Research Reach

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RESEARCH CENTRE
College of Home Science Nirmala Niketan,
49, New Marine Lines,
Mumbai 400 020
nnrc.researchreach@gmail.com

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Mumbai – 400 020.

For subscription to the journal and other particulars, kindly contact:

The Director
RESEARCH CENTRE
College of Home Science, Nirmala Niketan,
49, New Marine Lines,
Mumbai – 400 020,
India

Email: nnrc.researchreach@gmail.com
Website: nirmalaniketan.com
Tel. no: 22076503 / 22007544

Editorial

New Year 2016! The *'sweet sixteen'* has arrived with a big bang with promises of fulfilling hopes and dreams. Meanwhile, at the Research Centre, we have more than just one reason to celebrate – Research Reach Journal of Home Science has completed 15 years of its existence. We look back and thank all the people who have made this journey a success, which includes our subscribers, authors, reviewers, editors, administration and staff. The journal has extended its services by introducing newer sections such as the list of theses submitted to the different Universities by the Master's and Doctorate students apart from the educational quiz from different specialisations in Home Science.

This issue begins with Dr L S Saraswathi's review of research studies conducted in the field of Nutrition which has pointed out the lacunae in certain sub-areas of research and suggested more studies in the influence of the media on awareness. Two research papers from the field of Textiles and Fashion Technology present the unique blends and finishes that improve strength and antimicrobial properties. Both make use of natural materials and attempt to reduce the use of chemical compounds that are damaging to the environment during processing. The third paper presents evidence of an association between birth weight and cognitive abilities in adolescents, combining methods used in Nutrition and Child Development. The two papers on Food Product Development make use of different processing methods and ingredients to improve the nutritive value of foods, with the added benefits – one on addition of soya okara in bread and the other on malting and incorporation of pulses to improve the taste and nutritional content of a *sattu* recipe.

The 68th UN General Assembly declared 2016 the International Year of Pulses (IYP) with the aim of creating the public awareness of the nutritional benefits of pulses as part of sustainable food production aimed towards food security and nutrition. The journal wishes to publish the research work carried out on pulses, legumes and oil seeds by the nutritionists. In this connection, research articles are invited for the next issue to be published in July 2016.

Chief Editor,
Dr G Subbulakshmi

INSTRUCTIONS TO THE AUTHORS

We're in the process of updating our Journal of Home Science! Everything goes one step at a time. At present, our focus is to improve the quality of our writing and the articles. Do take a look at our **revised instructions to the authors**. We hope that with the improved clarity, authors will have an easier time formatting their manuscripts for RESEARCH REACH.

RESEARCH REACH – Journal of Home Science, is a peer-reviewed journal registered by the National Institute of Science Communication and Information Resources (ISSN 0974 – 917X). It is a bi-annual publication from the Research Centre, College of Home Science, Nirmala Niketan, 49, New Marine Lines, Mumbai – 400020. The journal invites previously unpublished original articles and review articles from students, faculty and researchers in the fields of Nutrition and Dietetics, Human Development, Home Science Extension Education, and Textile Sciences.

On submission to RESEARCH REACH, the manuscript (original paper) or review will come under the ownership of the journal. RESEARCH REACH reserves the right to edit the manuscript for grammar, consistency and clarity without additional permissions from the author. No changes will be made by the editors in the content or data. A copy of the edited document will be sent to the author for approval and for clarifications/corrections. The author is required to respond within 5 working days via email or through telephonic conversation.

1. Peer review policy

RESEARCH REACH has a double-blind reviewing policy. This means that the names of the author and reviewer are withheld from each other to prevent bias. The reviewers assess whether the study is relevant, has followed ethical guidelines, and designed appropriately. They may raise questions on the methodology, interpretation of the data, statistical analysis, etc. if necessary. The acceptance of a paper is dependent on the comments provided by the reviewer.

2. Acknowledgement and Conflict of Interest

Acknowledgements must appear at the end of the manuscript, after the conclusion. Authors must declare any conflict of interest in a separate section after the acknowledgements.

3. Funding source

All manuscripts must be submitted with details of the funding agency and the grant number. If the study is supported by multiple grants, all must be listed in this section after the

acknowledgements. In case the research is not supported by any grant, this must be stated in a single sentence.

