming a high sodium and low potassium diet.

Table 3: Average sodium and potassium intake of selected hypertensive elderly calculated from three days dietary recall in comparison with RDA

Nutrient	Gender	Age group	Mean intake	RDA
Sodium (in mg)	Female	60-69	7466	1300
		70-80	7107	1200
	Male	60-69	7103	1300
		70-80	7416	1200
Potassium (in mg)	Female	60-69	1157	4700
		70-80	1604	
	Male	60-69	1223	
		70-80	1179	

Conclusion

Thus it may be stated that daily consumption of (250 ml) tender coconut water for 21 days has a lowering effect on the blood pressure of hypertensive subjects in contrast there were no such changes observed in the blood pressure reading of the control group after 21 days as they were not consuming tender coconut water.

On observing the post supplementation changes in the experimental group after three week of stopping the supplementation a clear increase in systolic blood pressure for females and males and an increase in diastolic blood pressure for males was seen. This indicates that consumption of tender coconut water has brought down the blood pressure during the supplementation period, but on discontinuing the supplementation there is an increase in blood pressure.

It was observed diastolic blood pressure was less affected by supplementation with tender coconut water particularly as 33.3 % females from the experimental group showed no reduction in diastolic blood pressure. It may be due to the fact that diastolic blood pressure follows a pattern where it rises until the age of 50 years, tends to level off over the next decade and may remain the same or fall later in life.

As calculated from three days dietary recall average nutrient intake for protein, carbohydrate, energy, sodium and potassium intake was not meeting the RDA requirements whereas the overall fat intake was higher that RDA requirements in all the groups in particular females were consuming very high fat diet when compared to the RDA requirement. All the subjects were consuming high sodium (6 times higher than RDA) and a low potassium diet (4 times lower than RDA requirement).

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A Study on Acceptability of Lined Jackets made from Jute Blended and Union Fabrics

Prathibha Sanganeria and Samita Gupta

ABSTRACT

The study 'Acceptability of lined jackets made from jute blended and union fabrics' was undertaken with an objective to provide diversification for the jute fibre. An attempt was made to study various factors influencing the buying behavior of jackets. A good response towards jackets made out of jute blended and union fabrics with lining was found. Jackets were worn by young adults the most. Black was the most popular colour of jackets. The sketches and the fabrics for construction of jackets were judged and finally selected by a panel of judges. Construction details of jackets and preference towards the constructed jackets was assessed through a questionnaire. Jacket with halter neckline and black jute-cotton blend fabric was most preferred followed by jacket with V-shaped neckline and off-white jute-cotton union fabric. Short jackets had a higher comfort level compared to the long jackets. Long jackets were preferred for winter wear while short jackets were considered wearable in all seasons. Overall appeal and colour were found as the important factors affecting the preference for the constructed jackets while garment and lining fabric was not considered as important a factor. There was an appreciation for such kind of attempt towards diversification for jute fibre in the segment of fashion apparels such as jackets.

Keywords: Jute Diversification, Jute Blend and Union Fabric, Lining

Introduction

Jute is a natural cellulosic fibre, under the category of bast fibres which is obtained from the stem of the plant. The jute fibre possesses higher strength and stiffness and much lower extensibility implying that it is strong and dimensionally stable. These properties help use of jute for making of rope, twines, braids and nets. High strength, good dimensional stability and low cost, easy availability, eco-friendliness is specific characteristics of jute based fabrics used for hessian and sacks.

Owning to the low price of jute and its steady supply in sufficient quantity, jute established its position at the top as raw material for packing. But the high price and short supply of jute in the past few years have done harm to the jute industry. A large number of fibres such as polypropylene, natural fibre like cotton have tried to replace jute. In the present context, there is a need for orienting jute from its present status of struggle against other alternatives in area of packaging, to a positively prospering commodity having diverse applications such as jute pulp and paper, handicrafts including jute jewellery and gifts items, jute non-woven products for industrial applications like in the automobile industry, insulation / encasings etc., jute composites and particle boards of households, interior applications and knock-down furniture, jute geotextiles applied for prevention of soil erosion, rural roads, embankment protection, land slide prevention, land-scaping, and horticulture applications, home textiles comprising floor coverings, carpets, mats, under-laying and wall hangings etc., fashion garments and accessories, jute and jute blended fabrics / decorative fabrics.

In order to supplement the deficiencies of jute fibre such as coarseness, efforts have been made for the last two decades to blend jute fibres with other fibres, viz., viscose, rayon, wool, polypropylene, cotton etc. entirely in jute machinery system, in order to produce a variety of products to suit different end-use requirements such as furnishing, apparels such as jackets etc.

A jacket is a type of sleeved hip- or waist-length garment for the upper torso. It is generally shorter, ending just below the waist and often lighter. Some jackets are fashionable, while others serve as protective clothing. Lining is a unit assembled in the same silhouette as the jacket. It is used to prevent the outer fabric from coming in direct contact with the body, to facilitate putting on and putting off the jacket, to provide a clean, inside finish when attached and to prolong the life of the jacket.

Methodology

In this study the methodology adopted to collect the data for analysis was as follows:

Sample: The present study was done by selecting the sample by the purposive method. Fifty females belonging to age group 15 to 25 years and 25 to 35years from the city of Kolkata were selected.

Preliminary Study: Eight designs each for long and short jackets were sketched. Eight fabric swatches were taken. Close ended questionnaire was prepared and administered on ten garment industry experts. Two designs each from long and short jacket designs and four fabrics were selected for the final study. Market survey was done for lining fabric also and taffeta was the selected lining fabric.

Detailed study: A structured questionnaire was constructed keeping in view the buying behavior towards jackets, preference of fabrics for jackets and construction details of jackets.

Physical testing of the chosen fabrics: Fabric density, thickness, crease recovery, stiffness testing were done for the selected fabrics.

Construction of Jackets: The set of four selected patterns were cut and stitched with lining using the four different fabrics selected for the study.

Fabric	Thickness (in mm)		Bending Length (in cm)	Crease Recovered Angle (in Degrees)		Number of Threads Per Inch	
		WARP	WEFT	WARP	WEFT	WARP	WEFT
F1	.75	1.5	2.5	105	95	48	28
F2	.4	1	2.2	100	65	50	30
F3	.5	.75	.5	100	75	44	32
		WARP	WEFT	WARP	WEFT	WARP	WEFT
F1	.75	1.5	2.5	105	95	48	28
F2	.4	1	2.2	100	65	50	30

Assessment of Constructed Jackets: The constructed jackets were shown to the.respondents and they were requested to rank them. Opinion of the respondents was taken on the basis of various factors such as fabric, colour, fit, cut, construction details, comfort, overall appeal etc.

Collection of Data: A survey was done by displaying all the jackets and the questionnaire was administered on the respondents.

Analysis of the data: The data collected was interpreted and statistical tests were undertaken.

Results & Discussion

From the preliminary study it was seen that most of the respondents were keen on jackets made out of jute blended and union fabrics with lining. Out of the following categories, i.e. adolescents, young adults, middle aged adults and old people, jackets were worn by the adolescents and young adults the most. Black was the most popular colour of jackets. Majority of the people would not prefer embellishments on the jackets.

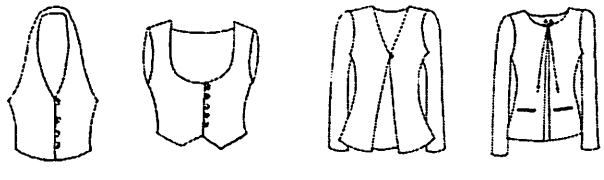
The results of the detailed study showed that majority of the respondents preferred comfortable lined jackets over jackets without lining. Taffeta was found to be the most preferred fabric for lining followed by satin, lawn and muslin. Most of the respondents preferred jackets with V-neckline, collars, full sleeves, flap pockets, zippers and jackets of short length.

Out of different materials used for jackets, respondents preferred denim followed by fur, tweed, leather and lastly jute. But when jute was compared with jute blend and union fabrics, 82% of respondents showed interest. They felt that jute blend and union fabrics were softer and smoother, had better drape, and were less stiff and less hairy. But some felt that jute had a more natural and trendy look and a higher aesthetic appeal.

F4	.72	2.5	2.9	90	70	25	23

Table 1: Physical properties of the selected jute union and blend fabrics

Fig 1 Designs selected for jackets



SJD1 SJD3 LJD2 LJD6

SHORT JACKETS LONG JACKETS

Out of the four designs selected for the study, jacket with halter neckline(SJD1) was most preferred. It had a more fashionable look compared to other jackets and therefore had a good response. Black coloured jute-cotton blend fabric (F3) was preferred the most which could be for the colour or for the overall softness and smoothness of the fabric.

The second preference of design was for jacket with V-shaped neckline(LJD2). Off-white coloured jute-cotton union fabric (F1) also showed high ranking. The fabric had a good aesthetic appeal which could be because of the weave and also its feel was most soft in comparison to the other fabrics, which could be the reasons for its preference.

Waistcoat being a short fitted jacket had a fashionable look which could be a reason for its 3rd rank(SJD3). Reasons for this design's less appreciation in comparison to the previous two designs could be due to the contrast of a rounded neckline which might have clashed with a V-shaped hemline. Some respondents might have liked the design for its trendy look.

The lowest preference for jacket with round neck, full sleeves and beige colour jute-viscose blend fabric could be because of the design that probably lacked innovation and the fabric which was most stiff and lacked drape to a great extent (LJD6).

Short jackets had a higher comfort level compared to the long jackets. (F4) i.e. jute-viscose blend fabric in beige colour was stiff and had a poor drape which could be the reason for jackets constructed with that fabric had a low comfort level according to most of the respondents.

Long jackets with full sleeves had a higher preference as a winter wear. Also jackets made with thicker fabrics, i.e. jute-cotton union fabric (F1) and jute-viscose blend fabric (F4) showed preference as a winter wear.

Most of the respondent liked the fabric used for lining. 75% of the respondents felt that a combination of all factors such as smothness and softness, easy to slip in, comfort influenced their preference for a lining fabric.

As per the costing done for the jackets, selling price of the jackets was estimated. Most of the respondents felt that the jackets were low priced. The result didn't show much relation between preference for a jacket and response towards selling. Consumer buying behaviour being highly complex, dependent on combination of various social, psychological, economic and other factors; its relation to selling of a product cannot be completely understood.

Conclusion

For orienting jute from its present status of struggle against other alternatives, mainly in the area of packaging to a positively prospering commodity having diverse applications, the versatility and all the positives of jute need to be appreciated. To meet the dynamics of ever changing demand driven market, new designs, products and technological innovations in the jute sector is required. It was found that such kind of attempt towards diversification for jute fibre in the segment of fashion apparels such as jackets constructed from jute blend and union fabrics was well accepted and appreciated.

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Modification and adaptation of designs inspired from Madhubani Paintings and their application through various textile ornamentation techniques on household textile products

Ruchita Bohra and Amita Dutta

ABSTRACT

A study was done to explore the rich motifs of Madhubani Paintings as a source of design for the contemporary use on household products with the aim of making the products more appealing and in turn popularizing Madhubani Paintings.

Madhubani Paintings of, bharni, kanchi and godhna styles were studied and one painting from each was modified in three different styles of designs stylized, geometric and naturalistic. These were applied on three household articles, cushion cover, tablemat and napkin and bag. A preliminary survey was conducted on three categories of respondents, retailers, consumers and derived consumers, twenty- five respondents from each category.

According to the result, stylized design was the most preferred choice and was therefore applied on all the three articles by six surface enrichment techniques i.e. three printing techniques, screen, stencil and digital printing and three embroidery techniques, machine, hand and embroidery with beads and sequins work. A total of twenty four products were made.

A final survey was done to understand the comprehensive acceptance of the products. The overall response for the modification in design and its application on different household products through various surface enrichment techniques was very well appreciated. All the products were found very suitable for marketing.

Keywords: Madhubani Painting, Stylized Design, Screen Printing, Stencil Printing, Digital Printing, Embroidery Techniques

Introduction

There are many Traditional and Folk forms of paintings in India like the Madhubani Painting of Mithila, Warli of Maharashtra, Mandana of Rajasthan, Pabo Ji na Phad from Rajasthan, Pata Chitra from Orissa and many other forms.

Amongst these, the Madhubani Painting or Mithila Painting practiced in the Mithila region of Bihar state in India, has succeeded in creating a place for itself internationally and is appreciated world wide. This art can be traced to a town called Madhubani *(literal meaning of which is Forest of Honey)*[5,6,7]. This traditional-folk form of art is known for its distinct style. In Madhubani society the women were sole bearers of Mithila Painting for centuries and they have handed down the tradition of wall painting from mothers to daughters[1,7] which are deep rooted with strong cultural and religious connotations[7]. Their vividness of details, clarity in expression of the design and brightness of colour combinations used, make them extremely adorable. They have a universal appeal and therefore it was felt that if the motifs from these paintings were modified in a novel way, they could have a greater appeal.

As per the belief of the people of Madhubani, Gods visit each house in the morning to bless them with luck and prosperity. Thus the art probably initiated as the welcome paintings for the local deities. *Aripana* is made on the floor at the entrance, (similar to the *Alpanas* of Bengal) and *Bhittichitra* is done on exterior mud-walls of houses particularly at three places: room of the family god/goddess, room of the newly wedded couple *(Khobar ghar)* and the drawing room of the houses to welcome the gods. Paintings were more elaborately made for various ceremonies and rituals such as pujas, weddings, household alterations, greeting the full moon, or half moon, end of harvest or entering into a new phase of life, birth of a child etc. Even in scorching sun, drought, flood, earthquakes, prolonged monsoon, the Mithila woman used to paint her walls and floors to avert these natural disasters [8]. These paintings became meaningless after the situation changed or the occasion was over, and the walls were recoated with cow-dung and clay, which were ready to be repainted for the next occasion.

Most Madhubani Paintings depict Hindu religious motifs[6,7] revolving around the Hindu deities. They also use motifs from nature consisting of sun, moon, plants, animals, birds, flowers which have symbolic meaning, for example, fish and coupling birds are symbols of fertility, parrot signifies love, Surya represents Sun God etc [4,7,8]. Mithila art is never purely decorative. Each and every symbol has its own significance.

These paintings are well recognized by their distinct style of painting. There is no shading in the application of colors. A double line is drawn for outlines and the gap is filled with variations of tiny

lines. Some linear Maithili Paintings do not have application of colors; only the outlines are drawn, whereas some have flat bold colours. The faces of the figures have large bulging eyes and a jolting nose emerging out of the forehead. Paintings normally have a double line border with simple geometric designs or with ornate floral patterns on it. Anything that is depicted in the paintings has a symbolic meaning attached to it. No empty space is left and the gaps between the two lines are filled with cross or straight lines. There is hardly any empty space in the paintings; all spaces are filled with flowers, animals, birds and even geometric designs.

Madhubani Paintings have three distinguished styles which correspond to three distinct castes.

Bharni Style -

Bharni literally means 'filling'. This is a style practiced by the '*Brahmin community*'[7]. This style of painting employs bold, black outlines to clearly define the subjects[7]. The enclosed areas are filled with vibrant colours[1]. The artist's brilliance lies in the balance between pattern, details and bold field of colours.

Kanchi Style –

Khachni literally means 'line'. This is a style practiced by the *Kayastha* or *Scribe community*[7]. This style of painting uses only one or two colours, generally black and red. The artists rely on delicate fine line with a variety of inventive patterns using hatching and stripping. This style is marked for its intricate details that make every square inch of painting look like delicate thoughtful embroidery [1,3].

Godhna Style –

Godhna literally means 'tatoo'. This is a style practiced by the *Dusadha Community*[7]. Dusadha is low caste group and they are not allowed to represent divinities. Their painting themes include the flora and fauna, and Lord Salhesha (a cultural hero). This style consists of small stick line figures based on body tattoos, geometrically organized in parallel lines, concentric circles and rectangles. Some of these paintings are then filled with colours, others simply drawn in black. Considering its rich use of colours it is closer to Brahmin school of painting[3,7].

The world has come to know about Madhubani Paintings after few natural calamities. During the Bihar famine (1964-65), various NGOs entered to help the villagers. They saw their wall paintings and were awe struck. The rich hidden heritage definitely had the power to mesmerize the onlooker but the paintings were on walls and so they gave them paper to paint on. Some of Madhubani women, who until now painted only on walls or floor, began to paint on paper[2]. Again due to major ecological economical crisis that resulted from prolonged drought in (1966-68), All India Handicraft Board further encouraged the women artist to produce paintings on handmade papers for commercial use in order to create a new source of non-agricultural income.

In recent years a number of truly accomplished Mithila artists have been painting original and sometimes innovative work which have become increasingly exhibited and recognized abroad from Japan and USA to South Africa, France, Australia, Germany, Mexico and may be all over the world. Yet these artists remain unknown within India itself.

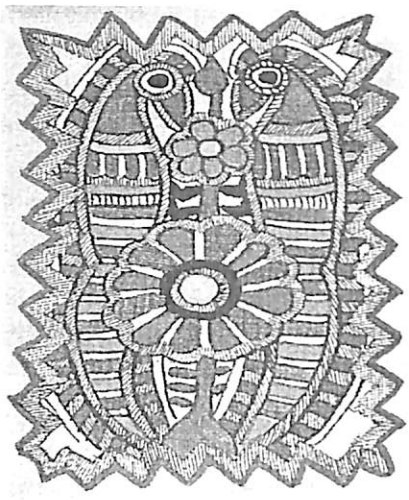
Methodology

Study of Madhubani Paintings

A study on Madhubani Paintings was conducted from various books, magazines, journals and websites. One design each from three different styles of Madhubani paintings *(Bharni, Kanchi and Godhna.)* were selected and modified in 3 different styles of design (*stylized, geometric and naturalistic)* for adaptation and application on three different household articles (cushion cover, table mat and napkin and bag).

Modification and adaptation of the selected motifs in different styles of design

Each selected Madhubani style of painting (bharni, kanchi, godhna) was modified in three different styles of design (stylized, geometric, naturalistic) using *corel draw* software. Each design was first adapted according to the shape and size of the product for which it was chosen. For example the *bharni design* chosen for cushion cover was a rectangle, whereas the cushion cover is square. So the design was first modified to a square design. Then it was modified into three different styles, *stylized, geometrical* and *naturalistic* keeping in mind the requirements of the surface enrichment techniques to be used. Secondly the *kanchi* design which was selected was very intricate for the techniques chosen. Thus only a part of the design was selected and modified in the three styles in a way that would be suitable for table mat and napkin. Similarly godhna design chosen for bag was also modified into three different styles of designs.

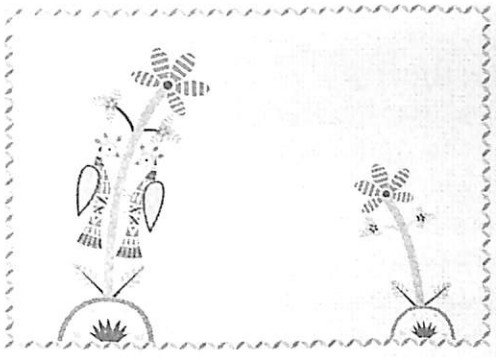


Original Madhubani Painting

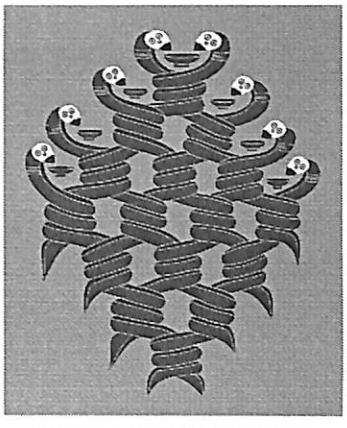
Original Madhubani Painting

Original Madhubani Painting

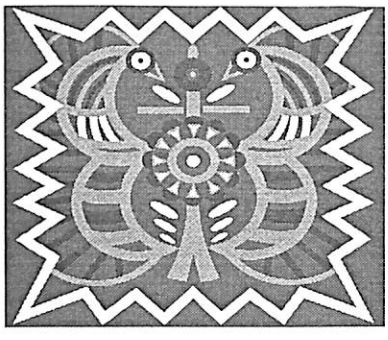
Modified Madhubani Painting *(Bharni) in Stylized design),* adapted for cushion cover



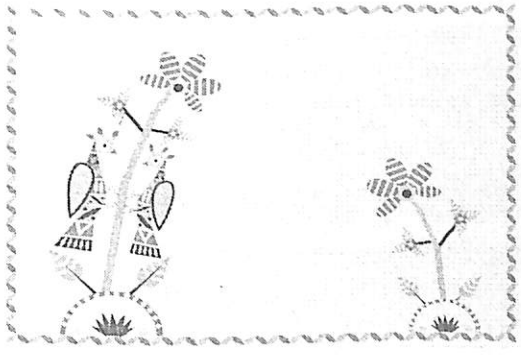
Modified Madhubani Painting *(Kanchi) in Sylized design),* adapted for Table Mat and Napkin



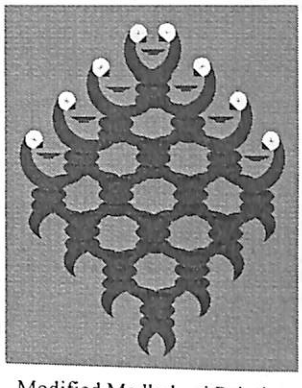
Modified Madhubani Painting *(Godhna) in Stylized design),* adapted for Bag



Modified Madhubani Painting *(Bharni in Geometric design),* adapted for cushion cover

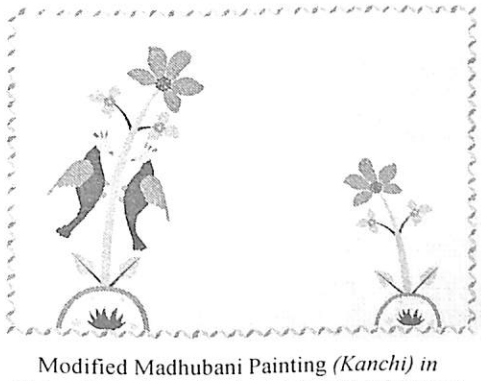


Modified Madhubani Painting *(Kanchi) in Geometric design),* adapted for Table Mat and Napkin



Modified Madhubani Painting *(Godhna) in Geometric design),* adapted for Bag

Modified Madhubani Painting *(Bharni in Naturalistic design),* adapted for cushion cover



Modified Madhubani Painting *(Kanchi) in Naturalistic design),* adapted for Table Mat and Napkin

Modified Madhubani Painting *(Godhna) in Naturalistic design)* adapted for Bag

Since the surface enrichment techniques used on the products are expensive, the deep, rich and sober colours appealing to higher end markets were adapted on the modified designs, though original Madhubani Paintings are bright.

Preliminary Survey

A preliminary survey was carried out through Questionnaire method. The sample size for the survey was 75. Three different categories of respondents were selected; retailers, consumers and derived consumers, and 25 respondents from each category. The questionnaire dealt with respondent's selection amongst Original and Modified designs, and their preference among the three styles of design: naturalistic, stylized and geometric designs.

Application of Surface enrichment techniques

On the basis of the results obtained from the preliminary study, stylized design was most preferred and was further modified for various surface enrichment techniques. These modified and adapted designs were applied to all the three articles by two surface enrichment techniques i.e. printing and embroidery. Three printing (Stencil, Screen and Digital printing) and three embroidery (Hand embroidery, Machine embroidery and Bead and sequins work) technique were selected.

After the products were made, it's costing was taken out. With addition of a nominal 10%, price of the products were fixed. The profit margin was kept low because single article was produced in each technique so the initial cost price was high.

Final survey

After the completing of the products in the above mentioned techniques, the second questionnaire was prepared

Again the data was collected from a sample size of 75 people (25 retailers, 25 consumers, 25 derived consumers).

The questionnaire dealt with the buying habits, respondent's awareness about the traditional art, acceptance of modification and adaptation of Madhubani motifs, basic preference of the surface enrichment techniques in relation to design and colour selected and understanding of marketability.

Results and Discussions

The data collected for preliminary survey was processed and analyzed using the technique Analysis of Variance (ANOVA). A two way ANOVA was used to study the difference in acceptability of original and modified Madhubani Paintings. The score obtained for modified Madhubani design was higher than the original Madhubani designs. 93% respondents preferred modified Madhubani designs compared to original Madhubani designs.

In the second case, the differences in acceptability of modified Madhubani designs were to be tested;

Table 1: Showing the scoring of three styles of modified design

Respondents									
	A	B	C	A	B	C	A	B	C
Retailers	22	53	0	46	11	18	7	11	57
Consumers	46	29	0	22	25	28	7	21	47
Derived	45	29	1	24	28	23	5	17	53
Total	113	111	1	92	64	69	19	49	157
Marks	226	111	0	184	64	0	38	49	0
Total Marks	337			248			87		
Rank A = 2 marks	*Rank B = 1 mark*						*Rank C*		

From the above table it can be observed that stylized design was the most preferred choice by all the categories of respondents, followed by geometric design and least preferred was naturalistic design.

Again a two-way ANOVA technique was taken. Since significant difference was found among the acceptance of the different styles of modified Madhubani designs, a pair wise comparison was done, between three styles of designs i.e., stylized, geometric and naturalistic design to find which is most preferred. The statistical analysis of the preliminary study showed that stylized design was the most preferred design style and applied to three household articles by 6 surface enrichment techniques.

General information about Madhubani Paintings

From the results of final survey it was observed that the most of the respondents were not aware about Madhubani Paintings. (Since a number of consumers and derived consumers surveyed, were from our college, it was found that the percentage of aware respondents in these categories were higher.) Therefore pictures of Madhubani Paintings were shown to respondents and then they were asked the next question. Majority of them felt that the idea of modification and adaptation of Madhubani Paintings on various utilitarian textile products was a good idea.

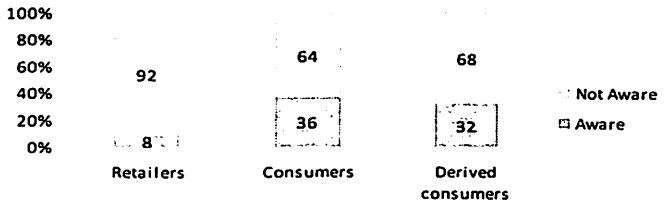


Fig 1 Awareness about Madhubani Painting

From the above graph it can be observed that only 8% of the retailers, 36% of the consumers and 32% of the derived consumers are aware about Madhubani Paintings.

Effect of Age and Educational Qualification

The survey was done on three age groups 16-25, 26-45, 46-65 and it was found that, 46-65 years age group preferred hand work a little more than the younger groups as preference for stenciling and hand embroidery is slightly higher in this age group

Educational qualification (< higher secondary, graduation, post graduation) was not affecting the choice of printing and embroidery techniques for various household products.

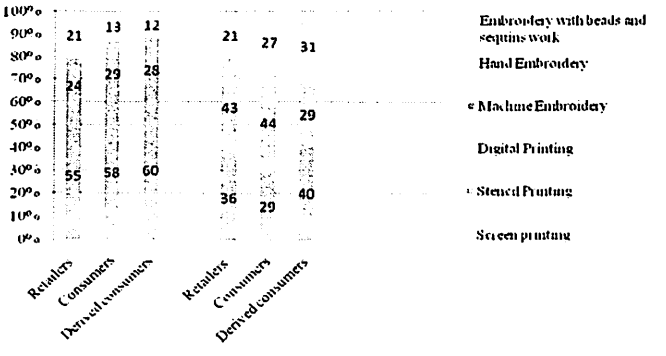


Fig 2 Preference of Surface Enrichment Techniques

From the above graph it can be observed that amongst the printing techniques, screen printing was the most preferred choice.

Amongst the embroidery techniques hand embroidery was the most preferred choice followed by machine embroidery with narrow margin.

Thus it was observed that the preference in the embroidery techniques was not absolute.

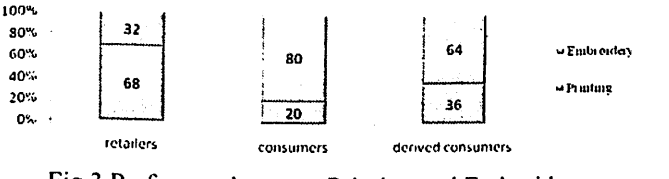


Fig 3 Preference between Printing and Embroidery

From the above graph it can be observed that amongst the two techniques, embroidery was preferred over printing. 32% retailers, 80% consumers, and 64% derived consumers preferred embroidery techniques over printing techniques. Hence it can be said that among the retailers, printing technique was more preferred than embroidery technique whereas consumers and derived consumers preferred embroidery technique more than printing. Hypothesis Testing of Proportion method was used to analyze which technique was the most preferred.

Acceptance of Designs and Colours

15.55 % respondents found that the colours used to be excellent, 38.66 % found it very good, 38.22 % rated the colours as good. 7.55 % rated it fair. No one rated it as poor.

Colours chosen for the cushion cover was the most preferred by the respondents.

25.77 % respondents found the design to be excellent, 38.22 % found it very good, 31.55 % rated the design as good. 4.44 % rated it fair. No one rated it as poor.

Price and Marketability

80.66% of respondents found the products to be of good taste and reasonably prized. They were keen to buy the products. This figure would rise to 86.66% if digital printing was not taken into account.

All the respondents were unanimous to state that the products were definitely marketable.

The present profit margin of 10 % can increase with mass production.

Conclusion

The modified designs and colour adaptations were accepted very well by the respondents. Stylized designs were preferred over geometric and naturalistic styles.

Various surface enrichment techniques added further richness to the already rich and vibrant Madhubani Paintings.

Age and education qualification did not have any major influence in the preference of surface enrichment techniques.

Screen printing was the most accepted printing technique, whereas under the embroidery section hand embroidery had the highest preference, marginally followed by machine embroidery.

Digital printing was appreciated but was found very expensive.

All the products were found suitable for marketing.

Lastly these adaptations and modifications can help designers to contemporize and enrich his/her

collection, and make them more appealing and acceptable. A designer can thus, use modified Madhubani Paintings as his own valuable design source, and at the same time promote the rich Indian Tradition.

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Dyeing of Silk Fabric with Onion Peel Waste Using Unconventional Methods

Yamini Dhanania and Deepali Singhee

ABSTRACT

The present study is an endeavour to make the process of natural dyeing cost effective through use of a waste product which is available in plenty and use of room temperature in the dyeing process. Attempt has also been made to improve the light and wash fastness of silk fabric dyed with onion peel extract. The effect of varying conditions of extraction and dyeing process variables (time, temperature, pH, MLR and dye concentration) on the surface colour strength and related colour parameters along with colour fastness of the dyed fabric has been assessed and optimum value established. Dyeing process variables like pH, temperature and dye concentration are the predominating dyeing parameters for dyeing silk fabric with onion peel. There is ½ - 1 grade improvement in the light and wash fastness of silk fabric dyed with aqueous extract of onion peel and subsequently treated with 2% UV-absorbers (benztriazole, benzophenone and MEK) and 2% dye fixing agents (Tinifix WS Conc., cetrimide and CTAB) respectively when applied by the pad-dry process. Further with an objective to economize on the water consumption and use of fuel / energy, silk fabric has also been dyed with purified onion peel extract by the simpler dyeing process - pad-dry-cure and pad-batch-dry. Pad-batch-dry method gives highest K/S values and uniform dyeing results when 5 gpl dye concentration of the purified onion peel extract is used on silk fabric.

Keywords: Aluminium Sulphate, Cationic Dye-fixing Agents, Crepe Silk Fabric, Natural Dyes, Onion Peel, Pad-dry-cure andPad-batch-dry, Pre-mordanting, Soxhlet Extraction, UV-absorbers.

Introduction

The craft of dyeing with natural dyes quickly fell out of favour in the mid 19th century when the brilliant colours from synthetic dyes were discovered. These widely available, cheaper and easy to apply synthetic dyes have moderate to excellent colour fastness properties as compared to the poor to moderate wash and light fastness of the natural dyes.

Off late, organic awareness and environmental consciousness of consumers have led to a revived interest in natural dyed textiles[1]. A large amount of the source material is required to produce small quantity of the natural dye. Use of waste material as a dye source would make the process of natural dyeing cost-effective. Thus, in the present study dye from onion peel waste which is available abundantly and free of cost has been used to make the process of natural dyeing relatively more cost effective.

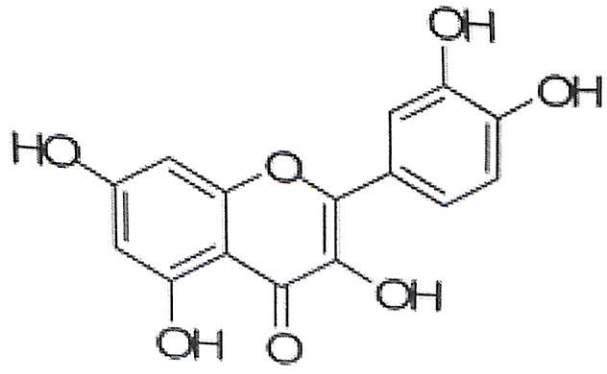
Recent fashion trend shows that though crepe is an expensive fabric, it is in much demand these days for its use as high-end apparel wear (saris and dresses). Application of natural dyes on crepe fabric is thus expected to enhance its value giving it an 'eco-friendly' tag.

The pad-dry-cure technique is used efficiently and successfully for dyeing using various synthetic dyes over a continuous ranger. Scientific reports on alternate route or method for dyeing textiles with natural dyes are limited and scanty[2]. Further, most natural dyes are applied to textiles by the exhaust method, which involves use of high temperature for longer dyeing time for obtaining good results. Thus, dyeing of textiles using natural dyes by a cold process that can be carried out at room temperature (pad-dry-cure and pad-batch-dry) and in a very short time (pad-dry-cure) has been attempted in the present study.

Materials

Bleached, undyed and plain weave 100% crepe silk fabric weighing 62 g/m^2 was used in the present work. Aluminium sulphate 16-hydrate [$(Al_2(SO_4)_3.16H_2O$] was used as the chemical mordant.

Outer papery skin of onion peel was used as the natural dye. The main colouring component found in the outermost dry skin of onion is Quecertin - $C_{15}H_{10}O_7$ (3, 5, 7, 3 pentahydroxy flavones) a flavonoids also known as C.I. Natural Yellow. Besides quecertin, kaempferol, quecertin-3-glucoside and some tannin are also present [3]. There are also some protocatechuic, tannins and anthocyanidines in the red and violet varieties of skin.



Quercetin (C.I 75670)

Figure 4.1: Colouring components found in onion peel[3]

Dye-fixing agents - cetrimide (*N*-tetradecyl *N*-trimethyl-ammounium-bromide) CTAB (*N*-cetyl *N* trimethyl-ammonium-bromide) and Tinifix WS Conc., and UV-absorbers - 1,2,3-benztriazole ($C_6H_5N_3$), benzophenone ($C_6H_5.CO.C_6H_5$), and MEK (methyl-ethyl-ketone – $CH_3.CO.C_2H_5$) were also used.

Methods

3.1 Degumming of silk fabric

Beached silk fabric was degummed using 6gpl soap and 2gpl Na_2CO_3 at 90°C for 90 min using MLR 1:20.

Aqueous extraction of dye from onion peel

The colouring matter using onion peel was extracted under variable conditions of time (15 to 90 min), temperature (RT to 90°C), MLR (1:10 to 1:50) and *p*H (2 to 11) and each condition was optimized on the basis of the highest optical density observed at the maximum wavelength. The optimized conditions for aqueous extraction of onion peel are given as below:

Temperature (°C)	Time (mins)	MLR	*p*H
90°C	80 minutes	1:20	5

Purification of colour component in onion peel

Aqueous extract of the onion peel (extracted at optimized conditions) was double filtered using 40 pore size filter paper and then evaporated to a semi solid mass in a water-bath. This mass wrapped in a filter paper was further subjected to extraction in the soxhlet apparatus using 50:50 ethyl alcohol:toluene mixture for 10 cycles nearly for 2 hr at 70°C followed by evaporation at 50°C and drying under low temperature in a vacuum oven. The dry residue was then washed in methyl alcohol followed by acetone wash and finally dried in air to obtain the dry powder of the purified colour component of onion peel which was used only for the unconventional routes of dyeing i.e. pad-dry-cure and pad-batch-dry techniques.

Pre-mordanting of degummed crepe silk using aluminium sulphate as a mordant

The degummed silk fabric was pre-mordanted using optimized 10% (owf) aluminium sulphate (Al_2SO_4) at 60°C for 30 min using MLR 1:20; this mordant concentration was the optimum value identified on the basis of highest colour yield, minimum loss in strength and good fastness on silk fabric pre-mordanted with various concentrations of the mordant and subsequently dyed with aqueous extract of the dye.

Exhaust dyeing of pre-mordanted crepe silk using solution of onion peel extract

Pre-mordanted fabric samples were dyed using aqueous extract of the dye under variable parameters of dyeing time (30-90 min), dyeing temperature (40-100°C), material-to-liquor ratio (1:10-1:50), dye concentration (10-200%), and *p*H (2-11) and the optimum values for each conditions established. While studying a particular variable, the other variables were kept constant (temp-80°C, *p*H 5, MLR – 1:30, dye conc.-100%, time - 90 min). After dyeing the samples were rinsed thoroughly in running water and air dried in shade.

Pad-dyeing of silk fabric using purified colour component of onion peel

Pre-mordanted (10% owf aluminium sulphate) silk fabric sample were padded with purified extract (1, 5 and 10 gpl) of onion peel using two bowl laboratory padding mangle maintaining 80% wet pick-up in the fabric by 2 dip-2 nip process. After padding for 2 s, the samples were dried at 90°C for 5 min for the pad-dry technique. In case of simultaneous dyeing and mordanting, the mordant was added to the dye-bath before immersing the fabric.

Under the cold pad-batch-dry technique, the padded fabric was rolled on a glass rod kept with a plastic sheet wrapped around the rolled fabric at room temperature for 24 h. After the dyeing, the samples were washed in 1 gpl of a non-ionic soap at 80°C for 5 min followed by air-drying at room temperature.

Application of Cationic Dye-fixing Agent and UV Absorbers

Crepe silk samples dyed at optimized conditions (40 min, 60°C, *p*H 4, 80% dye concentration, MLR 1:40) were further treated with 2% (owf) aqueous solutions of cetrimide, CTAB, tinifix WS Conc, benztriazole (predissolved in hot water at 60°C), benzophenone, methyl ethyl ketone and separately using MLR 1:30 for 10 min at 60°C maintaining *p*H 5. In another set of experiment the samples were treated with these agent through padding using two bowl laboratory padding mangle maintaining 80% wet pick-up in the fabric by 2 dip-2nip process followed by drying-cum-heat treatment at 100°C for 15 min in an laboratory oven In both the case the samples were subsequently rinsed in water and air dried.

Determination of Maximum Absorbance Wavelength of the Dye Solution

The maximum absorbance wavelength of 1% aqueous extracted solution of onion peel (as a natural dye) was identified by evaluating the relative optical densities of the solutions (extracted at 90°C for 30 min using 1 gm of dry source material of the dye in 100 ml of water) at different wavelengths (360-700 nm visible range) using Hitachi-U-2000 UV-VIS absorbance spectrophotometer. The aqueous extract of onion peel showed maximum optical density at 460 nm (wavelength in the visible range) indicating that this natural dye shows maximum absorbance at this wavelength.

Thus, all further tests on colour parameters (*K/S* values, ΔE, ΔL, Δa, Δb, ΔC, ΔH, MI, etc.) were assessed at 460 nm.

Estimation of Surface Colour Stength, Dyeing Uniformity and other Related Colour Interaction Parameters

Surface colour strength of dyed crepe silk samples was estimated in terms of *K/S* values (Kubelka Munk function[4,5] by measuring surface reflectance of each of the dyed samples at the λ_{max} (460 nm) using a Premier Colour Scan (model SC 5100A) reflectance spectrophotometer along with associated colourlab plus colour matching software.

Also the coefficient of variation (CV%) of *K/S* values was determined from the 10 point *K/S* data taken at 10 different points of the corresponding dyed fabric samples indicating dye uniformity. The CV% off *K/S* values was determined using standard equations [6].

Total colour difference (ΔE), lightness/darkness (ΔL^*), redness/greenness (Δa^*), blueness/yellowness (Δb^*), change in chroma (ΔC^*), and change in hue ((ΔH_{ab}), values were measured before and after dyeing to compare the shade depth and colour differences of each dyed sample against particular undyed (bleached / mordanted) standard sample using the following CIE-lab equations[6].

General metamerism index (MI) was calculated employing the following Nimeroff and Yurow's equation[7].

Measurement of colour difference index

A newer colour interaction parameter called Colour Difference Index (CDI) postulated earlier[8] which indicates the combined effects of different known individual colour difference parameters between any two samples when dyed with varying shade under different conditions of dyeing has also been used in the present work to understand the combined effects of different dyeing variables by a single parameter. For the application of same concentration of dye between two sets of dyeing under varying condition, only the magnitudes of the respective $\ddot{A}E$, $\ddot{A}C$, $\ddot{A}H$ and MI values (irrespective of their sign and direction) may be considered to calculate CDI values using the following empirical relationship:

$$\text{Colour difference index (CDI)} = \frac{\Delta E \text{ X } \Delta H}{\Delta C \text{ X MI}}$$

Evaluation of Colour Fastness

Colour fastness to washing[9] of the dyed samples was determined as per the IS: 764-1984 method following ISO-II and ISO-III wash fastness evaluation methods.

Colour fastness to rubbing[9] (dry and wet) was assessed as per the IS: 766-1984 method.

Colour fastness to light[10] was determined as per the IS: 2454-1984 method using MBTF Microscal fade-o-meter.

Colour fastness to perspiration (alkaline and acidic)[10] was determined as per IS: 971-1983 method using a perspirator.

Result and Discussion

Effect of different dyeing process variables for optimization of dyeing conditions with respect to the colour related parameters

Effect of different dyeing process variables was optimized on the basis of uniform colour yield and maximum fastness properties obtained on crepe silk fabric samples pre-mordanted with 10% aluminium sulphate and subsequently dyed with onion peel extract (extracted at the optimized conditions).

It was observed that keeping all other dyeing process variables fixed, an increase in the dyeing time (30-40 min) caused a resultant increase the *K/S* values, which started decreasing with increase in the dyeing time to 80 min. However, further increase in the dyeing time to 90 min gave maximum colour yield, indicating that the dye (from onion peel extract) shows different dye absorption character for different time periods of dyeing (*Fig-1a*).

Increasing the dyeing temperature (room temperature to 60°C), caused a small increase in the surface colour strength (*K/S*) values which reached the maximum at 60°C indicating that the equilibrium absorption of onion peel on silk fabric is reached at 60°C. Beyond 60°C, *K/S* of the dyed sample decreased probably due to the desorption of the dye molecules (onion peel extract) from the fibre surface at higher temperature (*Fig-1b*).