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Kindly note: Hard copies (printed version) of the paper *without* the matching soft copy will NOT be accepted.

6. Title Page

The Title Page must begin with the title of the manuscript in bold, uppercase, followed by the names of authors in font size 12, and the highest degree obtained by them written next to the names. Use superscripts next to the name to refer to the author affiliations. The names of the organisation, email id, and the departments may be presented in a list. The corresponding author's affiliation must be accompanied by the complete postal address, email id, and telephone number (office/residence and mobile).

7. Abstract

The abstract should start on a new page. This page must also have the title of the paper. The abstract must be between 150–250 words; it must have an introduction, describe the aim of the study, the methods, the results, and a conclusion. Please provide 3-6 keywords at the end of the abstract.

8. Body of the manuscript

Research papers: 8-12 typed pages including abstract, tables, figures, and references (Times New Roman, size 12 and spacing 1.15).

Review articles: 15-20 pages (Times New Roman, size12 and spacing 1.15).

Short papers: 2-5 typed pages about a minor project such as but not limited to product development.

Case reports: 1-2 typed pages about a unique case study comprising of a summary, background, case presentation, investigations, diagnosis, treatment, outcome and follow-up, discussion, and references. Images, if any, will be included within the two pages.

The manuscript must begin with an introduction which can describe the background and purpose of the study. This must be followed by a section on Materials and Methods. This section may be divided into subsections if necessary. The Results and Discussion must be combined. Avoid describing the table in the results. Rather, use the space to explain trends in the data and associate it with your hypothesis. Finally, give your concluding statements in the Conclusion section.

Review articles must include a summary at the end of the manuscript, of not more than 200 words.

9. Writing style

The whole paper must be written in British English. Numerals between one and ten must be spelled out. Do not begin a sentence with numerals. When using abbreviations, expand the term in the abstract (if the term is to be repeated within the abstract) and at the first mention within the body of the manuscript. Maintain consistency in the use of units. Use internationally accepted short forms of units. Use of kilocalories (Kcal) for energy is encouraged.

10. References

The references must contain the names of the original authors or editors, the year of publication, title of the article, names of journal/book, volume and issue or edition, and page numbers.

For journal references:

Palermo M, Pellegrini N, Fogliano V. (2013). The Effect of Cooking on the Phytochemical Content of Vegetables. Journal of Science Food Agriculture. 94 (6): 1057–1070. DOI: 10.1002/jsfa.6478.

For Book References:

- Wheless JW, Ashwal S. (1999). The Ketogenic Diet (ch.45). In: Swaiman KF (ed). Pediatric Neurology- Principles and Practice. Stephen Ashwal/ Mosby, 719–728.

For Web references:

- Cammans J. (2006). Nutrition, Health and Related Claims. Accessed from http://www.health.sa.gov.au/pehs/Food/survey-health-claims-jan07.pdf. Accessed on 11th Jan 2009.
- Food Colours – A Survey of Artificial Colours in Foods and Beverages. (2005). Accessed from http://www.health.sa.gov.au/pehs/Food/report-food-colours-nov05.pdf. Accessed on 25th April 08.

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For clarity, the figures, diagrams in the paper should be in grayscale or black and white format or drawn using excel program. Avoid coloured graphs.

Give appropriate titles to the tables and figures, and number them using Arabic numerals. All abbreviations in the table must be expanded under the table. Preferably add the units in the column/row headings. Column headings should be brief. The values in the table should be rounded-off to two decimals places or less. All significant values must be accompanied by an asterisk (*) and the asterisk must be explained below the table. Avoid duplication of data as Figures and Tables. Figures must be of good quality and high resolution. The journal will print the images only in black and white. Please acknowledge the original authors/owners of the image or table, if any.

12. Ethics and Study Participants

All studies involving the use of human participants and animal experimentation must comply with the principles of ethics and laws governing their use in research. Certificate of ethical clearance must be provided whenever requested by the journal.