Varying degrees of dye uptake was observed with the variation in the *p*H of the dye-bath. With an increase in the *p*H from 2 to 4, there was a noticeable increase in the *K/S* values. Beyond *p*H 7, the colour yield either decreased or remained more or less same. The highest colour yield was obtained on the pre-mordanted silk fabric when dyed at *p*H 4, which was considered as the optimum value (*Fig-1c*). In presence of acidic *p*H between 3-5, the phenoxy-hydroxyl containing colour component acting as the dye (colour) component in the extract of onion peel is susceptible to ionization thus giving higher dye transportation, absorption and diffusion of the dye into the fibre which is perceived in the form of higher colour yield in an acidic *p*H.

Keeping other variables constant, the *K/S* value of the dyed samples increased with the increase in material-to-liquor ratio (MLR) from 1:10 to 1:40, after which it decreased. MLR (*Fig-1d*) 1:40 gave maximum colour yield in terms of the *K/S* values and was selected as the optimum.

There was a sharp linear increase in *K/S* value with the increase in dye concentration from 10-80% (on the basis of weight % of dried onion peel). However, with dye concentration beyond 80%, the colour yield started decreasing (*Fig-1e*). Hence, 80% dye concentration is as the optimized value.

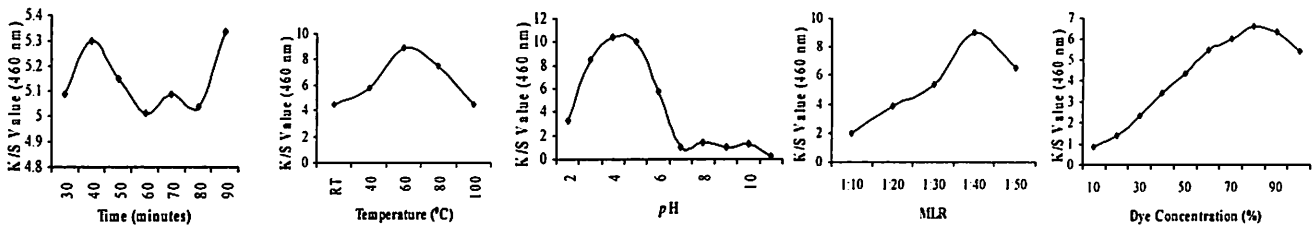


Figure 1 (a-e): Plots showing the effects of time temperature, pH, MLR, dye concentration in the dye-bath on colour yield dyeing alum pre-mordanted crepe silk fabric using aqueous extract of onion peel

Table 1: Colour strength and related parameters of aluminium sulphate (10%) pre-mordanted crepe silk fabric dyed with standardized aqueous extracted solution of onion peel (OP) using variable conditions of dyeing

Varying Parameters	*K/S* at λ_{max}	ΔE	ΔL	Δa	Δb	ΔC	ΔH	MI (LABD)	CDI	RCR (CDI_{max} - CDI_{min})
Degummed and alum pre-mordanted silk (Control)	0.06	1.12	0.02	0.26	-1.08	-1.12	-0.05	0.29	0.18	—
Variation in TIME (*in min*) [dyed at 80°C, *p*H-5, MLR-1:30 using 100% dye (on the basis of weight % of dried solid OP)]										
30 min	5.09	46.78	-30.49	10.57	33.87	35.19	-4.53	5.43	1.11	
40 min	5.30	46.68	-32.61	10.74	31.63	33.04	-4.68	5.26	1.26	
50 min	5.15	46.41	-32.00	10.98	31.77	33.28	-4.76	5.34	1.24	
60 min	5.01	45.89	-32.03	10.60	31.10	32.53	-4.65	5.25	1.25	0.25
70 min	5.09	45.76	-32.89	10.69	29.96	31.46	-4.73	5.18	1.33	
80 min	5.04	44.69	-32.70	10.29	28.68	30.12	-4.64	5.06	1.36	
90 min	5.34	46.69	-32.48	11.21	31.62	33.19	-4.83	5.35	1.27	
Variation in TEMPERATURE (°C) [dyed at *p*H-5, MLR-1:30 using 100% dye (on the basis of weight % of dried solid OP) for 90 min]										
RT °C	4.47	50.12	-25.48	10.48	41.87	42.96	-4.16	5.96	0.81	
40 °C	5.72	57.47	-20.63	6.79	53.29	53.65	-2.70	6.23	0.46	
60 °C	8.92	58.30	-29.41	12.39	48.79	50.13	-4.59	6.01	0.88	1.22
80 °C	7.49	50.73	-36.77	10.71	33.27	34.65	-4.56	5.19	1.29	
100 °C	4.46	44.81	-35.07	11.40	25.47	27.40	-5.25	5.12	1.68	
Variation in *p*H [dyed at 80°C, MLR-1:30 using 100% dye (on the basis of weight % of dried solid OP) for 90 min]										
2	3.30	41.83	-32.20	15.78	21.54	25.60	-7.60	5.58	2.23	
3	8.43	52.94	-39.54	14.72	31.94	34.63	-6.28	5.36	1.79	
4	10.44	54.41	-41.53	12.40	32.90	34.75	-5.31	4.85	1.71	
5	10.01	54.07	-39.74	11.90	34.68	36.32	-5.02	4.95	1.51	
6	5.77	46.91	-34.50	10.60	29.96	31.43	-4.74	5.00	1.41	1.75
7	1.01	23.95	-19.23	7.87	11.90	13.45	-4.76	3.51	2.41	
8	1.49	29.32	-23.16	9.18	15.46	17.24	-5.11	4.01	2.17	
9	1.08	24.92	-20.10	8.10	12.30	13.91	-4.85	3.57	2.43	
10	1.27	27.02	-23.47	7.75	10.92	12.50	-4.80	3.28	3.16	
11	0.30	9.85	-7.62	2.38	5.78	5.97	-1.82	3.51	1.99	

Variation in MLR [dyed at 80°C, *p*H-5 using 100% dye (on the basis of weight % of dried solid OP) for 90 min]										
1:10	1.94	34.94	-20.41	8.14	27.17	28.12	-3.68	5.18	0.88	
1:20	3.83	43.22	-28.63	11.37	30.32	32.02	-4.82	5.65	1.15	
1:30	5.32	47.25	-32.42	11.40	32.42	34.04	-4.73	5.55	1.18	0.50
	9.05	52.57	-39.41	11.38	32.88	34.47	-4.70	5.24	1.37	
1:50	6.50	49.68	-35.83	12.85	31.93	34.00	-5.31	5.64	1.38	
10%	0.88	25.76	-11.28	3.27	22.93	23.08	-1.96	4.12	0.53	
20%	1.37	31.14	-15.55	5.54	26.41	26.82	-2.89	4.76	0.70	
30%	2.34	38.43	-20.46	7.73	31.60	32.33	-3.64	5.33	0.81	
40%	3.42	44.03	-23.52	9.31	36.04	37.00	-4.12	5.70	0.86	
50%	4.35	46.36	-26.92	10.02	36.39	37.49	-4.36	5.68	0.95	0.76
60%	5.44	49.40	-29.12	10.83	38.40	39.64	-4.59	5.74	1.00	
70%	6.02	50.26	-30.60	10.54	38.45	39.62	-4.49	5.63	1.01	
80%	6.62	51.47	-31.36	11.16	39.26	40.54	-4.68	5.69	1.04	
90%	6.31	50.15	-30.10	12.02	34.76	36.41	-5.18	5.55	1.29	
100%	5.43	46.43	-28.98	10.54	34.71	35.97	-4.62	5.53	1.08	
Dyeing carried out at the optimized conditions - Time 60 min, temperature 60°C, *p*H 4, MLR 1:40 and Dye Conc. 80%										
Optimized Conditions	3.79	42.18	-27.78	7.95	31.18	32.05	-2.8	5.13	0.72	—

ΔE – total colour difference, ΔL – lightness/darkness, *da* – greenness/redness difference, Δb – blueness/yellowness, ΔH – change in hue, ΔC – change in chroma, MI – metamerism index, CDI – colour difference index The highlighted data correspond to the optimum values

With respect to the implications of the colour difference in terms of ΔL, Δa and Δb for silk fabric dyed with multi-constituent natural dye from onion peel extract, it can seen from *Table-1* that changes in *p*H show variation in all scales of colour difference parameters (ΔL, Δa and Δb), while dye concentration shows variations only in the lightness / darkness (ΔL) and redness / greenness (Δa) scales. Variation in the blueness / yellowness scale (Δb) is pronounced when dyeing temperature was varied. Maximum negative ΔH was also observed in case of *p*H. Thus, both the colour related parameters and wide dispersion of CDI (colour difference index) values similarly support the result that *p*H is the major and most important dyeing variable followed by temperature and dye concentration while dyeing silk fabric with onion peel extract. Lastly, even under variation in dyeing condition the colour from onion peel extract is absorbed uniformly by silk fabric as indicated by the least metametric effect of one varying condition of dyeing to the other.

Analysis of colour fastness (washing, rubbing, light and perspiration) for application of onion peel extract under different dyeing conditions

The UV-VIS spectral curve of the purified dye solution from onion peel (Fig-2) show significant small peaks in the UV range (190-360 nm) and thus this natural dye shows good-average light fastness (3-4) on aluminum sulphate mordanted silk fabric dyed with onion peel extract (Table-2). This is due to the UV-absorbance nature of the constituents in the onion peel extract as a result of which the dye (in the onion peel extract) can preferentially absorb UV-rays and reduces intensity and effect of the rays on the dyed fabric which is thus rendered more stable to UV-light. The wash fastness with respect to loss in colour depth (LOD) ranged from 1 to 4, indicating poor to good fastness. Irrespective of the different dyeing process variables studied, the wash fastness with respect to extent of staining (ST) of the adjacent non-mordanted cotton fabric was generally very good (4 to 4-5). The wash-fastness ratings (LOD and ST) for each variable were poorer in case of ISO-III (use of additional alkali) as compared to ISO-II.

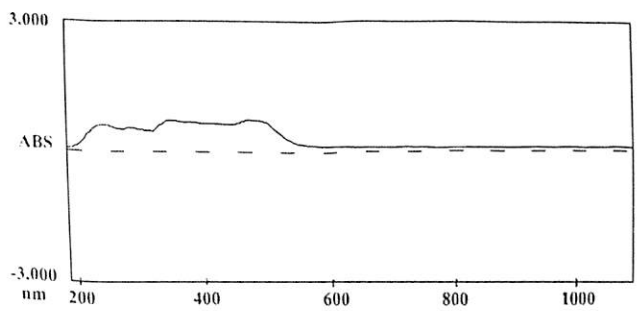


Figure 2: UV-VIS spectra of aqueous extract of colour components of onion peel as a natural dye

Not much variation was observed with respect to the wet and dry rub fastness of dyed silk samples with onion peel when the conditions of the dyeing parameters are varied although in general the wet rubbing fastness is lower in most cases than dry rubbing fastness (*Table-2*).

Acidic perspiration with respect to the loss in depth of colour ranged from fair to good (3 to 3-4) in most cases and was much varied within each dyeing condition parameters varied. The alkaline perspiration with respect to the change in the depth of colour on the other hand ranged from (1-2 to 4) and also varied significantly with each parameter studied (*Table-2*). The data for alkaline perspiration fastness was lower that the corresponding data for acidic perspiration with respect to the change / loss in the colour depth (LOD). Acidic perspiration fastness of silk fabric dyed with onion peel either showed similar or slightly better extent of staining on adjacent cotton than silk fabrics; while a reverse trend was observed in case of alkaline perspiration fastness where cotton stains more than silk under comparable conditions.

Although the dyeing temperature has been optimized at room temperature in terms of the fastness properties, the colour yield is appreciably higher at 60°C dyeing temperature (which also exhibits comparable fastness properties of the dyed fabric under comparable conditions). *p*H 4 gives maximum surface colour (*K/S* – 10.44) with fastness properties almost as good as that obtained when dyeing is carried out under *p*H 11. MLR 1:40 gives comparable light and wash fastness ratings, but higher *K/S* values when compared with the results obtained for MLR 1:10. A dye concentration of 80% (on dry weight of dry solid source of the natural dye) gives comparable overall colour fastness apart from better higher surface colour depth.

From this study, it may thus be summarized that the observed optimum conditions of dyeing of the alum pre-mordanted crepe silk fabric with aqueous extract of onion peel are 40 min dyeing time, 60°C dyeing temperature, *p*H 4, 1:40 MLR, and 80% dye concentration (weight percentage of dried source material) of the said natural dye.

Table 2: Colour fastness properties of aluminium sulphate (10%) pre-mordanted crepe silk fabric dyed with standardized aqueous extracted solution of onion peel using variable conditions of dyeing

Variables	LF	Wash Fastness							Rubbing Fastness		Perspiration Fastness					
		ISO II			ISO III						Acidic			Alkaline		
		LOD	ST		LOD	ST			Dry	Wet	LOD	ST		LOD	ST	
			Cot	Sil		Cot	Sil					Cot	Sil		Cot	Sil
Variation in TIME (*in min*) [dyed at 80°C, *p*H-5, MLR-1:30 using 100% dye (on the basis of weight % of dried solid OP)]																
30 min	3-4	2-3	4-5	4	1	3-4	4		3	2-3	3	3	2-3	2-3	3	4
40 min	3-4	3	4-5	4-5	1	4-5	4		2-3	2-3	3	3	2-3	3	3	4
50 min	3-4	3	4-5	4	1	4-5	4		2-3	2-3	2	3	2-3	2	3	4
60 min	3-4	3	4-5	4	1	4	4		3	2-3	3	3	3	2-3	3	4
70 min	3-4	3	4-5	4	1	4	4		3	2-3	3	3	3	2-3	3	3-4
80 min	3-4	3	4-5	4-5	1	4-5	4		3-4	2-3	3	3	3	2-3	3	3-4
90 min	3-4	3-4	4-5	4	1	4	4		3-4	2-3	3	3	3	2	3	4
Variation in TEMPERATURE (°C) [dyed at *p*H-5, MLR-1:30 using 100% dye (on the basis of weight % of dried solid OP) for 90 min]																
RT	3-4	3	4-5	4-5	1	4-5	4-5		3-4	3	4	2	2	2-3	2	2-3
40 °C	3-4	1	4-5	4-5	1	4-5	4		4	3	2	2-3	2-3	2-3	2-3	3
60 °C	3-4	1-2	4-5	4-5	1	4	4-5		3	3	2	2-3	3	2	2-3	3
80 °C	3-4	1-2	4-5	4-5	1	4	4		3	3	3-4	3	3	4	3	4
100 °C	3-4	1-2	4-5	4	1	4-5	4-5		4	3	3	3	3	3	3	4
Variation in *p*H [dyed at 80°C, MLR-1:30 using 100% dye (on the basis of weight % of dried solid OP) for 90 min]																
2	3-4	4-5	4-5	1	4	4-5	4		2-3	3-4	2-3	2-3	3-4	2-3	2-3	3
3	3-4	2-3	4	4	1	4	4		3	3	4	2	2	3-4	2-3	2-3
4	3-4	3-4	4-5	4-5	1	4	4-5		3	2-3	3-4	2	2-3	2	2-3	3
5	3-4	3-4	4	4-5	1	4	4-5		3	3	2-3	2	2	3	3	3
6	3-4	2	4-5	4	1	4	4		3	2-3	4	3	3	3-4	3-4	4
7	2-3	2-3	4-5	4-5	2	4-5	4		4-5	4-5	4	4	3-4	4	4-5	4-5
8	2-3	4	4-5	4-5	2	4	4-5		4-5	4-5	3	4	3-4	3-4	4	4-5
9	2-3	2	4	4-5	1	4-5	4		4	4	3	2	4	3	4	4-5
10	3-4	1-2	4	4-5	1	4-5	4		4	4	2	4	4	2	4	4-5
11	3-4	3-4	4	4-5	4-5	4-5	4-5		4	4	4	4-5	4-5	4	4-5	4-5
Variation in MLR [dyed at 80°C, *p*H-5 using 100% dye (on the basis of weight % of dried solid OP) for 90 min]																
1:10	1-2	2-3	4-5	4-5	1	4-5	4-5		4-5	4	4	4	3	2-3	4	4
1:20	3-4	2	4	4-5	1	4	4-5		4-5	3-4	2	4	3-4	3	4	3-4
1:30	3-4	2	4-5	4-5	1	4	4		4	3	3-4	3-4	3-4	2	3-4	3-4
1:40	3-4	2-3	4-5	4-5	1	4	4-5		4	3	3-4	3	2	3-4	3	4
1:50	3-4	2-3	4-5	4	1	4-5	4		4	3-4	4	3	3	4-5	3-4	4

Variation in **DYE CONCENTRATION** [(on the basis of weight % of dried solid OP) dyed at 80°C, *p*H-5, MLR-1:40 for 90 min]															
10	2	1	4	4-5	1	4-5	4	4	4	3	4	4	1-2	4	4-5
20	1-2	1-2	4	4-5	1	4-5	4-5	4	4	2-3	4	4	1-2	4	4-5
30	2-3	1-2	4	4-5	1	4-5	4-5	4	4	4	3-4	3-4	3	4	4-5
40	2-3	1-2	4	4-5	1	4-5	4-5	4	3-4	4	3-4	3	1-2	4	4-5
50	2-3	1-2	4	4-5	1	4-5	4	4	3-4	4	4	4	1-2	4	4-5
60	2-3	1-2	4-5	4-5	1	4-5	4-5	4	3	1	3	2-3	1-2	4	4
70	3	1	4	4-5	1	4-5	4-5	4	4	1	3	2-3	2-3	3-4	4
80	3	1-2	4	4-5	1	4-5	4-5	3	3	4	3-4	3-4	2-3	4	4
90	3	2	4	4-5	1	4-5	4-5	3	3	4	3-4	3-4	3	4	4
100	3	1-2	4	4-5	1	4-5	4-5	3	3	3-4	3	3	2-3	4	4
Dyeing carried out at the optimized conditions of dyeing, time 90 min, temperature 60°C, pH 4, MLR 1:40 and dye conc. 80%															
	3	2-3	4	4	1	3-4	4	4-5	4						

LF – Light Fastness, LOD – Loss in dept of shade, ST – Extent of staining, Cot – Cotton, Sil – Silk
The highlighted data correspond to the optimum values

Improvement of light fastness and wash fastness of pre-mordanted crepe silk fabric samples dyed with onion peel extract

Since the light and wash fastness of the silk samples dyed with aqueous extract of onion peel was found to be average, an attempt was made to improve the light fastness and wash fastness through after-treatment with several UV-absorbers and dye fixing agents by simple exhaust procedure and pad-dry method. The exhaust method of application of the said agents did not render an improvement in the fastness (light and wash) of the dyed samples. However, there was a ½ to 1 grade improvement in the light fastness and wash fastness (LOD) ratings when the silk fabric dyed with onion peel extract was subsequently treated with UV-absorbers and dye fixing agents by the pad-dry-cure method. Benztriazole and benzophenone gave best results for light fastness, while CTAB showed higher degree of improvement in the wash fastness by the pad-dry-cure process.

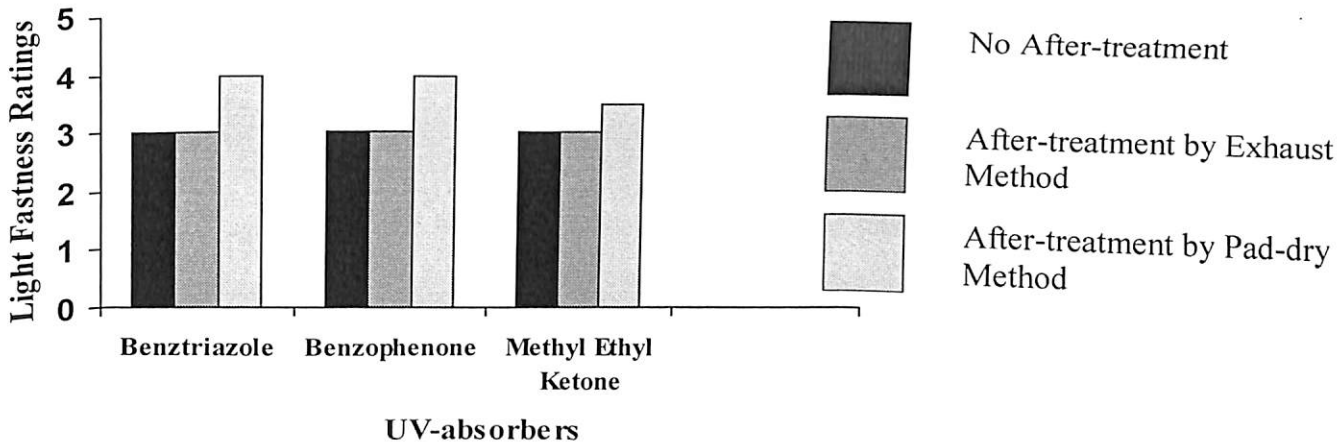


Figure 3: Relative improvement in light fastness rating of silk fabrics dyed with aqueous extract of onion peel and subsequently treated with different UV-absorbers

Application of onion peel extract on silk fabric by unconventional methods

An attempt was made to dye silk fabric in cold using pad-dry-cure method to restrict the use of high dyeing temperature and enable continuous dyeing. Since natural dyes need adequate dyeing time for obtaining good results, an attempt was also made to explore the pad-batch-dry method of dyeing which would help in economizing use of water and energy required for heating purpose.

There was an increase in the colour yield with the increase in the dye concentration when pre-mordanted silk is dyed using purified onion peel extract by both the pad-dry-cure and pad-batch-dry methods (*Table-3*).

Table 3: Surface colour strength and colour fastness properties of silk fabric dyed with standardized purified extract of onion peel using 10% owf aluminium sulphate as a mordant by pre-mordanting and simultaneous mordanting and dyeing sequences by the **pad-batch-dry** method of dyeing at 80% wet pick-up and pH 4

Dye Concen-tration	*K/S* at λ_{max}	CV of *K/S* (%)	LF	Wash Fastness				Rubbing Fastness	
				ISO-II		ISO-III			
				LOD	ST on Cot	LOD	ST on Cot	Dry	Wet
Pre-mordanted sample dyed with purified dye at optimized conditions (60°C, *p*H 4, 40 min, MLR-1:40 and 80% dye concentration) by the Exhaust Method									
80 gpl	8.16	4.66	3-4	1-2	4 (4)*	1	4 (4)*	4	3
Pre-mordanting and dyeing technique using purified dye									
1 gpl	0.13	36.84	3	3	3-4 (4)*	2	3-4 (4)*	4-5	4-5
5 gpl	10.94	4.70	2-3	2	3 (4-5)*	1-2	3 (4-5)*	3	2-3
10 gpl	0.68	9.43	3	2	4 (4-5)*	1-2	4-5 (4-5)*	2-3	2-3
Simultaneous dyeing and mordanting technique using purified dye									
1 gpl	0.14	36.36	3	2	3-4 (4)*	2	3-4 (4-5)*	4-5	4
5 gpl	1.71	4.98	3	2	3-4 (3-4)*	1-2	4 (4)*	4-5	4
10 gpl	1.46	7.23	2-3	1	2-3 (4-5)*	1	4 (4-5)*	4	3-4

LF – Light fastness, LOD – Loss in dept of shade, ST – Extent of staining,
* data in the parenthesis are the corresponding data on extent of staining on silk fabric

Although simultaneous method of mordanting and dyeing showed an increase in the *K/S* values with the increase in the dye concentration of crepe silk fabric using purified extract of onion peel by the pad-dry method, it was much lower than that obtained by the pre-mordanting process (*Table-3*). Samples dyed with onion peel by the pad-dry-cure method exhibited lower colour yield and light and wash fastness (LOD) than the ones obtained by the exhaust method (*Table-4*).

Although pad-batch-dry method was time consuming, it gave significantly good colour strength (better than that obtained by the pad-dry-cure method) with comparable wash fastness when pre-mordanting method was used as compared to that obtained by the sample dyed with aqueous extract of the dye by the exhaust method under comparable conditions of dyeing. Pad-batch-dry method gave highest *K/S* values when 5 gpl dye concentration is used, even higher than that obtained by the exhaust or the pad-dry-cure methods. On further increase in the dye concentration, the *K/S* values decreased. The CV% of *K/S* values of the silk sample dyed with 5 gpl dye application by the pad-batch-dry method was within the acceptable range indicating uniform dyeing.

Table 4: Surface colour strength and colour fastness properties of silk fabric dyed with standardized purified extract of onion peel using 10% owf aluminium sulphate as a mordant by pre-mordanting and simultaneous mordanting and dyeing sequences by the **pad-dry-cure** method of dyeing at 80% wet pick-up and pH4

Dye Concen-tration	*K/S* at λ_{max}	CV of *K/S* (%)	LF	Wash Fastness				Rubbing Fastness	
				ISO-II		ISO-III			
				LOD	ST on Cot	LOD	ST on Cot	Dry	Wet
Pre-mordanted sample dyed with purified dye at optimized conditions (60°C, *p*H 4, 40 min, MLR-1:40 and 80% dye concentration) by the Exhaust Method									
80 gpl	8.16	4.66	3-4	1-2	4 (4)*	1	4 (4)*	3	4
Pre-mordanting and dyeing technique using purified dye									
1 gpl	0.30	38.95	3	2	3-4 (3)*	1	3 (4)*	4-5	4
5 gpl	2.66	7.85	2-3	1	4 (4-5)*	1	4 (4-5)*	4	4
10 gpl	5.42	10.30	2-3	1	3 (4-5)*	1	3 (4-5)*	3	3
Simultaneous dyeing and mordanting Technique using purified dye									
1 gpl	0.25	30.75	3	1	3-4 (4-5)*	2	3-4 (4-5)*	4	4
5 gpl	0.55	5.52	3	2	4 (4-5)*	1	4 (4-5)*	3-4	3
10 gpl	1.51	3.16	2-3	1	3-4 (4-5)*	1	4 (4)*	4-5	4

LF – Light fastness, LOD – Loss in dept of shade, ST – Extent of staining, * data in the parenthesis are the corresponding data on extent of staining on silk fabric

Conclusions

From the present study the following may thus be concluded:

The optimized extraction condition with respect to the highest optical density at maximum wavelength for onion peel has been established at: 80 min (extraction time), 90°C (extraction temperature) using MLR-1:20 and at *p*H-5.

10% mordant concentration was optimized both with respect to the minimum strength loss and maximum surface colour strength of the treated and dyed fabric.

For uniform dyeing with onion peel extract for silk and other protein fibres, special care should be taken for controlling of *p*H and temperature of the dye-bath apart from the dye concentration as indicated by a wide dispersion of CDI.

UV-absorbers like benztriazole and benzophenone gives ½ to 1 grade improvement in the light fastness; while among the different dye fixing agents used, CTAB (cetyl trimethyl-ammonium-bromide) shows higher degree of improvement in the wash fastness when applied by the pad-dry-cure process on silk fabric dyed with aqueous extract of onion peel by the exhaust method.

Pad-batch-dry method gives highest *K/S* values and uniform dyeing results when 5 gpl dye concentration of the purified onion peel extract is used on silk fabric. This is higher than that obtained by either the pad-dry-cure process or the exhaust method of dyeing.

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Shade Development through Application of Mixture of Natural Dyes (Eucalyptus Bark and Red Sandalwood) on Silk

Dipika Baid and Deepali Singhee

ABSTRACT

Degummed and 25% owf $Al_2(SO_4)_3.16H_2O$ pre-mordanted crepe silk fabric was dyed using aqueous extract of eucalyptus bark. The effect of varying conditions of extraction and dyeing process variables (time, temperature, pH, MLR and dye concentration) on surface colour strength and colour related parameters apart from fastness (light, wash, rub and perspiration) was optimized. Temperature, pH and dye concentration are the predominanting dyeing parameters for eucalyptus bark as indicated by the widely dispersed CDI values. Pre-mordanted silk fabric has also been dyed with different proportions of the binary mixture of purifed extracts of red sandalwood and eucalyptus. High K/S values were obtained with higher proportion of red sandalwood in the mixture. Samples dyed with the mixture of dyes show poor wash fastness with respect to change in the depth of colour, which improves slightly on treatment with CTAB, a cationic dye fixing agent. Both the methods of assessing compatibility of the mixture of dyes, eucalyptus bark and red sandalwood i.e the traditional qualitative method based on plots of K/S vs ΔL and ΔC vs ΔL and the relatively newer quantitative method based on calculation of closeness *of CDI values* shows that there is no appreciable synergistic interaction between the two dyes and the RCR was found to be 2. Thus, the two dyes are only fairly compatible.

Keywords: Aluminium Sulphate, Cationic Dye Fixing Agent, Colour Difference Index (CDI), Crepe Silk Fabric, Eucalyptus Bark, Mixture Dyeing, Natural Dyes, Pre-Mordanting, Red Sandalwood, Soxhlet Extraction.

Introduction

Off late, organic awareness and environmental consciousness have revived the consumers' interest in natural dyed textiles made from natural fibres. Silk is considered superior among the highly priced textile fabrics, since it combines strength, durability with beauty, lightness and lustre. In an era of consumers' preference for eco-friendly products even at higher prices, a study to improve the value of silk fabrics through dyeing with natural dyes thus becomes relevant.

In the present study the dye-sources from eucalyptus bark which is a waste has been used making the process of natural dyeing relatively more cost effective.

Newer and uncommon shades can be achieved by applying mixture of compatible natural dyes or by using sequential dyeing techniques with two or more natural dyes. However, there are only few and discrete studies available in literature for application of binary mixture of natural dyes[1].

Mixture dyeing using more than one natural dye may also be associated with the advantage of improvement in the wash fastness property of the resultant dyed fabric through combined effect of both the dyes present in the mixture. For the use of mixture of natural dyes, the dyers must know whether the dyes are compatible with each other. Thus, in the present study an attempt has also been made to develop more number of better and darker shades along with improved colour fastness properties through application of a mixture of extracts of eucalyptus bark and red sandalwood. The compatibility[2] of these two dyes has also been established.

Materials

Bleached, undyed and plain weave 100% crepe silk fabric weighing 62 g/m² was used in the present work. Aluminium sulphate 16-hydrate [$(Al_2(SO_4)_3.16H_2O$] was used as the chemical mordant.

Eucalyptus bark and red sandalwood was used as the natural dye for the study. The major coloring component of eucalyptus bark is quercetin [3], which is also an antioxidant. The main colour components in the red sandalwood are Santalin A, Santalin B and Deoxysantalin[2].

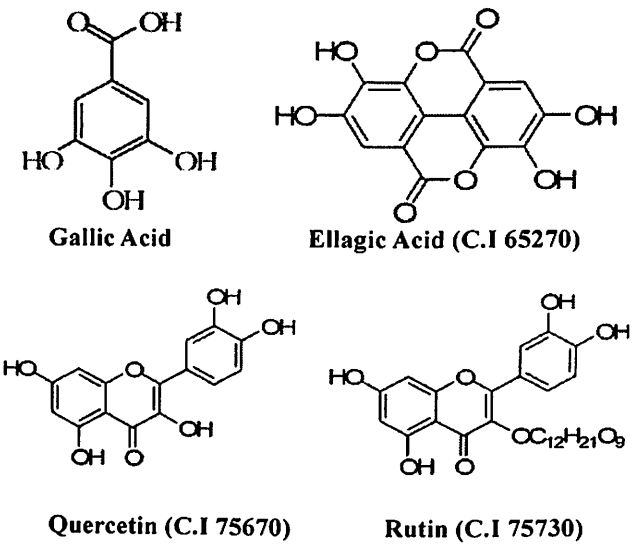


Figure 1: Colouring components found in eucalyptus leaves and eucalyptus bark[3]

Dye-fixing agents CTAB (*N*-cetyl *N* trimethyl-ammonium-bromide) has also been used in the

present work for improving fastness properties of silk dyed with mixture of eucalyptus bark and red sandalwood.

Methods

Degumming of silk fabric

Beached silk fabric was degummed using 6 gpl soap and 2 gpl Na_2CO_3 at 90°C for 90 min using MLR 1:20.

Aqueous extraction of dye from eucalyptus bark and red sandalwood

The colouring matter using dried powder of eucalyptus bark was extracted under variable conditions of time (15 to 90 min), temperature (RT to 90°C), MLR (1:5 to 1:40) and *p*H (2 to 11) and each condition was optimized on the basis of the highest optical density observed at the maximum wavelength. The optimized conditions for aqueous extraction of eucalyptus bark are given as below:

Temperature (°C)	Time (mins)	MLR	*p*H
80	60	1:20	9

The colouring matter from the powdered red sandalwood bark was extracted by soaking 5 gm of the powder in 100ml of water (MLR 1:20) for 90 minutes at 80°C using *p*H 4.5 [7]. The extracted liquor was finally filtered using a muslin cloth. The clear solution thus obtained was used for dyeing.

Purification of colour component through soxhlet extraction using ethyl alcohol and toluene mixture

Aqueous extract of the eucalyptus bark and red sandalwood (extracted at optimized conditions) was double filtered using 40 pore size filter paper and then evaporated to a semi solid mass in a water-bath. This mass wrapped in a filter paper was further subjected to extraction in the soxhlet apparatus using 50:50 ethyl alcohol:toluene mixture for 10 cycles nearly for 2 hr at 70°C followed by evaporation at 50°C and drying under low temperature in a vacuum oven. The dry residue was then washed in methyl alcohol followed by acetone wash and finally dried in air to obtain the dry powder of the purified colour component of eucalyptus bark and red sandalwood which was used to study the compatibility of their binary mixture with each other.

Pre-mordanting of degummed crepe silk using aluminium sulphate as a mordant

The degummed silk fabric was pre-mordanted using optimized 25% (owf) aluminium sulphate (Al_2SO_4) at 60°C for 30 min using MLR 1:20; this mordant concentration was the optimum value identified on the basis of highest colour yield, minimum loss in strength and good fastness on pre-mordanted silk fabric dyed with aqueous extract of the dye.

Exhaust dyeing of pre-mordanted crepe silk using solution of eucalyptus bark extract

Pre-mordanted fabric samples were dyed using aqueous extract of the dye under variable parameters of dyeing time (30-90 min), dyeing temperature (40-100°C), material-to-liquor ratio (1:10-1:50), dye concentration (10-200%), and *p*H (2-11). While studying a particular variable, the other variables were kept constant (temp-80°C, *p*H-9, MLR-1:40, dye conc-200%, time-60 min). After dyeing the samples were rinsed thoroughly in running water and air dried in shade.

Dyeing of crepe silk fabric using a binary mixture of eucalyptus bark and red sandalwood

Pre-mordanted crepe silk fabric were dyed with the purified aqueous extract of both single or the binary pair of eucalyptus bark and red sandalwood in varying proportion (100:0, 75:25, 50:50, 25:75 and 0:100), using 1% (owf) concentration of the natural dyes at 100°C for 60 mins using 1:50 MLR. Finally, the dyed samples were subjected to soaping with 2g/l soap solution at 60°C for 15 min, followed by repeated water wash and drying under sun.

Determination of Maximum Absorbance Wavelength of the Dye Solution

The maximum absorbance wavelength of 1% aqueous extracted solution of eucalyptus bark (as a natural dye) was identified by evaluating the relative optical densities of the solutions ((extracted at 80°C for 60 min using 1 gm of dry source material of the said natural dye in 100 ml of water) at different wavelengths (360-700 nm visible range) using Hitachi-U-2000 UV-VIS absorbance spectrophotometer. The aqueous extract of eucalyptus bark showed maximum optical density at 420 nm (wavelength in the visible range) indicating that this natural dye shows maximum absorbance at this wavelength.

Thus, all further tests on colour parameters (*K/S* values, ΔE, ΔL, Δa, Δb, ΔC, ΔH, MI, etc.) were assessed at 420 nm.

Application of Cationic Dye Fixing Agent

Dyed crepe silk fabric was treated with the 2% aqueous solutions of CTAB at 60°C for 15 mins using MLR 1:50.

Estimation of Surface Colour Stength and Related Colour Interaction Parameters

Surface colour strength of dyed crepe silk samples was estimated in terms of *K/S* values (Kubelka Munk function[4,5]) by measuring surface reflectance of each of the dyed samples at the λ_{max} (460 nm) using a Premier Colour Scan (model SC 5100A) reflectance spectrophotometer along with associated colourlab plus colour matching software.

Also the coefficient of variation (CV%) of *K/S* values was determined from the 10 point *K/S* data taken at 10 different points of the corresponding dyed fabric samples indicating dye uniformity. The CV% off *K/S* values was determined using standard equations[6].

Total colour difference (ΔE), lightness/darkness (ΔL^*), redness/greenness (Δa^*), blueness/yellowness (Äb^*), change in chroma (ΔC^*), and change in hue ((ΔH_{ab}), values were measured before and after dyeing to compare the shade depth and colour differences of each dyed sample against particular undyed (bleached / mordanted) standard sample using the following CIE-lab equations[6].

General metamerism index (MI) was calculated employing the following Nimeroff and Yurow's equation[2].

Measurement of colour difference index

A newer colour interaction parameter called Colour Difference Index (CDI) postulated earlier [7] which indicates the combined effects of different known individual colour difference parameters between any two samples when dyed with varying shade under different conditions of dyeing has also been used in the present work to understand the combined effects of different dyeing variables by a single parJameter. For the application of same concentration of dye between two sets of dyeing under varying condition, only the magnitudes of the respective ΔE, ΔC, ΔH and MI values (irrespective of their sign and direction) may be considered to calculate CDI values using the following empirical relationship:

$$\text{Colour difference index (CDI)} = \frac{\Delta E \times \Delta H}{\Delta C \times \text{MI}}$$

Compatibility Tests For Selected Binary Pair of Natural Dyes

a) Conventional Method[2]

Selected binary pair (50:50) of eucalyptus bark and red sandalwood was applied on the alum pre-mordanted crepe silk fabrics using overall 1% (owf) of the extracts. In compatibility test of binary pair, alum pre-mordanted crepe silk fabrics samples were dyed in different sets (Set-I and Set-II) of progressive depth shade for the binary pair of dyes (eucalyptus bark and red sandalwood) taken equal proportions (50:50).

In Set I, the progressive depth of shade was developed by varying the dyeing time and temperature profile during dyeing. Thus, five separate small alum pre-mordanted crepe silk fabrics samples were dyed with 1% of a purified mixture of eucalyptus bark and red sandalwood in the ratio of 50:50 using Lab Dyer (Model No. 1012SS) of MAG Solvics make with temperature controller using MLR 1:50 and *p*H 5 and the following conditions of time and temperature: 0 min at 40°C, 10 min at 50°C, 20 min at 60°C, 30 min at 70°C, 40 min at 80°C, 50 min at 90°C and 60 min at 100°C.

In Set-II, the progressive depth of shade was developed by varying total concentration of dye mixture from 0.1 to 1%. For each pair of five separate small alum pre-mordanted crepe silk samples were dyed at the increments of 0.1 (owf) for the pair of dyes (EB:RSW) taken in equal proportion (50:50) at 100°C for 60 mins.

For both Set-I and Set-II dyeing, all the dyed fabrics were subjected to normal washing, soaping and before final air drying. The difference in the lab coordinates, namely Ä*L*, Ä*a*, Ä*b* and Ä*C* for the dyed fabrics using Set-I and Set-II method with respect to the standard undyed fabric sample were obtained from separate measurement of the same using the above mentioned Premier Colour Scan (model SC 5100A) reflectance spectrophotometer along with associated colourlab plus colour matching software. The compatibility of a pair of dyes can be judged from the degree of closeness and overlapping of the two curves Ä*C* vs Ä*L* of *K/S* vs Ä*L* observed using the two sets of dyeing (Set-I and Set-II) [2].

b) New Method[6]

An alternative method of assessing compatibility of pairs of dyes was also involved. After the application of different proportions of binary pairs of dyes on the same fabric, the magnitudes of the respective ΔE, ΔC, ΔH and MI values, irrespective of their sign and direction was utilized to obtain colour difference index (CDI).

The closer the CDI values for binary pairs of dyes, the higher is the compatibility rating (between 0 and where rating 5 shows as the maximum or excellent compatibility, rating 1 indicates minimum or worst compatibility and rating 0 is considered as completely compatible).

Evaluation of Colour Fastness

Colour fastness to washing[8] of the dyed samples was determined as per the IS: 764-1984 method following ISO-II and ISO-III wash fastness evaluation methods.

Colour fastness to rubbing[8] (dry and wet) was assessed as per the IS: 766-1984 method.

Colour fastness to light[9] was determined as per the IS: 2454-1984 method using MBTF Microscal fade-o-meter.

Colour fastness to perspiration (alkaline and acidic)[9] was determined as per IS: 971-1983 method using a perspirator.

Result and Discussion

Effect of different process dyeing variables for optimization of dyeing conditions with respect to surface colour strength and other colour related parameters

Effect of different dyeing process variables have been optimized on the basis of uniform colour yield and maximum fastness properties for crepe silk fabric pre-mordanted with 25% aluminium sulphate and dyed with eucalyptus bark (*Table-1*).

It was observed that with other variables fixed, an increase in the dyeing time (30–90 min), the *K/S* values slowly increases upto 80 min in case of eucalyptus bark and then starts decreasing with further increase in the dyeing time (*Fig-1a*). This may possibly be due to the achievement of dyeing equilibrium at the specific time for the respective dye, depending on the rate of dye diffusion. Thus, 80 mins were the optimized condition for dyeing for eucalyptus bark.

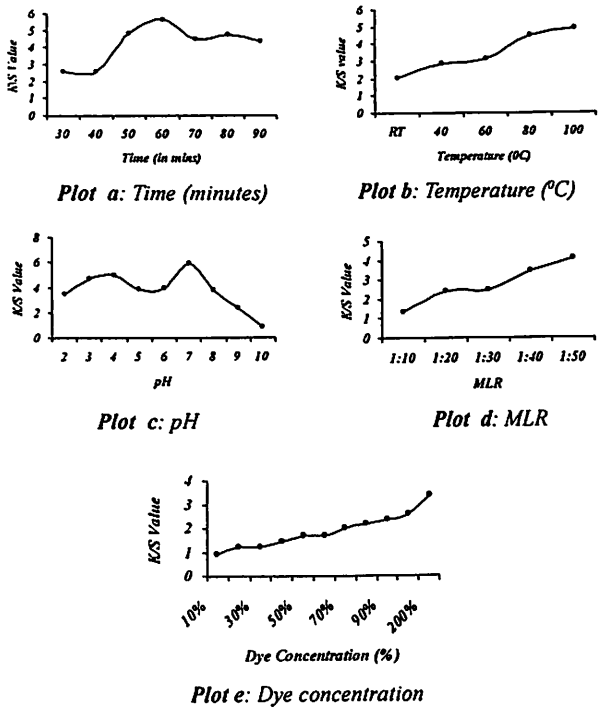
On increasing the dyeing temperature (from room temperature to 100°C), there was a linear increase (*Fig-1b*) in the surface colour strength (*K/S*). It was found that at 100°C eucalyptus bark gave maximum dye absorption with respect to *K/S* values.