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RESEARCH IN HOME SCIENCE HIGHER EDUCATION: AN OVERVIEW

L. S. Saraswathi
Home Science Extension Education Expert, Freelance Researcher, Chennai.

INTRODUCTION

Home Science as a field of academic study in higher education in India began in the 1940s. Rapid expansion was seen in 1950s and, between 1955 and 1962, there were 37 colleges and departments of Home Science in eleven universities granting degrees. Thanks to the vision and perseverance of some of the pioneers and the birth of the Home Science Association of India in the early 1950s, the field of Home Science grew at all levels of education. In the 1960s, several colleges and universities started a master's programs in the various fields of Home Science. Around the same time, the introduction of a department, a college, or a faculty of Home Science as a unit in Agricultural Universities was yet another direction in which Home Science education spread. Courses in Extension Service in Home Science at those universities were supported by the Directorate of Extension under the Ministry of Food and Agriculture. Strengthening the staff of a number of colleges and universities offering Home Science was supported by the Technical Cooperation Mission, also known as International Cooperation Mission, in the 1950s and The Ford Foundation in the 1960s and 70s.

Research in the various areas of Home Science was given importance by initiating the master's students into the process of research by making dissertations a part of their course completion and also by introducing research-based Ph.D. programs.

This short history of Home Science as an academic field with a focus on professionalism through **'research'** arouses a natural curiosity of any professional to get at least a glimpse of the total research scenario of Home Science in higher education. This triggered an interest in the author of this paper to find a way (though not rigorous) to have an overview of research in Home Science higher education.

The **purpose** of this review is to present a holistic picture of research in Home Science higher education in order to:

(a) Gain clarity about the Home Science research at the Ph.D. level with regard to each of the five major areas of Home Science as an academic field and also all the five areas put together;
(b) Take a critical look at the research scenario regarding each major area through relevant questions;
(c) Identify pointers for future directions for research in Home Science higher education.

METHODOLOGY

A desk research was conducted in which Ph.D. research titles in Home Science in the **'University News'**, a weekly chronicle of Higher Education published by the Association of Indian Universities, New Delhi, were listed for a period of 12 Years (1991–2002). This was considered as an authentic source of relevant information as most of the research at Ph.D. level gets listed in the University News.

These twelve years' data were taken as a sample for getting a glimpse of the research scenario in higher education in Home Science. This period was considered because it could give us a more stable picture as two decades had passed since the introduction of Ph. D programs in almost all the five major areas of Home Science. One can expect the research gaining momentum after initial years' experience giving the departments and colleges of universities confidence in initiating and guiding relevant research programs in each of the five major areas.

The limitations of this review include:

- The list may not be all inclusive. Some studies may not have found a place in the list.
- The study is limited to a 12 year period which could only be taken as a Sample.
- The classification of the study titles according to the major areas, though clear in most of the titles, could be an issue when the titles are too general. Also the major areas are not mutually exclusive as Home Science is an applied field with a focus on quality of life in the home.

The steps in preparing data for this study were as follows:

1. A list of all the studies listed under the academic field of Home Science in the 'University News' for the twelve years specified earlier was prepared.
2. The list was classified according to the major areas of Home Science, namely, Foods and Nutrition; Home Science Education and Extension Education; Child Development and Family Relations; Home Management; Textiles and Clothing. (The author is aware of the change in the nomenclatures of the five areas as Food Sciences and Nutrition; Extension and Communication Management; Human Development and Family Studies; Resource Management and Consumer Sciences; Apparel and Textiles). The original names are retained in this study.
3. The base data thus obtained were analysed for:
    - The total number of Ph.D. level studies in each major area;
    - Number of studies according to the years for the twelve year(s) studied;
    - Number of studies according to the Universities granting the degrees.

The contents of the studies were further classified according to the sub-areas of each of the major area of Home Science and the number of studies in each of the sub-areas were also counted. This classification is based on the data and the analyses are presented as tables for each of the major areas and interpreted.

FOODS AND NUTRITION

One of the earliest introduced and probably most opted major area in Home Science as an academic field has the largest number of Ph.D. research for the 12 year period studied. It contains a total of 90 studies (42.65 %) of the total number of studies (211) in all the five areas together (Table 1).

Table 1: Ph.D level research studies in Foods and Nutrition

Year	Number
1991	05
1992	08
1993	08
1994	01
1995	02
1996	04
1997	12
1998	09
1999	06
2000	04
2001	10
2002	21
Total	**90**

A year-wise analysis of the number of Foods and Nutrition studies show variations from one year to the other. The range is quite wide from one study in the year 1994 to 21 studies in the year 2002. If analysed in terms of every three years, 1991–1993 shows 21 studies; 1994–1996 only 7 studies; 1997–1999 with 27 studies; and 2000–2002 with the maximum of 36 studies. Ignoring the 1994–1996 period, which is a lean period, there appears to be an increase in the number of studies done for the doctoral program during the rest of the nine years. The year 2000–2002 shows a fairly large number of studies, indicating a growing interest and popularity of this area.