An up and down (crests and troughs) trend for the *K/S* values was seen with the variation in the *p*H from 2 to 11 in case of dyeing silk fabric with eucalyptus bark (*Fig-1c*). However, there was a noticeable increase in the *K/S* values when *p*H was increased from 2 to 4 after which it decreases. It was maximum when dyeing was carried out at *p*H 7. Thus, *p*H 7 was considered as the optimum value.

The *K/S* value of the eucalyptus bark, dyed samples increased with the increase in material-to-liquor ratio (MLR) from 1:10 to 1:50; and MLR 1:50 gave maximum colour yield (*Fig-1d*).

A slow increase (*Fig-1e*) in *K/S* value was noticed with the increase in dye concentration from 10-200% (on the basis of weight % of dried solid eucalyptus bark). Maximum *K/S* value was observed when the silk fabric was dyed using 200% concentration of the dye.

As indicated by the wide dispersion of CDI (colour difference index) values, special care



Plot a: Time (minutes) *Plot b: Temperature (°C)*

Plot c: pH *Plot d: MLR*

Plot e: Dye concentration

should thus be taken to control temperature and *p*H of the dye-bath apart from the dye concentration in order to achieve uniform dyeing on silk with these two natural dyes.

Figure 1 (a-e): Plots showing the effects of time temperature, pH, MLR, dye concentration in the dye-bath on colour yield of aluminium sulphate pre-mordanted crepe silk fabric using aqueous extract of eucalyptus bark

Table 1: Colour strength and related parameters of alumimium sulphate (25%) pre-mordanted crepe silk fabric dyed with standardized aqueous extracted solution of eucalyptus bark (EB) using variable conditions of dyeing

Varying Parameters	*K/S* at λ_{max}	ΔE	ΔL	Δa	Δb	ΔC	ΔH	MI (LABD)	CDI	RCR (CDI_{max} - CDI_{min})
Degummed and alum pre-mordanted silk (Control)	0.16	5.88	-5.62	0.28	-1.69	-1.71	-0.03	0.44	0.23	—
Variation in TIME (in min) [dyed at 80°C, pH- 9, MLR-1:40 using 200% dye (on the basis of weight % of dried solid EB)]										
30 min	2.58	44.64	-37.63	22.21	9.09	21.91	-9.81	6.65	3.00	
40 min	2.60	44.01	-37.06	21.72	9.61	21.74	-9.59	6.56	2.96	
50 min	4.84	52.38	-46.12	22.93	9.56	22.76	-9.95	6.90	3.32	
60 min	5.66	54.35	-48.21	22.97	10.08	23.05	-9.89	6.99	3.34	0.41
70 min	4.51	50.59	-44.53	21.71	10.28	22.06	-9.49	6.68	3.26	
80 min	4.77	51.55	-45.69	21.71	9.94	21.89	-9.54	6.66	3.37	
90 min	4.35	49.37	-43.47	20.86	10.59	21.52	-9.19	6.50	3.24	
Variation in TEMPERATURE (°C) [dyed at *p*H- 9, MLR-1:40 using 200% dye (on the basis of weight % of dried solid EB) for 80 min]										
RT °C	2.05	34.52	-26.34	18.67	12.22	20.18	-9.52	5.79	2.81	
40 °C	2.86	40.19	-32.02	21.27	11.73	21.85	-10.62	6.37	3.07	
60 °C	3.11	42.77	-34.38	22.69	11.51	22.85	-11.19	6.75	3.10	1.34
80 °C	4.49	47.14	-40.33	22.16	10.24	21.68	-11.22	6.60	3.70	
100 °C	4.90	46.28	-41.57	16.95	11.22	18.25	-8.97	5.48	4.15	
Variation in *p*H [dyed at 80°C, MLR-1:40 using 200% dye (on the basis of weight % of dried solid EB) for 80 min]										
2	3.49	46.34	-38.23	20.29	16.56	24.81	-8.37	7.05	2.22	
3	4.68	49.84	-43.91	18.27	14.89	22.21	-7.90	6.47	2.74	
4	5.02	50.85	-43.72	20.27	16.21	24.56	-8.39	7.07	2.46	
5	3.84	47.07	-39.79	19.07	16.37	23.82	-8.02	6.74	2.35	
6	3.94	48.39	-40.96	20.59	15.53	24.32	-8.56	7.11	2.40	1.06
7	5.95	55.42	-48.11	24.71	12.09	25.57	-10.15	7.59	2.90	
8	3.78	48.33	-41.34	21.33	14.04	23.92	-8.93	6.99	2.58	
9	2.37	40.62	-35.08	18.45	8.88	18.56	-8.65	5.77	3.28	
10	0.84	25.60	-21.52	11.44	7.83	12.39	-6.23	4.09	3.15	
Variation in MLR [dyed at 80°C, *p*H- 9 using 200% dye (on the basis of weight % of dried solid EB) for 80 min]										
1:10	1.34	32.23	-27.11	16.36	5.99	14.54	-9.61	4.95	4.30	
1:20	2.44	40.17	-34.73	18.73	7.49	17.34	-10.31	5.66	4.22	
1:30	2.49	44.46	-38.94	19.85	8.16	18.64	-10.64	5.97	4.25	0.43
1:40	3.48	46.76	-41.19	20.42	8.48	19.29	-10.80	6.13	4.27	
1:50	4.09	39.39	-35.48	18.97	8.44	18.06	-10.24	5.70	3.87	
Variation in DYE CONCENTRATION [(on the basis of weight % of dried solid EB) dyed at 80°C, *p*H- 9, MLR-1:40 for 80 min]										
10%	0.89	23.06	-17.63	12.99	7.21	12.24	-8.42	4.07	3.90	
20%	1.19	27.83	-21.79	15.65	7.39	14.29	-9.77	4.77	3.99	
30%	1.23	29.91	-23.77	17.02	6.30	14.68	-10.68	5.03	4.33	
40%	1.46	31.80	-25.62	17.71	6.45	15.32	-10.97	5.22	4.36	
50%	1.69	33.93	-27.88	18.32	6.18	15.67	-11.33	5.35	4.59	
60%	1.72	34.10	-27.89	18.55	6.41	15.99	-11.38	5.42	4.48	1.35
70%	2.02	36.17	-29.93	19.11	6.84	16.69	-11.55	5.60	4.47	
80%	2.16	36.92	-30.66	19.33	7.03	16.98	-11.60	5.65	4.46	
90%	2.37	38.09	-31.97	19.45	7.10	17.13	-11.64	5.69	4.55	
100%	2.63	39.46	-33.19	20.00	7.47	17.78	-11.81	5.84	4.49	
200%	3.42	29.31	-34.61	17.33	6.88	15.25	-10.72	5.26	5.25	

ΔE – total colour difference, ΔL – lightness/darkness, Δa – greenness/redness difference, Δb – blueness/yellowness, ΔH – change in hue, ΔC – change in chroma, MI – metamerism index, CDI – colour difference index The highlighted data correspond to the optimum values

Analysis of colour fastness (washing, rubbing, light and perspiration) for application of eucalyptus bark/leaves extract under different dyeing conditions

Light fastness of eucalyptus bark on aluminium sulphate mordanted silk was found to range from poor to moderate (2-3) in most cases except when dyeing was carried out in an alkaline *p*H. UV-VIS wavelength scan (190 nm to 1100 nm) of the aqueous solution of this natural dye shows the presence of small humps at two points, one at 326 nm and the other at 276 nm as observed in the UV-VIS spectral curve (*Fig-2*) of respective the purified aqueous dye solutions. Presence of these humps in the UV-range

indicates that the dye from eucalyptus bark has the ability to absorb UV-rays preferentially at predominantly 276 nm, which thus may cause early fading of the dye. However, the UV absorption at 326-376 nm (near the visible range) by this natural dye (eucalyptus bark) and its emission of blue at visible range causes this dye to also act as an optical brightener. Thus, with this UV absorbance character, the dye increases the lower stability to UV-light. This culminates into poorer light fastness. However, higher mordant concentration yielded higher dye uptake and this higher dye concentration per surface area showed poor light fastness as more dye was accessible for fading.

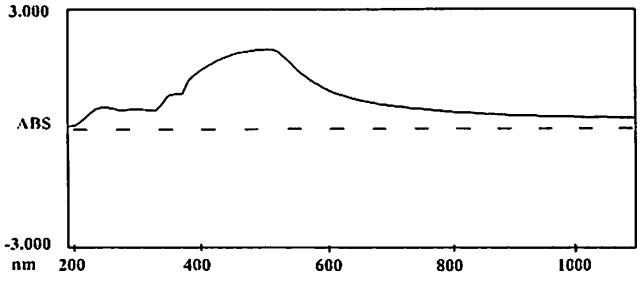


Figure 2: UV-VIS spectra of aqueous extract of colour components of eucalyptus bark as a natural dye

The wash fastness with respect to change in colour depth for eucalyptus bark ranged from 1-2 to 3-4, indicating fair to moderate fastness and that with respect to extent of staining of the adjacent non-mordanted cotton fabric is very good (4-5); while staining of the adjacent un-mordanted silk fabric comparatively showed slightly poor fastness.

No change was observed for wet and dry rub fastness of silk samples dyed with eucalyptus bark with respect to variation in the conditions of the dyeing parameters, both of which was very good. The wet rubbing fastness was either same or marginally lower in most cases than the corresponding dry rubbing fastness baring a few instances.

In general fastness to acidic perspiration with respect to loss in the depth of colour was either same or better for acidic perspiration than that for alkaline perspiration, indicating that the dye from eucalyptus bark gets easily hydrolyzed in the presence of alkali; a phenomenon also indicated by the results of ISO-III wash fastness rating, where alkali (2 gpl) is present in the washing liquor. However, in case of variations in *p*H, a reverse trend was seen. Acidic perspiration fastness of eucalyptus bark dyed silk fabric showed slightly better extent of staining on both cotton and silk adjacent fabrics when compared with that of corresponding fastness values for alkaline perspiration (*Table-2*).

Table 2: Colour fastness properties of alumimium sulphate (25%) pre-mordanted crepe silk fabric dyed with standardized aqueous extracted solution of eucalyptus bark using variable conditions of dyeing

Variables	LF	Wash Fastness						Crocking Fastness		Perspiration Fastness					
		ISO-II			ISO-III					Acidic			Alkaline		
		LOD	ST		LOD	ST		Dry	Wet	LOD	ST		LOD	ST	
			Cot	Sil		Cot	Sil				Cot	Sil		Cot	Sil
Variation in **TIME** (*in min*) [dyed at 80°C, *p*H- 9, MLR-1:40 using 200% dye (on the basis of weight % of dried solid EB)]															
30 min	2-3	3	4-5	3-4	2-3	4	3-4	4	3	2	3-4	3	1-2	3	2-3
40 min	2-3	3	4-5	3-4	2-3	3	4	3-4	3-4	2	4	3	1-2	3-4	2-3
50 min	2-3	3	4-5	4	2-3	4	4	4	4	2	4	3-4	1-2	3-4	2-3
60 min	2-3	3-4	4-5	4	2-3	4	4	3-4	3	2	4	3-4	1-2	3-4	2-3
70 min	2-3	3-4	4-5	4	2-3	4	4	3-4	3-4	2	4	3-4	1-2	3-4	2-3
80 min	2-3	3	4-5	3-4	2-3	4	4	3	3	2	4	3-4	1-2	3-4	2-3
90 min	2-3	3	4-5	3-4	2-3	4	4	4	3-4	2	4	3	1-2	3-4	2-3
Variation in **TEMPERATURE** (°C) [dyed at *p*H- 9, MLR-1:40 using 200% dye (on the basis of weight % of dried solid EB) for 80 min]															
RT	2-3	2	4-5	4	2	4	3	3-4	3	3	4	3	1	3	2
40 °C	2-3	2-3	4-5	4	2	4	3-4	3-4	3	2-3	4	3	1-2	3	2
60 °C	2-3	2	4-5	4	2	4	3-4	4	3-4	2	4	3	1	3	2
80 °C	2-3	2	4-5	4	3	4	3-4	4	4	2-3	4	3	1-2	3-4	2-3
100 °C	2-3	2-3	4-5	4	3	4	3-4	3-4	3	2-3	3	3	1-2	4	3-4
Variation in ***p*H** [dyed at 80°C, MLR-1:40 using 200% dye (on the basis of weight % of dried solid EB) for 80 min]															
2	2-3	1-2	4	3	2	4	3-4	2	2-3	4	4	4	2	3-4	3
3	2-3	1	4	3	2	4	3-4	2	3	4	4	3-4	2	3	2-3
4	2-3	1	4	4	1-2	3-4	3	3	3	4	4	3-4	1-2	3	3
5	2-3	1	4	4	1-2	3-4	3	3	3	4	4	3-4	1-2	3	3
6	2-3	1	4	3-4	1-2	4	3	3	3	4-5	4	3-4	1-2	3	3
7	3-4	2	4	4	3	4	3-4	2-3	3	3-4	4	3	2	3	3
8	3-4	1-2	4	4	1-2	4	3-4	2-3	3-4	4	4	3	1-2	4	3
9	3-4	4	4	4	4	4	3-4	4	3-4	2	4	3-4	1-2	4	3-4
10	3-4	3-4	4	4	4	4	4	4	3-4	2-3	4	3-4	3	3-4	3-4
11	3-4	3	4	4	4	4	4	4	3-4	2-3	4	3	3	4	2

Variation in MLR [dyed at 80°C, *p*H- 9 using 200% dye (on the basis of weight % of dried solid EB) for 80 min]															
1:10	3-4	3	4	4	3	4	3-4	4	4	2-3	3-4	3	1-2	3-4	2-3
1:20	3-4	2-3	4	4	3	4	4	4	4	2-3	4	3-4	1-2	3-4	3-4
1:30	3-4	2-3	4	4	3-4	4	4	3-4	3	2	4	3	2	3-4	2-3
1:40	3-4	3	4	4	3-4	4	4	4	3-4	2	4	3	2	3-4	2-3
1:50	3-4	3	4	4	3-4	4	4	4	3-4	2	4	3-4	2	3-4	3-4
Variation in DYE CONCENTRATION [(on the basis of weight % of dried solid EB) dyed at 80°C, *p*H- 9, MLR-1:40 for 80 min]															
10	2-3	2-3	4	3-4	2	4	4	4	4	3-4	4	3-4	2-3	4	3-4
20	2-3	2-3	4	3-4	2-3	4	4	4	4	3-4	4	3-4	2-3	4	3-4
30	2-3	2-3	4	3-4	2-3	4	4	4	4	2-3	4	3-4	2-3	4	3-4
40	2-3	2-3	4	3-4	2-3	4	4	4	4	2-3	4	3-4	3	4	3-4
50	2-3	2-3	4	3-4	3	4	4	4	4	2-3	4	3-4	3	4	3-4
60	2-3	2-3	4	3-4	2-3	4	4	4	4	2-3	4	3-4	2-3	4	3-4
70	2-3	2-3	4	3-4	2-3	4	4	4	4	2-3	4	3-4	3	4	3-4
80	2-3	2-3	4	3-4	2-3	4	4	4	4	2-3	4	3-4	3	4	3-4
90	2-3	2-3	4	3-4	2-3	4	4	4	4	2-3	4	3-4	3	4	3-4
100	2-3	2-3	4	3-4	2-3	4	4	4	4	2-3	4	3-4	3	4	3-4
200	2-3	2-3	4	3-4	2-3	4	4	4	4	2-3	4	3-4	3	4	3-4

LT – Light fastness, LOD – Loss in dept of shade, ST – Extent of staining, Cot – Cotton, Sil - Silk

Assessment of surface colour strength of selected binary pair of purified natural dyes extracted from eucalyptus bark and red sandalwood when applied to crepe silk fabrics by the exhaust method

To develop compound shades, use of mixture of dyes is common while dyeing with synthetics dyes. However, for obtaining good colour yield, a study on the compatibility of two single dyes to be used together in a mixture is essential. In this part of the study, mixture dyeing of crepe silk fabric using purified extracts of eucalyptus bark and red sandalwood has been studied. Since the maximum absorption wavelength of red sandalwood as reported in literature[2] is also 420 nm like eucalyptus bark, colour strength and all other colour related parameters of the silk fabric dyed using mixture of natural dyes (eucalyptus bark and red sandalwood)) were assessed at the common wavelength (420 nm).

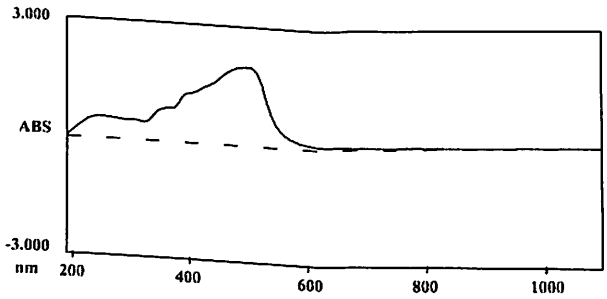


Figure 3: UV-VIS spectra of aqueous extract of colour components of red sandalwood as a natural dye

Table-3 shows the *K/S* values at the common wavelength (420 nm) for pre-mordanted crepe silk fabrics dyed with selected proportions (75:25, 50:50 and 25:75) of binary pair of eucalyptus bark and red sandalwood. The colour yield of the silk fabrics dyed with purified extract of eucalyptus bark and red sandalwood in terms of the *K/S* values was found to be higher when the said natural dyes was used in combination rather then when they were used alone. There was a synergistic effect showing significant increase in *K/S* values for use of binary mixture of these two dyes expectedly be due to the hypsochromic / bathochromic shift of colorimetric absorption values due to the influence of one individual colour component over the other when used in the mixture, either causing colour addition or subtraction effects by relevant interactions between the said two dyes. The resultant colour yield (*K/S*) on silk fabric for use of binary mixture of these two dyes was found to be higher when the proportion of red sandalwood in the mixture is more than eucalyptus bark as was evident from the data in *Table-3*.

Table-3 also gives data for total colour difference (ΔE), changes in hue (ΔH), changes in chroma (ΔC) and metamerism index (MI) for the said mixture dyeing for development of compound shades. The data for total colour difference (ΔE) is minimum for 75:25 proportion of EB:RSW combination. The MI values is lowest again for 75:25 proportion of EB:RSW combination. ΔH values are found to be negative in all cases. The order of increasing MI for different EB:RSW combinations is follows: 75:25 < 50:50 < 25:75

CV% of *K/S* values indicates uniformity of dyeing. Lower is the dye concentration, higher is the CV% of *K/S* values and higher dye concentration lowers the CV% of *K/S* values giving uniform dyeing and reproducibility. However, as per the earlier reports[10], CV % of *K/S* values upto 5% is acceptable to consider as uniform dyeing. So 25:75 (EB:RSW) application showed CV% of *K/S* values within 5% (< 4.16), which is acceptable and maybe an the best combination ratio for dyeing eucalyptus bark with red sandalwood in a mixture on silk fabrics (vide data in *Table-3*).

Table 3: Colour difference index (CDI) and relative compatibility (RCR) of alumimium sulphate (25%) pre-mordanted crepe silk fabric dyed with binary mixture of purified eucalyptus bark (EB) and red sandalwood (RSW) in different proportions using 1% (owf) dye at 100°C for 60 min with MLR 1:50 and pH 7.

Proportion of dye in the mixture (EB:RSW)	K/S at λ_{max} (420 nm)	CV of K/S (%)	ΔE	ΔH	ΔC	MI(LABD)	CDI (CDI_{max} - CDI_{min})	RCR	Compatibility Grade
1% Dye									
Degummed and alum pre-mordanted silk	0.13	—	—	—	—	—	—		
100:0 (only EB)	0.45	3.24	11.78	-1.69	9.08	2.47	0.88		
0:100 (only RSW)	0.55	2.46	20.77	-8.63	13.10	4.31	3.17	2.58	2 (POOR)
25:75 (EB:RSW)	0.42	4.16	12.63	-3.22	9.23	2.49	1.77		
50:50 (EB:RSW)	0.46	8.24	19.81	-9.20	12.31	4.27	3.46		
75:25 (EB:RSW)	0.58	5.42	16.09	-6.10	10.48	3.18	2.94		

EB – eucalyptus bark and RSW – Red Sandalwood

Assessment of fastness properties of selected binary pair of purified natural dyes extracted from eucalyptus bark and red sandalwood when applied to crepe silk fabrics by the exhaust method

The light fastness of the sample dyed with the mixture of eucalyptus bark and red sandalwood was 3-4 for all different proportions of the dye mixture used. There is specific UV-absorbance peak for red sandalwood, while there is no UV-absorbance peaks in the UV-VIS spectra of eucalyptus bark and thus during UV-light fading, red sandalwood (RSW) faded earlier due to preferential UV-absorbance unlike eucalyptus bark. Among the two dyes, the colour started fading by weakest lightfast dye and hence the effect of higher / highest lightfast dye was not obtained for use of mixture dyes for development of a compound shade.

Table 4: Colour fastness of alumimium sulphate (25%) pre-mordanted crepe silk fabric dyed with binary mixture of purified eucalyptus bark (EB) and red sandalwood (RSW) in different proportions using 1% (owf) dye at 100°C for 60 min with MLR 1:50 and pH 7.