The reason for the low number of studies in 1994-1996 could be due to a reduction in enrolments for Ph.D. in the earlier years; students taking longer period for completion of their studies; or constraints due to the lack of availability of faculty time for guidance. This could be a point for discussion by the professionals at the university level.

Twenty-eight universities had awarded a total of 90 Ph.D. degrees in Foods and Nutrition in the twelve year period studied (1991–2002). Seventy-eight of the 90 (86.67%) of the Ph.Ds in Foods and Nutrition were given by 15 of the 28 (53.57%) universities. Thirteen of the 90 (14.44%) of the Foods and Nutrition Ph.Ds were from 13 Universities. Only seven universities (25%) brought out six or more Ph.Ds in 12 years. Another eight universities (28.6%) awarded two to five Ph.Ds in 12 years. Thirteen universities (46.4%) produced only one Ph.D. during the study period of 12 years *(Table 2)*.

Table 2: Number of Ph.D research studies in Foods and Nutrition according to the Universities/Colleges

Sr. no.	Names of the University/College	Number of studies
1.	Punjab Agricultural University, Ludhiana	10
2.	Sri Avinashilingam Institute of Home Science and Higher Education for women, Coimbatore	8
3.	Chaudhry Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur.	8
4.	Nagpur University, Nagpur	7
5.	Benares Hindu University, Varanasi	7
6.	S.N.D.T. Women's University, Mumbai	6
7.	Bangalore University, Bangalore	6
8.	Devi Ahalya Viswa Vidyalaya, Indore	4
9.	Rani Durgavati Viswa Vidyalaya, Jabalpur	4
10.	Chaudhry Charan Singh Haryana Agricultural University, Hisar	3
11.	University of Jammu and Kashmir, Jammu	3
12.	M.S. University, Vadodhara	3
13.	University of Mysore, Mysore	3
14.	Barkatullah Viswa Vidyalaya, Bhopal	3
15.	Babasaheb Bhimrao Ambedkar Bihar University, Muzzafarpur	2
16.	Pujabrao Deshmukh Krishi Vidyapith, Akola	1
17.	Vikram University, Indore	1
18.	Govt. Aadharsh Science College, Bilaspur	1
19.	Vasanthrao Naik Marathwada Agricultural University, Parbhani	1
20.	Rajasthan Agricultural University, Bikaner	1
21.	Pt. Ravishankar Shukla University, Raipur	1
22.	Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	1
23.	University of Delhi, Delhi	1
24.	Sambalpur University, Jyoti Vihar, Burla	1
25.	Saurashtra University, Rajkot	1
26.	Vinobha Bhave University, Hazaribagh	1
27.	J. N. Krishi Viswa Vidyalaya, Jabalpur	1
28.	No University name, Calcutta	1
	TOTAL	**90**

Looking at the years in which these Ph.Ds were awarded, only about 10 universities had Ph.Ds in the earlier years, that is, 1991–1995; 18 universities had Ph.Ds only in the later years, namely,

1996–2002. In the study period of 12 years, ten Ph.Ds were awarded in Punjab Agricultural University, Ludhiana and these were given in eight years. It is interesting to note that during the three year lean period of 1994–96 there was no Ph.D. from this university.