Proportion of dye in the mixture (EB:RSW)	Light Fastness	Wash Fastness ISO-II			Rub Fastness	
		LOD	ST on Cot	ST on Sil	Wet	Dry
1% Dye						
0:100	3-4	2	4-5	3-4	4-5	4-5
25:75	3-4	2	4	4	4-5	4
50:50	3-4	2	4-5	3-4	4-5	4
75:25	3-4	2	4	3-4	4-5	4
100:0	4	2	4-5	3-4	4-5	4-5

EB – eucalyptus bark and RSW – Red Sandalwood
LOD – Loss in dept of shade, ST – Extent of staining, Cot – Cotton

Under ISO-II conditions, adjacent non-mordanted fabrics (cotton and silk) did not stain and show good to excellent wash fastness grade 3-4 to 4-5 for samples dyed with the mixture of the said natural dyes (*Table-4*). But all the silk fabric samples dyed with single or mixture of dyes showed somewhat poorer wash fastness with respect to change in the depth of colour. Thus, 50:50 ratio of eucalyptus bark and red sandalwood in a mixture dyes silk giving overall good fastness, which is comparable or slightly better than when the said two natural dyes were used alone.

An attempt was been made to improve the wash fastness of the silk fabric dyed with mixture of RSW and EB by complexing the unfixed dye with a cationic dye fixing agent CTAB. Some improvement (grade 2-3 from grade 2) in the wash fastness with respect to change in colour depth (loss of depth) has been achieved by after-treating the silk fabric samples dyed with a mixture on eucalyptus bark and red sandalwood with CTAB as can be seen from *Table-5*.

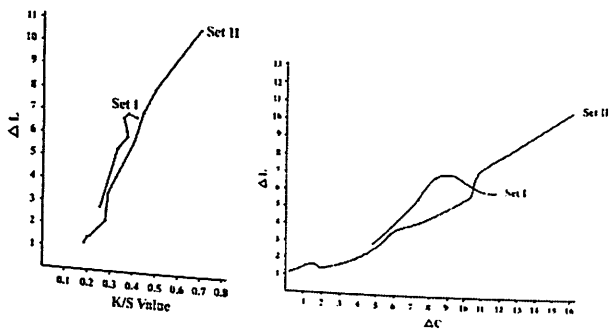
Table 5: Treatment with 2% (owf) aqueous solutions of CTAB (N-cetyl N trimethyl-ammonium-bromide), using MLR 1:30 for 10 min at 60°C maintaining pH 5 to improve the wash fastness of alumimium sulphate (25%) pre-mordanted crepe silk fabric dyed with binary mixture of purified eucalyptus bark (EB) and red sandalwood (RSW) in different proportions using 1% (owf) dye at 90°C for 60 min with MLR 1:50 and pH 7.

Proportion of dye in the mixture (EB:RSW)	Wash Fastness (ISO-II)		
	LOD	ST on Cot	ST on Sil
100:0	2	4-5	4
0:100	2	4-5	4
25:75	2-3	4-5	4-5
50:50	2-3	4-5	4-5
75:25	2-3	4-5	4-5

EB – eucalyptus bark and RSW – Red Sandalwood
LOD – Loss in dept of shade, ST – Extent of staining, Cot – Cotton

4.5 Assessment of the compatibility of the selected binary pair of purified natural dyes extracted from eucalyptus bark and red sandalwood when applied to crepe silk fabrics by the exhaust method

Plots for K/S vs ΔL (Set-I and Set-II) show both eucalyptus bark and red sandalwood natural dyes to be fairly compatible when used as a mixture but varying widely in colour build-up for variation in time and temperature profile; indicating need of precision control of both for mixture dyeing (Table-6). On the other hand, plots for ΔC vs ΔL show that although the curves for Set-I and Set-II show similar build-up, they partially overlap and at a certain point and get widely separated indicating lesser degree (average to fair) of compatibility between these dyes. Therefore as per the conventional method, this binary pair of dyes is fairly compatible for use as mixture (Fig-4 a & b).



Plot a: ΔL vs K/S *Plot b: ΔC vs ΔL*

Figure 4 (a-b): Plots of ΔL vs K/S and ΔC vs ΔL for dyeing binary pair of eucalyptus and red sandalwood natural dyes on aluminium sulphate pre-mordanted crepe silk fabrics

The new method of compatibility test on the basis of CDI values show the binary mixture of eucalyptus bark and red sandalwood to exhibit 'poor' grade of compatibility rating (RCR - relative compatibility rating of 2), indicating that there is least synergistic interaction between the two dyes (*Table-3*). This shows that there is least synergistic interaction between the two dyes and CDI values differ widely indicating varying colour build-up probably due to their wide variation in the molecular structure and may be absorbed on silk at different rates. Moreover, this maybe due to the additional dulling effect of one colour component (due to the presence of gallic acid) present in eucalyptus bark that is perhaps not compatible with the colour component present in red sandalwood[2].

Table 6: Colour difference index (CDI) and relative compatibility (RCR) for application of alumimium sulphate (25%) pre-mordanted crepe silk fabric dyed with 50:50 binary mixture of purified eucalyptus bark (EB) and red sandalwood (RSW) for variable time at variable temperatures using MLR 1:50 and pH 5 at 100°C for 60 min.

Varying Parameters	*K/S* at λ_{max} (420 nm)	*ΔL*	*ΔE*	*ΔH*	*ΔC*	MI (LABD)	CDI
SET-I *(1% dye mixture of EB and RSW (50:50 ratio) using MLR 1:50 and pH 5)*							
For 0 min at 40°C	0.26	-2.91	8.45	-6.18	4.97	2.85	3.69
For 10 min at 50°C	0.43	-6.89	14.79	-8.58	9.62	3.96	3.33
For 20 min at 60°C	0.38	-6.02	16.18	-9.19	11.89	4.90	2.55
For 30 min at 70°C	0.38	-7.00	13.66	-8.26	8.92	3.93	3.21
For 40 min at 80°C	0.35	-5.50	12.56	-8.08	7.51	3.53	3.83
For 50 min at 90°C	0.60	-6.80	13.84	-8.96	8.43	4.60	3.20
For 60 min at 100°C	0.38	-6.26	15.27	-8.82	10.77	4.96	2.52
SET-II *(90°C for 60 min, using MLR 1:50 and pH 5)*							
0.1%	0.17	1.12	1.66	-1.22	0.07	0.47	1.55
0.2%	0.20	-1.49	4.31	-3.80	1.98	1.30	6.36
0.3%	0.21	-1.64	3.85	-3.44	1.62	1.50	5.45
0.4%	0.27	-2.26	7.21	-5.23	4.41	3.18	2.69
0.5%	0.29	-3.52	9.47	-6.54	5.88	2.19	4.92
0.6%	0.33	-4.20	11.05	-6.93	7.51	2.83	3.60
0.7%	0.41	-5.79	14.27	-7.91	10.36	3.96	2.75
0.8%	0.45	-7.11	15.63	-8.57	10.97		
0.9%	0.50	-8.13	17.31	-9.04	12.32		
1.0%	0.70	-10.72	21.49	-8.93	16.35		

ΔL – lightness/darkness, ΔC – change in chroma, ΔH – change in hue, MI – metamerism index, CDI – colour difference index, RCR – relative compatibility rating

Thus, both the conventional method of test of compatibility by plots of ΔL Vs ΔC or ΔL vs K/S for two sets of varying colour build-up under two sets of predetermined conditions and the newer RCR methods, show very similar results indicating that the results of the RCR system is in agreement with the results of the conventional compatibility test based on the analysis of K/S vs ΔL and ΔC vs ΔL plots. It can be concluded that eucalyptus and red sandalwood are 'fair to poor' compatibility when used together in dyeing to develop compound shades.

Conclusions

From the present study the following may thus be concluded:

The optimized conditions for dyeing on crepe silk fabric with eucalyptus bark are - 60 min dyeing time; 80oC dyeing temperature; 1:50 MLR; 7 *p*H; 200% (owf) dye concentration.

Interpretation from colour difference index values of eucalyptus bark clearly reveals that temperature and *p*H of dyebath and dye concentrations are the most important dyeing process variables

amongst all other parameters of dyeing process variables as indicated by a wide dispersion of CDI values.

The colour yield of the silk fabrics dyed with binary mixture of eucalyptus bark and red sandalwood in terms of *K/S* values is found to be higher when the said natural dyes are used in combination rather than when they are used alone. The colour yield is higher when the proportion of red sandalwood in the mixture is more than eucalyptus bark.

All the samples dyed with single and mixture of dyes shows poor wash fastness.

There is a slight improvement (grade 2-3 from grade 2) in the wash fastness with respect to change in colour depth after treating the samples dyed with a mixture on eucalyptus bark and red sandalwood with CTAB.

The compatibility of the said two natural dyes assessed by both the older and the traditional method based on progressive depth of shade build up, obtained by varying dyeing time/ temperature in one set and varying the total dye concentration in another set and the relatively newer quantitative method based on calculation of closeness of CDI values for the samples dyed with different proportions of the two dyes and the degree of compatibility in terms of grades of RCR system, show that there is no synergistic interaction between the two dyes and the two dyes are only fairly compatible.

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Clothing Practices and Designing of Functional Garments for Challenged Children

Sweta Agrawal and Shweta Tuteja

ABSTRACT

The study was carried out to investigate the clothing practices and problems of challenged children and design functional garments as per their need. 30 mentally retarded respondents (21 male and 9 female) were interviewed and observed to identify their clothing practices and problems while dressing and undressing. Clothing practices for both male and female was interviewed for both summer and winter seasons. The problems encountered by respondents while dressing and undressing were identification of sides, manipulating fasteners, difficulty in operating the openings and fastening the pant's belt. According to the problem faced by the respondents, 20 sketches were made with the incorporation of functional features. After selection of the sketches, 5 functional garments were constructed. Velcro tape, zipper, elasticized gathers, pleats were incorporated as the functional features in the garments Assessment of the garments was done on a three point arbitrary scale and these garments were found to be highly acceptable by the respondents.

Keywords: Autism, Cerebral Palsy, Functional Clothing, Mental Retarded, Orthopaedically Handicapped, Self Help, Speech Handicapped, Visually Handicapped

Introduction

Clothing is the integral part of human life and has a number of functions: adornment, status, modesty and protection. Clothing has been recognized as a primary need of mankind throughout the globe. Clothing is considered as a language, a non-verbal communication that through its symbol conveys much about the wearer to the viewer[3]. Clothing is an extension of self, a symbol of security, a means of identifying with someone, and a source of satisfaction.[2] However, for those whose surroundings environment is limited by age, conditions of health, or physical and mental handicaps, dressing properly is a very difficult and often impossible task. [1] Medical personnel such as occupational therapist, social workers, psychologists and medical doctors have concerned with the special clothing needs and appearance problems of the handicapped. Desire of approval from the society is always present in handicapped people and this gives them a feeling of well being and self confidence[1]. Most of times a person with physical limitations wear ordinary clothes that hinder the movement, produce discomfort and even build an inferiority complex.

Clothing is one of the rehabilitating tools for the handicapped as it facilitates and encourages independent undressing and dressing and boost up their self-esteem and also need special attention. The clothing related problems of the disabled are highly individualized because these depend on the type of disability[4]. The clothing related problems are left to parents or caretakers, which are not easy to be solved because of the reason that disabled need clothing that fit their body which is not of standard size and shape. Availability of functional clothing with self help features that is designed and constructed in accordance with physical limitations reduces dependence on others for undressing and dressing.

Methodology

Selection of sample

The present investigation was undertaken to study the clothing practices and problems of mentally retarded respondents and designing of suitable garments for them. The study was conducted in Kolkata city. The study was conducted on 30 respondents of age group 10-20 years, selected through purposive sampling technique. A descriptive survey method was used along with keen observation.

Collection of data

The pre-coded interview schedule was used as the main tool to carry out the survey. The respondents and their caretakers were personally interacted to collect the data. The clothing problems of the respondents were also identified by observation method which was used to have an insight into the problems encountered by them in donning and doffing and manipulating the fasteners.

Analysis of Data

The data from the interview schedule were coded and tabulated. The data was analyzed by frequency and percentage. Weighted score, mean and rank method was used to find out the existing clothing practices, preferences and clothing problems of the respondents.

Sketching, Selection and Assessment of Constructed Functional Garments

On the basis of the survey results, a total of 20 sketches (4 designs were sketched for each associated disability i.e. orthopaedically handicapped, visually impaired, autistic, cerebral palsy, speech disorder) were made which included self help features according to physical disability comprising of both

upper and lower garment for male and female respondents. Sketched designs were shown to a panel of 10 Judges, which included experts and heads of various Institutions and caretakers. 5 most preferred sketches (1 from each associated disability) were selected for fabrication. Constructed garments were given to the respondents for wear trials for ten days. Assessment of garments with functional features was also taken care of. Views of the respondents were taken regarding suitability of the various garment features, comfortability etc.

Results and Discussions

The findings of the present study are discussed below:

70 per cent of the mentally retarded respondents were males and 30 per cent were females.

Data from the Table 1 reveals that majority of respondents i.e. 25 respondents had associated disability whereas 5 respondents had no associated disability.

The perusal of table revealed that 13 respondents could not speak clearly followed by 4 respondents who suffered from orthopaedical problems and autism respectively. Other 3 had visual problems, whereas 1 respondent suffered from cerebral palsy.

Table 1: Distribution of respondents on the basis of Associated Disability

S.No.	Variables	N	%
1.	**Associated disability**		
a.	Yes	25	83.3
b.	No	5	16.7
2.	**Type of Associated Disability N=25**		
a.	Visually Handicapped	3	12
b.	Cerebral Palsy	1	4
c.	Orthopaedically handicapped	4	16
d.	Speech handicapped	13	52
e.	Autism	4	16

The most common garment worn by males in summers were half sleeved t-shirt, shirt, trousers, underwear and socks whereas in winters they wore full sleeved shirt, full sleeved pullover, trousers and socks.

Kameez, t-shirt, shirt, salwar, and panties for summers while full sleeved cardigan, churidar pyjama, salwar, trousers, socks, panties and slips for winters were the common garments worn by female respondents.

From the investigation, it was found that 65.21 per cent respondents prefer cotton fabric for the garment, 23.91 per cent respondents prefer knitted fabric and 10.87 per cent prefer blends (terricot, cotswool, terrywool, etc).

It was found out that 26 respondents need assistance while undressing and dressing. 17 respondents (56.67 per cent) needs help, 9 respondents (30 per cent) were completely dependent and only 4 respondents (13.33 per cent) can dress independently (Figure 1).

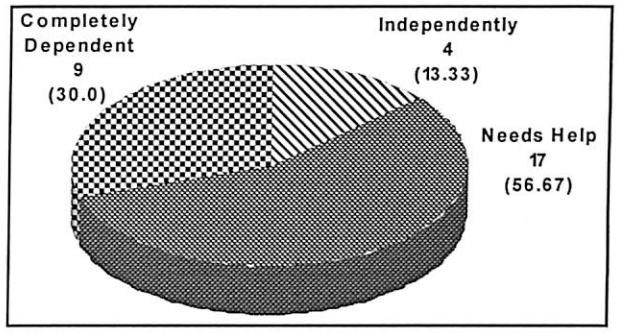
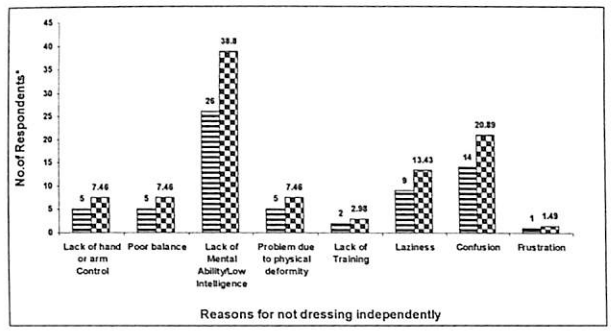


Fig. 1: Distribution of respondents on the basis of extent of help required in dressing and undressing

The data in figure 2 revealed that maximum respondents i.e. 26 respondents cannot dress independently because of lack of mental ability/low intelligence. Apart from this 14 respondents cannot dress independently because of confusion, 9 respondents cannot dress independently because of laziness. 5 respondents cannot dress because of the lack of hand or arm control, poor balance and problem due to physical deformity respectively. Apart from these, lack of training and frustration were the reasons for not dressing independently for 2 and 1 respondents respectively.



* ***Multiple Responses***

Fig. 2: Distribution of respondents on the basis of reasons for not dressing independently

It was observed from the data in table 2, that the respondents encounter great difficulty in identification of right and wrong side. (Rank I), followed by problem in identifying front and back (Rank II), differentiating the top and bottom (Rank III) while problem in differentiating armhole and neck hole ranked IV.

Problems related to upper garments were that maximum respondents faced difficulty in putting on and taking off the arm (0.93) and difficulty in putting over shoulder (0.9), followed by difficulty in slipping on and taking out from the head (0.63).

Clothing Practices and Designing of Functional Garments for Challenged Children

Sweta Agrawal and Shweta Tuteja

ABSTRACT

The study was carried out to investigate the clothing practices and problems of challenged children and design functional garments as per their need. 30 mentally retarded respondents (21 male and 9 female) were interviewed and observed to identify their clothing practices and problems while dressing and undressing. Clothing practices for both male and female was interviewed for both summer and winter seasons. The problems encountered by respondents while dressing and undressing were identification of sides, manipulating fasteners, difficulty in operating the openings and fastening the pant's belt. According to the problem faced by the respondents, 20 sketches were made with the incorporation of functional features. After selection of the sketches, 5 functional garments were constructed. Velcro tape, zipper, elasticized gathers, pleats were incorporated as the functional features in the garments Assessment of the garments was done on a three point arbitrary scale and these garments were found to be highly acceptable by the respondents.

Keywords: Autism, Cerebral Palsy, Functional Clothing, Mental Retarded, Orthopaedically Handicapped, Self Help, Speech Handicapped, Visually Handicapped

Introduction

Clothing is the integral part of human life and has a number of functions: adornment, status, modesty and protection. Clothing has been recognized as a primary need of mankind throughout the globe. Clothing is considered as a language, a non-verbal communication that through its symbol conveys much about the wearer to the viewer[3]. Clothing is an extension of self, a symbol of security, a means of identifying with someone, and a source of satisfaction.[2] However, for those whose surroundings environment is limited by age, conditions of health, or physical and mental handicaps, dressing properly is a very difficult and often impossible task. [1] Medical personnel such as occupational therapist, social workers, psychologists and medical doctors have concerned with the special clothing needs and appearance problems of the handicapped. Desire of approval from the society is always present in handicapped people and this gives them a feeling of well being and self confidence[1]. Most of times a person with physical limitations wear ordinary clothes that hinder the movement, produce discomfort and even build an inferiority complex.

Clothing is one of the rehabilitating tools for the handicapped as it facilitates and encourages independent undressing and dressing and boost up their self-esteem and also need special attention. The clothing related problems of the disabled are highly individualized because these depend on the type of disability[4]. The clothing related problems are left to parents or caretakers, which are not easy to be solved because of the reason that disabled need clothing that fit their body which is not of standard size and shape. Availability of functional clothing with self help features that is designed and constructed in accordance with physical limitations reduces dependence on others for undressing and dressing.

Methodology

Selection of sample

The present investigation was undertaken to study the clothing practices and problems of mentally retarded respondents and designing of suitable garments for them. The study was conducted in Kolkata city. The study was conducted on 30 respondents of age group 10-20 years, selected through purposive sampling technique. A descriptive survey method was used along with keen observation.

Collection of data

The pre-coded interview schedule was used as the main tool to carry out the survey. The respondents and their caretakers were personally interacted to collect the data. The clothing problems of the respondents were also identified by observation method which was used to have an insight into the problems encountered by them in donning and doffing and manipulating the fasteners.

Analysis of Data

The data from the interview schedule were coded and tabulated. The data was analyzed by frequency and percentage. Weighted score, mean and rank method was used to find out the existing clothing practices, preferences and clothing problems of the respondents.

Sketching, Selection and Assessment of Constructed Functional Garments

On the basis of the survey results, a total of 20 sketches (4 designs were sketched for each associated disability i.e. orthopaedically handicapped, visually impaired, autistic, cerebral palsy, speech disorder) were made which included self help features according to physical disability comprising of both

upper and lower garment for male and female respondents. Sketched designs were shown to a panel of 10 Judges, which included experts and heads of various Institutions and caretakers. 5 most preferred sketches (1 from each associated disability) were selected for fabrication. Constructed garments were given to the respondents for wear trials for ten days. Assessment of garments with functional features was also taken care of. Views of the respondents were taken regarding suitability of the various garment features, comfortability etc.

Results and Discussions

The findings of the present study are discussed below:

70 per cent of the mentally retarded respondents were males and 30 per cent were females.

Data from the Table 1 reveals that majority of respondents i.e. 25 respondents had associated disability whereas 5 respondents had no associated disability.

The perusal of table revealed that 13 respondents could not speak clearly followed by 4 respondents who suffered from orthopaedical problems and autism respectively. Other 3 had visual problems, whereas 1 respondent suffered from cerebral palsy.

Table 1: Distribution of respondents on the basis of Associated Disability

S.No.	Variables	N	%
1.	**Associated disability**		
a.	Yes	25	83.3
b.	No	5	16.7
2.	**Type of Associated Disability N=25**		
a.	Visually Handicapped	3	12
b.	Cerebral Palsy	1	4
c.	Orthopaedically handicapped	4	16
d.	Speech handicapped	13	52
e.	Autism	4	16

The most common garment worn by males in summers were half sleeved t-shirt, shirt, trousers, underwear and socks whereas in winters they wore full sleeved shirt, full sleeved pullover, trousers and socks.

Kameez, t-shirt, shirt, salwar, and panties for summers while full sleeved cardigan, churidar pyjama, salwar, trousers, socks, panties and slips for winters were the common garments worn by female respondents.

From the investigation, it was found that 65.21 per cent respondents prefer cotton fabric for the garment, 23.91 per cent respondents prefer knitted fabric and 10.87 per cent prefer blends (terricot, cotswool, terrywool, etc).

It was found out that 26 respondents need assistance while undressing and dressing. 17 respondents (56.67 per cent) needs help, 9 respondents (30 per cent) were completely dependent and only 4 respondents (13.33 per cent) can dress independently (Figure 1).

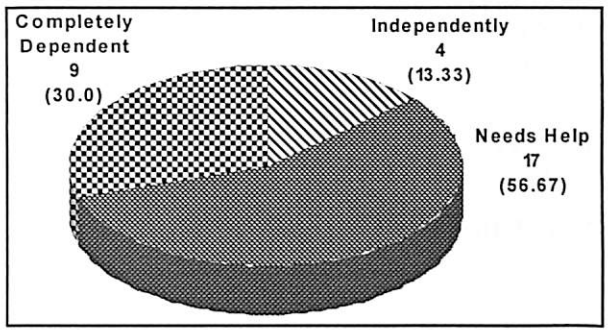
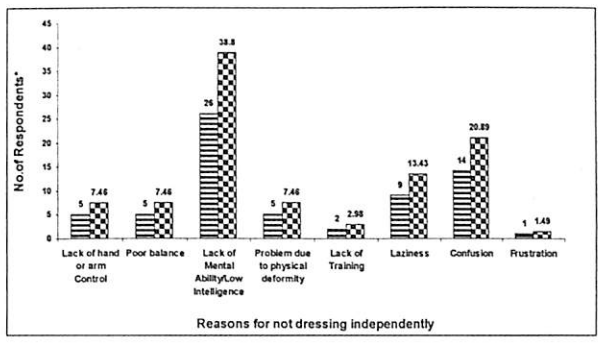


Fig. 1: Distribution of respondents on the basis of extent of help required in dressing and undressing

The data in figure 2 revealed that maximum respondents i.e. 26 respondents cannot dress independently because of lack of mental ability/low intelligence. Apart from this 14 respondents cannot dress independently because of confusion, 9 respondents cannot dress independently because of laziness. 5 respondents cannot dress because of the lack of hand or arm control, poor balance and problem due to physical deformity respectively. Apart from these, lack of training and frustration were the reasons for not dressing independently for 2 and 1 respondents respectively.



* *Multiple Responses*

Fig. 2: Distribution of respondents on the basis of reasons for not dressing independently

It was observed from the data in table 2, that the respondents encounter great difficulty in identification of right and wrong side. (Rank I), followed by problem in identifying front and back (Rank II), differentiating the top and bottom (Rank III) while problem in differentiating armhole and neck hole ranked IV.

Problems related to upper garments were that maximum respondents faced difficulty in putting on and taking off the arm (0.93) and difficulty in putting over shoulder (0.9), followed by difficulty in slipping on and taking out from the head (0.63).

Maximum respondents faced problem in fastening the belt at waist with the highest score of 1.67 (Rank I), followed by problem in aligning the upper and lower garment with a mean score of 1.43 (Rank II). Problem in operating fly front (1.17) and difficulty in passing legs (0.43) were the problems faced by the respondent related to their lower garment.

Manipulating fasteners was a tedious job for the respondents. All the respondents have problem in tying string (2.0). Problems in fastening hooks and eye and small button and button hole were next followed with a mean score of 1.4 and 1.07 respectively. Operating full centre front opening was a difficult task (0.66), followed by difficulty in operating half centre front opening with a score index of 0.43. Respondents faced equal difficulty in operating full and half centre back opening with the same score index of 0.33.

Table 2: Distribution of the respondents on the basis of extent of problem in the existing garment

S. No.		Weighted Score	$\bar{X}$	Rank
	Identification of Sides			
a.	Difficulty in differentiating the right and wrong side of the garment	37	1.23	I
b.	Difficulty in differentiating the front and back of the garment	31	1.03	II
c.	Difficulty in differentiating the armhole and neck hole of the garment	5	0.16	IV
d.	Difficulty in differentiating the top and bottom of the garment	8	0.26	III
2.	**Problems related to Upper Garment**			
a.	Difficulty in slipping on and taking out from the head	19	0.63	III
b.	Difficulty in putting on and taking off the arm	28	0.93	I
c.	Difficulty in putting over shoulder	27	0.90	II
3.	**Problems related to Lower Garment**			
a.	Difficulty in passing legs	13	0.43	IV
b.	Difficulty in aligning the upper and lower garment	43	1.43	II
c.	Difficulty in fastening the belt at waist	50	1.67	I
d.	Difficulty in operating fly front	35	1.17	III
4.	**Difficulty in Manipulating the Fasteners**			
a.	Button with buttonhole			
i.	*Small*	32	1.07	III
ii.	*Large*	27	0.9	IV
b.	Press Button			
i.	*Small*	27	0.9	IV
ii.	*Large*	23	0.76	VII
c.	Button with loop	26	0.86	VI
d.	Hooks and Eye	42	1.4	II
e.	Zipper	10	0.33	IX
f.	String	60	2.0	I
g.	Velcro Tapes	11	0.36	VIII
h.	Elasticized Bands	8	0.26	X
i.	Elasticized Casing	8	0.26	X
5.	**Difficulty in Operating the Openings**			
a.	Centre Front Opening			
i.	*Full*	20	0.66	I
ii.	*Half*	13	0.43	II
b.	Centre Back Opening			
i.	*Full*	10	0.33	III
ii.	*Half*	10	0.33	III
c.	Shoulder Opening			
i.	*One Side*	-	-	-
ii.	*Both Side*	-	-	-
d.	Side Opening			
i.	*Full*	-	-	-
ii.	*Half*	1	0.03	IV

An opinion was sought about the willingness for specially designed garments for mentally retarded children. It was revealed that 86.6 per cent of respondents expressed their willingness to adopt specially designed garments whereas 13.4 per cent of the respondents did not show their willingness for modified garments.

Respondents were willing to adopt functional garments to solve their dressing problem (Rank I), followed by factors like to make the child self dependent with self help features and to provide more comfort with Rank II and Rank III respectively.

Reasons for unwillingness of specially designed clothes were lack of knowledge about specially designed garments (Rank I), followed by factors like and garments will be costly and child may not accept Rank II and Rank III respectively (table 3).

Table 3: Distribution of respondents on the basis of reasons for willingness & unwillingness of specially designed clothes with self help features

** Multiple Responses*

S.No.	Variables	Weighted Score	$\bar{X}$	Rank
1.	**Reasons for Willingness of specially designed clothes***			
a.	To solve dressing problem	90	2.43	I
b.	To provide more comfort	8	0.19	III
c.	To make the child self dependent with self help features	51	1.37	II
d.	To make child socially acceptable	-	-	-
e.	To enhance the personality	-	-	-
2.	**Reasons for Unwillingness of specially designed clothes**			**N=4**
a.	Garments will be costly	5	1.25	II
b.	Lack of knowledge about specially designed garments	8	2	I
c.	It may make the child socially unacceptable	-	-	-
d.	It may lead to the development of inferiority complex in the child	-	-	-
e.	Child may not accept	1	0.25	III

Perusal of table 4, reveals that design features in the order of preferences were large armhole (Rank I), easy to manipulate fasteners (Rank II), enlarge front opening (Rank III), change in crotch length (Rank IV), size and placement of placket opening (Rank V), few fasteners (Rank VI) and garments with elasticized band (Rank VII).

Table 4: Distribution of respondents on the basis of their suggestion regarding incorporation of design features

S.No.	Designs features*	Weighted Score	$\bar{X}$	Rank
1.	Large Armhole	162	1.68	**I**
2.	Enlarge front opening	96	1.0	**III**
3.	Fasteners easy to manipulate	147	1.53	**II**
4.	Few Fasteners	24	0.25	**VI**
5.	Reinforcement at maximum wear and tear area	-	-	-
6.	Neckline deep in front than back	-	-	-
7.	Change in crotch length	48	0.5	**IV**
8.	Size & placement of placket opening	36	0.37	**V**
9.	Garments with elasticized bands	7	0.07	**VII**

*** Multiple Responses**

Based on the clothing requirement and suggestions by the respondents, 20 designs were made and were subjected to evaluation by panel of 10 judges who judged the designs on the basis of use of fasteners, incorporation of design features, depth of armhole/ crotch length, opening in the garment, ease in donning & doffing, and identification marks. Thus, 5 designs for mentally retarded, 1 for each associated disability (Fig. 3) which scored the maximum were constructed.

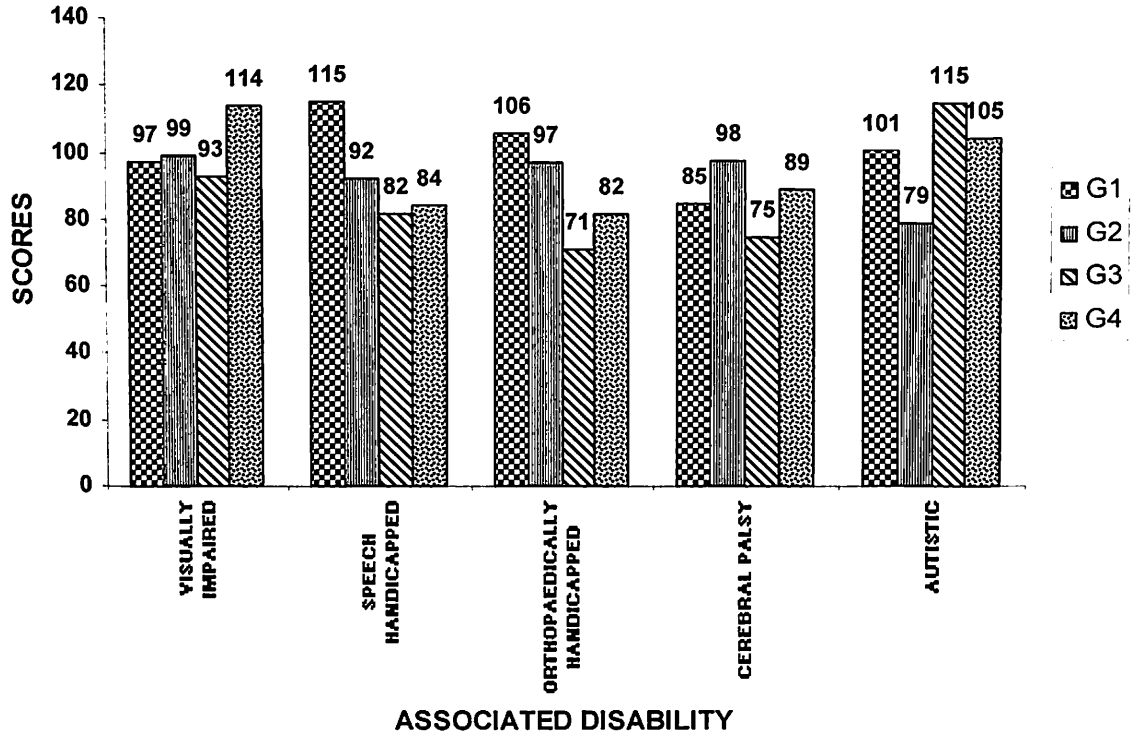
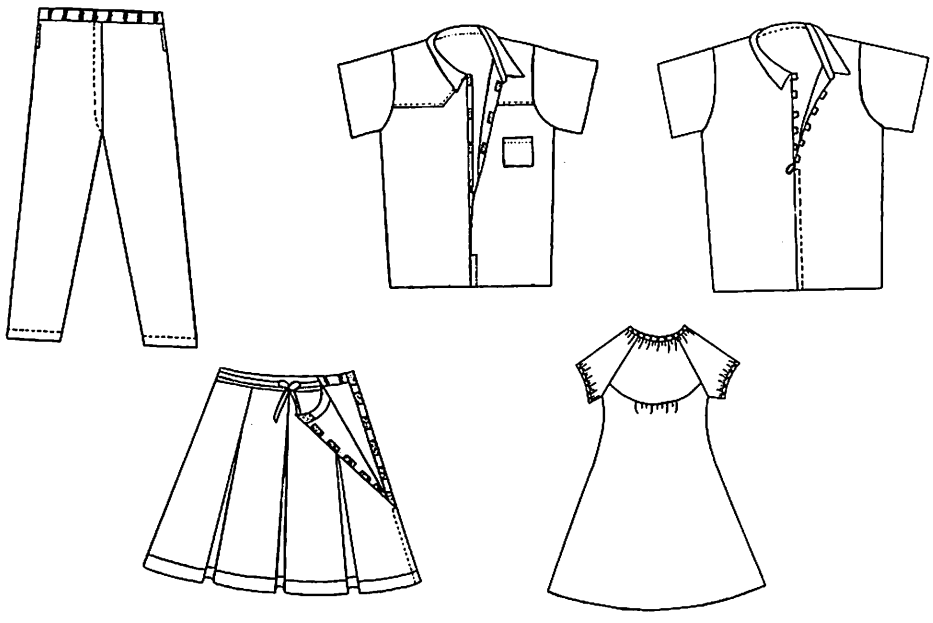


Fig 3 Evaluation of Sketched Designs



Scoring method was used for the evaluation of the designs and the preferred designs were fabricated for five mentally retarded respondents each with 1 associated disability. Thus, 5 designs which scored the highest marks were constructed.

The garment (trouser) is made of denim fabric. The garment is made with elasticized gathers at the waist instead of hook and eye. The fly is permanently stitched for ease of donning and doffing.

The garment (shirt with a yoke) was made for mentally retarded child having speech problem as the associated disability. The shirt had a yoke i.e. double layer of fabric which does not allow the saliva dripping from mouth to come in contact with

the body. Apart from this Velcro is used as fasteners instead of button and button hole in centre front. ¼ portion of the centre front is permanently stitched for ease in doffing and donning.

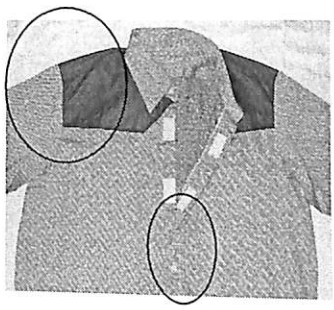
The garment (shirt with a zipper in centre front) is half sleeved shirt. Half part of the centre front is permanently stitched and rest half part consists of zipper. This was done for ease in undressing & dressing.

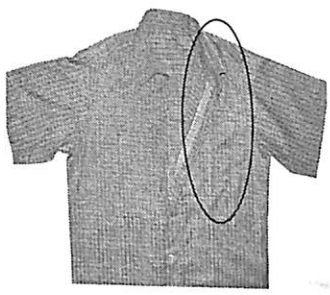
4. The garment is a skirt with inverted box pleats in front. Elasticized gathers was made at the back for better fit. A bow is made in front for identification of front. The skirt was half way stitched and velcro was given as a fastener on the remaining half portion at the side, this made the task of doffing & donning easy to the wearer.
5. The garment is a kurti which was made for mentally retarded girl having Autism as the associated disability. The kurti consist of a yoke in front with gathers which gives fullness to the garment. The neck and sleeve hem is elasticized and hence the wearer found it easy in donning and doffing.

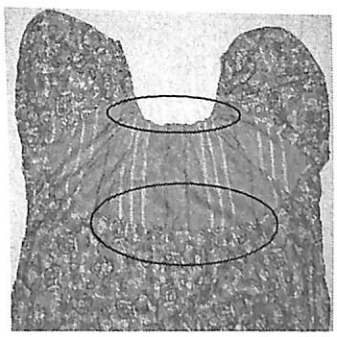
The respondents were given garments to wear for 10 days. Each feature in the garment was scored and the total score was obtained through which the acceptability of the garments were assessed (Table 5).

Table 5: Acceptability of Functional Garments

S.No.	Garment Code	Functional Features	Score of each feature	Total Score	Acceptability
1.	**$MRVIG_4$**	Elasticized gathers	90	90	H.A.
2.	**$MRSHG_1$**	Yoke	45	90	H.A.
		Velcro	45		
3.	**$MROHG_1$**	Fasteners	90	90	H.A.
4.	**$MRCPG_2$**	Elasticized gathers	20	80	H.A.
		Velcro	30		
		Pleats	30		
5.	**$MRAUG_3$**	Elasticized gathers	30	70	H.A
		Yoke	20		
		Gathers	20		







Conclusion

It may be inferred from the present study that most of the respondents were facing problems in undressing and dressing. Most of the respondents face problem in manipulating fasteners, identification of wrong and right side and difficulty to take off and put on the garments. Lack of mental ability was the main factor for not dressing independently. Keeping in mind their problems, some garments designed with self help features, which were easy to wear and were appropriate for the disability, in such a way that they were helpful in donning and doffing making them self dependent up to most extent.

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A Study on Acceptability of Jute Fabrics for Diversified Household Textiles

Saadgi Chowdhury and Deepali Singhee

ABSTRACT

Jute known as the golden fiber once dominated the world market as a packing material. However, with the introduction of the more user friendly synthetic fibers, the demand for jute declined significantly. Today, jute as a fibre with its several advantageous properties can be popularized as consumers are demanding eco-friendly and natural products. The fibre can thus be promoted through diversification and value addition of products made from it. The current research work is thus an endeavor in support of the diversification initiative of the jute industry. Diversified products in the form of table-mats and table-runners that require less fabric unlike the full-length table cloths have been made from decorative jute fabrics along with value addition of the same using printing (block and screen) and embroidery (appliqué) techniques to improve its consumer acceptability. The edges of the mats and runners were sealed/finished either by using a full-length facing (backing) or a short border on the edge. The raw edges in some mats were protected through lamination / encasing in a plastic film (jacketing). A detailed consumer survey was undertaken through a questionnaire prepared for the purpose to scientifically explain the consumer behavior as well as their opinion and their preference for the products developed. The data with respect to the consumer's responses were statistically analyzed using ANOVA test wherever applicable. 82% of the respondents knew about the presence / availability of traditional and more popular products made from jute. Comfort and fashion consciousness were the two important guiding factors guiding buying behaviour of the prospective consumers surveyed. Statistically significant difference was found between the acceptability of different techniques of finishing used for the table-mats among the respondents as indicated by the ANOVA test. The consumers preferred latticed and floral appliqué designs over the other for both table-mats and table-runners. The selected group of consumers preferred only table-mats over combinations of table-mats with matching table-runners as sets. They preferred highly ornamented jacquard fabric over the simpler fabrics for table-mats . The table-runners made from jute fabrics was acceptable to the respondents who found them better than full length table-cloths.

Keywords: ANOVA, Appliqué, Block Printing, Consumer Behaviour, Jute, Jacketing, Lamination, Screen Printing, Survey, Table-mat, Table-runner

Introduction

Jute was known as the golden fiber and once dominated the world market as a packing material, carpet backing and industrial textiles. However, with the introduction of the more user friendly synthetic fibers, the demand for jute declined significantly. Today jute as a fibre with its several advantageous properties can be popularized as consumers are demanding eco-friendly and natural products. The fibre can thus be promoted through diversification and value addition of products made from it. The current research work is thus an endeavor in support of the diversification initiative of the jute industry.

Methodology

Preliminary Study

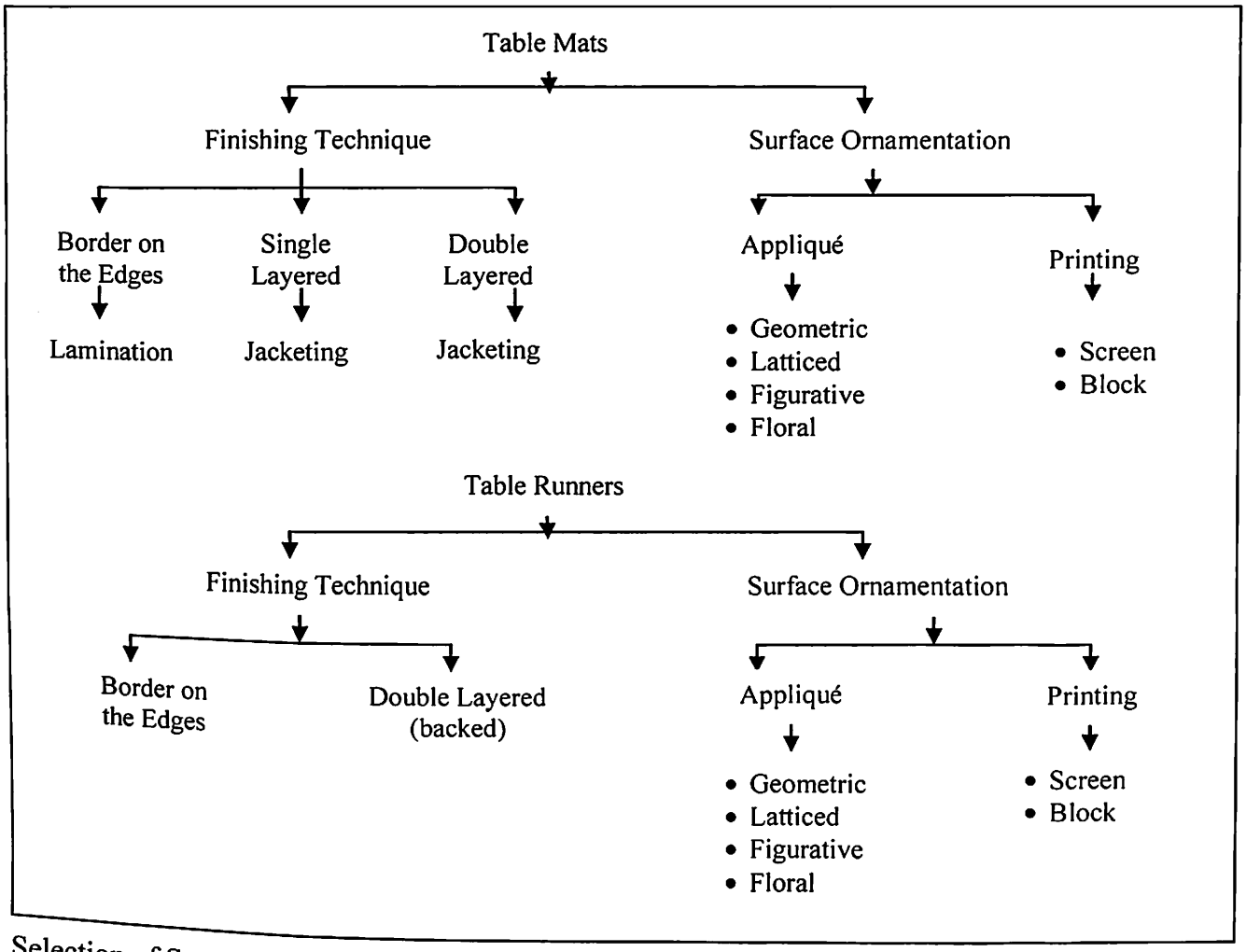
A preliminary informal study was undertaken to investigate the type of jute products and to explore the various types of decorative jute fabrics suitable for this study available in the local markets. The various specifications of the fabrics selected are as follows:

Table 1: Specifications of various Jute Decorative and Plain Fabrics

Fabric Property	**Decorative Fabrics**	**Plain Fabrics**
Fabric Density	26-36 Warp & 14-24 Weft	15-22 Warp & 14-18 Weft
Fabric Weight (in g/m^2)	346 - 407	259 - 335
Fabric Thickness (in mm)	1.33 - 1.63	0.77 - 0.91
Crease Recovery (in Degrees)	127 - 180	129 - 134
Flexural Rigidity (in mg.cm)	0.12 - 0.86	0.36 - 0.51

Products Developed

Various types of jute-table mats and jute-table runners were made from jute / jute-cotton union decorative fabrics in conjunction with or without matching coloured hessian fabrics. The following chart indicates the various products that were developed.



Selection of Sample Group

A group of 60 respondents were selected randomly with an attempt to maintaining similar number of students, housewives and professionals. No distinction was made between the males and females respondents who varied in their age groups and family monthly income. A structured questionnaire was prepared for the collection of relevant data.

Collection and Analysis of Data

The various table-mats and table-runners prepared were displayed systematically along with the codes mentioned on each product. The respondents were requested to give their feed-back through the questionnaire. The collected data was analyzed using average percentage and ANOVA.

Results & Discussions

General purchasing behavior of the respondents

Fig. 1 shows the general purchasing behavior of the respondents. Among the guiding factors related to the product, the respondents rated the various factors in the following order of preference:

Comfort > Aesthetics > Utility > Price > Serviceability > Ease in care > Environmental concern

This shows that the respondents who were mostly working women preferred the factors contributing to comfort and utility apart from the aesthetic look of the product while shopping. They cared less for the durability of the product or for the impact it had on the environment.

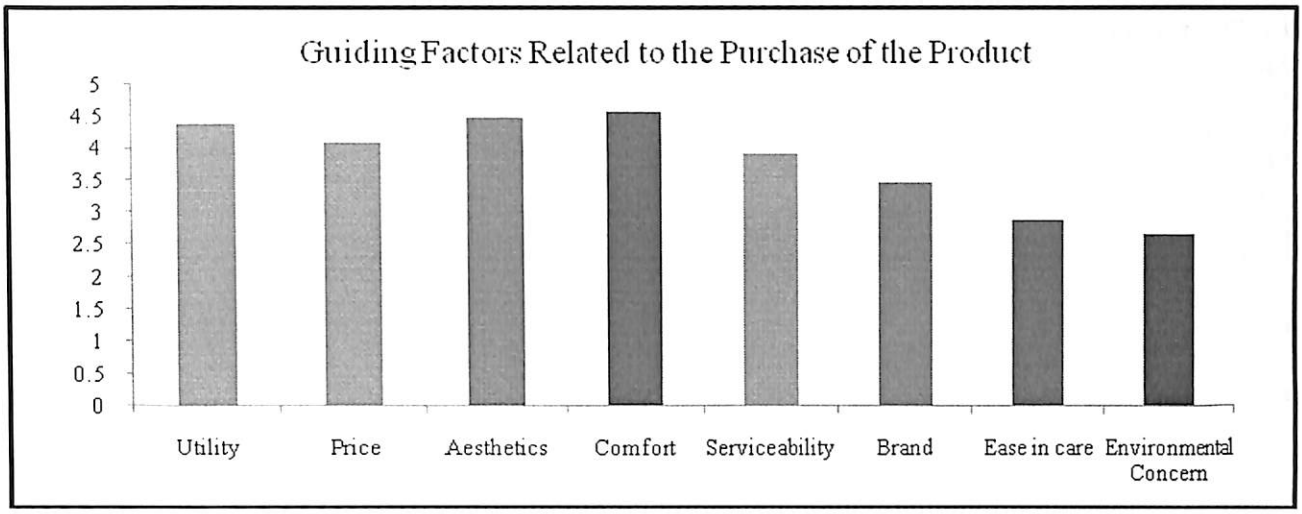


Fig 2 Awareness of the respondents regarding products made from jute (in terms of percentage)
1) Ropes and cordages; 2) Sacks & gunny bags; 3) Shopping & fancy bags; 4) Clothing & footwear; 5) Household furnishings & floor coverings; 6) Soft luggage; 7) Packaging; 8) Automotive textiles; 9) Geo-textiles & civil engineering; 10) Agro textiles, 11) Building & construction materials (jute composites) including furniture; 12) Industrial uses (like filter fabrics); 13) Materials used for environment protection (tarpaulins); 14) Decorative household handicraft items; 15) Apparel wear (sari, scarves, etc)

Preference of jute based decorative fabrics

It was found that there was no statistical difference between the respondents' preference for the different fabrics at 5% level of significance. This result implies that though the respondents' preference (in terms of a total score of five) of the jute decorative fabrics were different, the variations in the scores are statistically significant.

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F (Computed)	F (Tabulated)
Between Fabrics	0.88	5	0.176	1.017	2.53
Error	4.14	24	0.173	-	-
Total	**5.02**	**29**	-	-	-

Reasons for purchase of table runners

As indicated by Fig 3, instead of preferring the table-runners for its use of less fabric, the respondents rated aesthetics and purpose as reasons for preferring table-runners. Table runners would be able to protect the table tops and would be a better option than a full length table cloth.

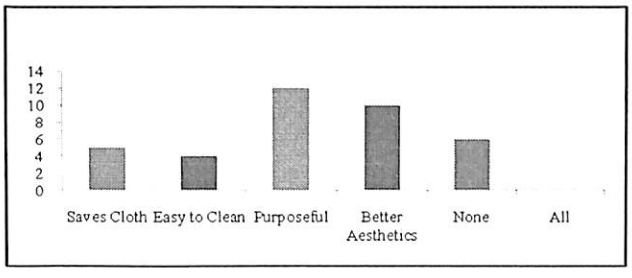


Fig 3 Reasons for preference of table-runners developed (in terms of actual number of responses)

Preference of finishing technique used for table mats and runners

Mats and runners finished with a border on the edge preferred more than the backed ones.

Finishing Techniques	Average Scores (Out of a total score of 5)
Table Mats	
Edging on the borders	4.07
Backing	3.39
Table Runners	
Edging on the borders	4.35
Backing	4.17

Preference of ornamental methods for table mats and runners

It was found that for both the developed products i.e., table mats and runners printing was preferred over appliqué as an ornamental method (Fig 5).

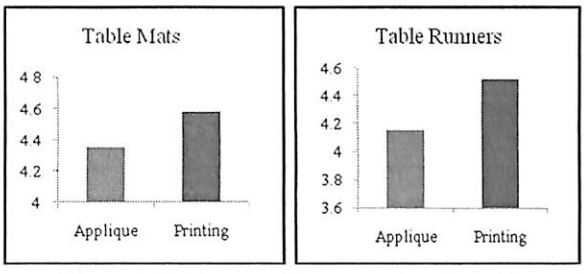


Figure 5: Preference of ornamental methods for Table mats and runners.

Preference of printing technique

It was found that for both the developed products i.e., table mats and runners screen printing was preferred over block printing technique (Fig 6).

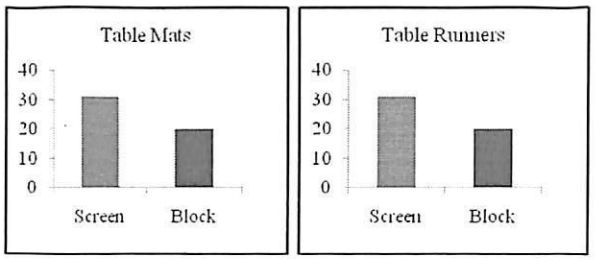


Fig 6 Preference of printing technique for table mats and runners (in terms of actual number of respondents)

Preference of appliqué designs

Fig 7 showcases the responses regarding the preference of the different designs and colours used for the appliquéd table-mats and table-runners. The respondents favoured the latticed / network design the most followed by floral design, geometrical and figurative design for both the product developed.

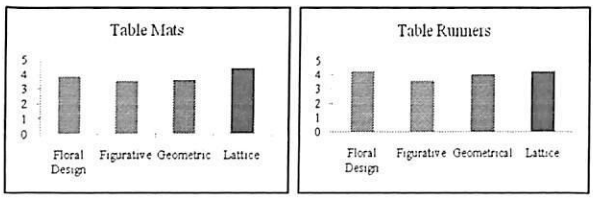


Fig 7 Respondent's responses with regards to the appliquéd designs developed for table mats and runners (in terms of average scores out of a total score of five)

Study on sets of mats with matching runners

There is no significant difference between the acceptances of only table- mats, only table-runners and both table- mats and table-runners as combined set. This implies that there is no statistically significant difference between the acceptability of the different techniques of finishing and surface ornamentation.

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F (Computed)	F (Tabulated)
Between Techniques	0.2247	3	0.0749	0.52	4.76
Between Selection	0.30	2	0.15	1.042	5.14
Error	0.865	6	0.144	-	-
Total	**1.39**	**11**	-	-	-

Conclusion

Respondents had limited awareness about non-conventional jute products.

Respondents found table-runners made from jute fabrics better than full length table cloths.

Although sets of table-mats with matching table-runners were appreciated, majority of the respondents preferred only table mats.

They preferred highly ornamented jacquard fabric over the simpler fabrics for table-mats, preferred only table-mats.

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Innovation of Bengal Batik as a Technique of Textile Printing

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ABSTRACT

The objective of the study was to develop new designs for Batik of Bengal, which is seeing a decline in its demand. After studying the existing designs available in the market, twenty new designs in a new colour range were developed using cold reactive dyes, unlike azoic dyes being used currently by the craftsmen. A survey was conducted to find the acceptability of these designs as compared to the existing designs. For this a sample of ninety females was obtained by purposive sampling. The Batik textiles surveyed were divided into different categories- I- old designs in old colours, II- old designs in new colours, III- new designs in old colours and IV- new designs in new colours. Five T-shirts were also developed. The results showed that new designs in new colours were rated the highest. The survey also showed that almost half the respondents did not have any idea about the craft. Majority of them preferred to choose Bandhani and Block printed textiles over Batik. The respondents gave most importance to aesthetic appeal and colour along with comfort while purchasing textiles. The colour fastness to washing and rubbing were also assessed and found to be good and very good respectively.

Keywords: Batik, Cold Reactive Dyes, Design, Resist Printing

Introduction

BATIK is one of the ancient methods of printing fabric in India. It is a resist technique which involves the process of blocking out areas of the fabric, by the resist so that they do not accept dye/ colour. In Bengal wax is used as the resist. Santiniketan in West Bengal, Chola Mandal and Swallow, a Swedish organization in Chennai are the key centres in India where Batik is practiced by eminent artists[4]. It is also practiced in Indonesia, Malaysia, Japan, China and some other South Asian countries.

The main drawback of Bengal Batik is that mainly azoic dyes are used for Batik as it is quick and easy to use, but azoic dyes are toxic in nature and hence harmful to the environment. The shades are restricted to yellow, oranges, reds, maroons, browns, navy blue and black. Azoic do not cover bright shades of greens, blues, turquoise and violet[3]. In other classes of dyes, mixtures of dyes produce a colour which can be predicted. But when cotton is treated with a mixture of two napthol and then developed in a solution containing two diazotized bases, the resulting colour may not be the one expected from the individual components[6]. Another drawback of Bengal Batik is its designs which are limited to cracks, alpana patterns and images which have been repeating over the years with just a few changes. Batik has also failed to establish itself either in the religious or in the social life of the country, unlike Indonesia where it is worn on religious as well as political occasions and is also believed to have spiritual powers[5]. Indonesians have constantly nourished and patronized the art. In India, the tie dyed Chunari has always been a part and parcel of rituals like marriage. Batik on the other hand has never enjoyed such specific demand[1].

In order to overcome the limitations of colour, other dye class can be used which has more shades available and are easy to use. The existing designs can be modified and new designs developed in order to bring innovation to Bengal Batik.

Methodology

Survey of the market

A market survey was carried out to study the demand and popularity of Batik products and the range of designs and colours available. The data was collected by the interview method. Retailers of 10 stores dealing in Batik fabrics were interviewed and samples available in the market were collected.

Design development

Geometric and floral patterns were developed for the study. The designs were classified into four categories:

Existing designs with existing colours:

In this category, readymade Batik samples were used. 5 different samples with traditional designs and colours were purchased from the market. This category was used so as to do a comparison between the preferences towards old and new patterns.

Existing designs with new colours:

In this category, 5 samples were made. The designs were the same as the previous category, i.e. traditional designs. The colours were modified. Shades available in cold reactive dyes were used.

New designs with existing colours:

In the third category, 10 new designs were developed with existing shades of colours that were available in the market.

New designs with new colours:

In the fourth category, 10 new designs were developed with new shades using cold reactive dyes.

Five Designs were chosen for making T shirts.

Experimental work:

Materials:

The raw materials used for the preparation of Batik samples were as follows:

Substrate: Mercerized and bleached cotton fabric (poplin and cambric) were chosen as the substrate for the test.

Dyes: Cold reactive dyes were selected.

Wax and resin: Bee's wax mixed with resin (9:1 ratio) was used as the resist[1].

Method:

After the selection of the raw materials, the Batik samples were prepared. The cotton fabric was first desized using a standard recipe[7]. Then the designs were traced on the fabric and T shirts with the help of carbon paper.

Bee's wax and resin in the ratio 9:1 were used for the preparation of Batik samples. The wax was taken in an aluminium bowl and melted by indirect heating. Once the wax was completely molten, it was applied, by means of brushes onto the fabric and T shirt, according to the design. After the fabric and T shirt was waxed, they were dyed with cold reactive dyes using the recipe (as provided by the dye manufacturer).

For samples which had two colours, the above processes of waxing and dyeing were repeated. The substrate was re waxed in portions where it was already waxed earlier, as well as places where the first dye colour was to be retained. It was then dyed in the second colour. The process was repeated for samples where the third colour was required.

Once the dyeing was complete, the samples were immersed in hot boiling water containing sunlight soap flakes. The substrate was held with tongs and dipped into water and taken out. The process was repeated until all the wax got removed. The substrate was then washed in running water, squeezed and dried.

Testing of the fabric:

The dyed samples were then tested for its colour fastness to wash and rub. Test III method based on ISO 105/C-1982 was used for wash fastness. Crock meter (wet and dry) test method based on ISO 105/D-1982 was used for rub fastness. The fastness was assessed using the grey scales as specified in IS 768:1982 and IS 769:1982. [2]

Consumer Survey to find acceptability of developed designs:

The questionnaire method was chosen for the collection of data. A survey was conducted taking 90 female respondents and 4 experts by the purposive method of sample selection. Equal numbers of respondents were selected from three age groups of 16-25 years, 26-45 years and 46-65 years.

Data interpretation:

The data collected, was processed and analysed using the technique Analysis of Variance (ANOVA). Since in this case, the difference in acceptance of Batik with different colours and designs was to be tested, a two-way ANOVA was taken. After testing the null hypothesis by ANOVA technique, a pair wise comparison was done, between categories I and II i.e., existing designs with existing colours and existing designs with new colours, to find the impact of new colours on acceptance by the respondents, and categories I and III i.e., existing designs with existing colours and new designs with existing colours, to find the impact of new designs on acceptance by the respondents.

Results & Discussions:

Result of the market survey

10 retailers dealing with Batik fabrics were interviewed and asked about the demand/sales for Batik and its popularity as compared to other techniques. They were also asked about the designs and colours available in Batik and whether any kind of modifications in colour and design would help in increasing the demand for the craft. The results showed that the demand for batik was low and the popularity had also decreased from before. According to the retailers other traditional techniques like Bandhani and block print were more popular as compared to Batik. Regarding changes in Batik, most of them thought that a change would definitely be appreciated.

Results of colour fastness:

The wash fastness of the Batik samples dyed with cold reactive dyes was found to be between excellent to very good. The rub fastness was found to be good. Conventionally Azoic dyes are used for Batik in Bengal. Azoic dyes possess excellent wash fastness but poor rub fastness. Thus it is seen that use of cold reactive dyes not only widens the colour range for Batik, it also gives better colour fastness property.

Results of the Consumer Survey:

It was observed from the data that, more than half the respondents (57 per cent) knew about Batik out of which 42 per cent knew specifically that it is a resist method of dyeing. 43per cent had not heard about Batik at all. It shows that being residents of Bengal, the awareness about the traditional craft of the State, among the people is low.

The survey also showed that Bandhani was the most popular technique. Almost 60 per cent of the total respondents choose Bandhani, showing how popular the craft is among people of Kolkata, despite it being a traditional art of Rajasthan. Given a choice most of the people would choose Bandhani followed by Block printed textiles. Only a few people had preferred Batik over the other techniques.

From the data it was observed that most of the people wanted a change in design followed by a change in colour. Only 24 per cent of the people did not want any change in the existing ones.

It was also observed that colour, aesthetic value and comfort were the prime and equally important attributes during purchase of textiles. Cost and durability aspects were also kept in mind by the respondents, but the major importance was given to the aesthetics and comfort.

To determine whether the four different categories of designs were equally preferred by the respondents, ANOVA statistical analysis was used.

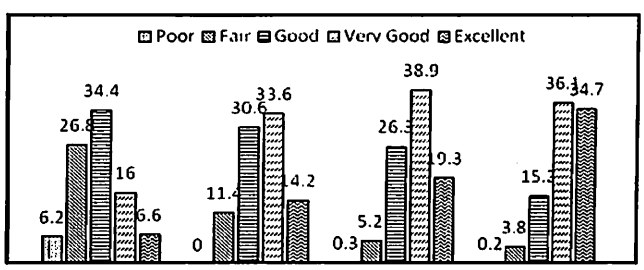

Figure 1: Distribution of the respondents on the basis of scoring of the four categories.

Results showed that the Null Hypothesis was rejected, i.e. four different categories of designs were not equally preferred by the respondents. The category with new designs and new colours was most preferred by the respondents. (FIGURE 1)

Pair wise comparison showed that category I and II were significantly different. Category II had been more preferred than category I. This implies that given the same designs, new colours were more preferred by the respondents.

The second pair wise comparison between category I and III showed that type I and III were significantly different; category III was more preferred than category I. This implies that given the existing colours, new designs have been more preferred by the respondents.

For the T-shirts, it was observed that 44per cent of the respondents found the T-shirts to be very good, while 29per cent found them to be excellent and the rest thought them to be good, while a very few thought them to be fair. It shows that on an average, the idea of Batik technique on T-shirts was well accepted by the respondents. The overall preference of Batik on T-shirts was between good and very good. The idea was also liked by the experts.

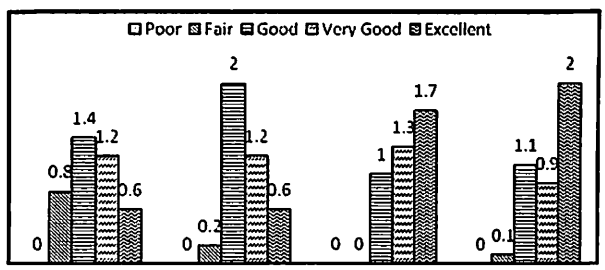

Figure 2: Distribution of experts on the basis of scoring of the four categories.

It was observed from the data (FIGURE 2) that the Batik samples with new designs and old colours was the most preferred by the experts. There was not much difference in the preference of existing designs with old colours and with new colours. The response was almost same for both I and II category. However, the acceptance of the III and IV category was very good.

Conclusion:

It was observed that colour, aesthetic value and comfort were the prime and equally important attributes during purchase of textiles. Most of the retailers thought that a change in existing Batik would definitely be appreciated. The same was observed from the respondents' data, who wanted a change in design followed by a change in colour. Results of the study showed that the category with new designs and new colours was most preferred by the respondents. Given the same designs, new colours were more preferred by the respondents and given the existing colours, new designs have been more preferred by the respondents.

It may thus be concluded that a change in the design of Batik fabrics may result in improving its demand, which is less than other traditional textile printing techniques like Bandhani and Block.

It was also seen that the use of cold reactive dyes not only widens the colour range for Batik, it also gives better colour fastness property.

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