- Eight Ph.Ds were awarded in Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishva Vidyalaya, Palampur. These were given in five of the seven years (1996-2002).
- The same is true of Sri Avinashilingam Institute of Home Science for Higher Education for Women, Coimbatore.
- Seven Ph.Ds in Foods and Nutrition were awarded in Nagpur University, Nagpur. These were given in six out of the 12 year study period. No doctoral degree seemed to be awarded in the years 1993-96, 1999, and 2000 from this university.
- Benares Hindu University, Varanasi awarded seven Ph.Ds in four years, 1991-1994. There was no Ph.D. studies reported after 1994.
- Six Ph.D theses were completed in S.N.D.T. University, Mumbai during this period. These were awarded in the years 1992, 1995, 2000, 2002. In the year 2002, there were three Ph.Ds.
- Six Ph.D theses were completed Bangalore University in just four years, 1999-2002. These six Ph.ds were submitted in just two out of the four years.
- Devi Ahalya Viswa Vidyalaya, Indore, and Rani Durgavathi Viswa Vidyalaya, Jabalpur, each brought out four Ph.Ds in three years out of five years (1998-2002) in the case of the former and four years out of the four years in the case of the latter.
- Three Ph.Ds each were completed in five universities: Chaudhry Charan Singh Haryana Agricultural University, Hissar; University of Jammu and Kashmir; M.S. University, Vadodara; University of Mysore; and Barkatullah Viswa Vidyalaya, Bhopal. These Ph.Ds awarded in one year (1999) in the case of Barkatullah Viswa Vidyalaya; in two years in the case of Haryana Agricultural University (1992, 1993), University of Jammu and Kashmir (1993, 2002), and University of Mysore (1998, 2001); and inin three years in the case of M.S. University of Vadodara (1996, 1997, 2002).
- Two Ph.Ds were awarded in Babasaheb Bhimrao Ambedkar Bihar University, Muzzafarpur (1992, 1997).
- Thirteen Ph.Ds were awarded in the 13 Universities each producing one Ph.D. during the study period 1991, 1993 (2), 1996, 1997 (5), 1998, 2002 (3); Calcutta (1993); Jawaharlal Nehru Agricultural University, Jabalpur (1996); Vasanthrao Naik Marathwada Agricultural University, Parbani (1997); Rajasthan Agricultural University, Bikaner (1997); Pandit Ravi Shankar University, Raipur (1997); Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (1997); University of Delhi (1998); Sambalpur University, Burla (2002); Saurashtra University, Rajkot (2002), Vinobha Bhave University, Hazaribagh (2002).

Interestingly, among the Ph.Ds in Foods and Nutrition, 25 out of the 90 Ph.Ds (27.78%) during the study period were from Agricultural Universities. There were altogether seven Agricultural Universities. The data presented suggests that:

- The universities offering Ph.D. in Foods and Nutrition may not award a Ph.D. every year. In the case of some of the universities, the gap in years between one PhPh.D and the other is wide and in others it is more frequent.
- Even the universities that brought out consistent Ph.Ds during the study period did have a gap in the years 1994–95. The reason is worth investigating.

- It is not clear in which year the Ph.D. program started in each of these 28 universities. In Benares Hindu University, there were seven Ph.Ds in four years (1991-94) and none after 1994. In Babasaheb Ambedkar Bihar University, Muzzafarpur, the two Ph.Ds were awarded in 1992 and 1997 and none after that. These findings raise several issues of importance:
- Do we have a list of Universities offering Ph.D. program in Foods and Nutrition in India?
- Do we know the year in which the Ph.D. programs were started in each of these universities?
- What are the reasons for some of the universities such as BHU awarding Ph.Ds. in the earlier years, but not having any Ph.Ds. in later years? Have they discontinued with the program? If so, why?
- What about the availability of qualified staff for guiding research at the doctoral level? Are there gaps in the availability of qualified staff? How does staff the turnover affect the students pursuing their doctoral studies?
- Who are the Home Scientist students who take up Ph.D. studies and why do they take up Ph.D. studies?
- What is the cost of a Ph.D. in each of these universities? Is it a factor in taking up studies at this level?

Table 3: Content of research in higher education in Foods and Nutrition: Number of doctoral studies according to the sub-areas of major area of Foods and Nutrition.

Sub-areas of Foods and Nutrition	Number of Doctoral Studies
1. Nutritional Status	
(a) Nutritional status of Infants and pre-school children	10
(b) Effect of nutritional measures on nutritional status	12
(c) Nutritional Status of adolescents and Young adults	03
(d) Nutritional status of women and young mothers	05
(e) Nutritional status of elderly	02
(f) Nutritional status of specific communities	03
Total	**35**
2. Foods	
(a) Nutritive value of local foods	02
(b) Nutritional evaluation of processed foods	12
(c) Effect of processing on nutritive values of foods	09
(d) Food Preservation	03
Total	**02**
3. Dietetics	28
(a) General	02
(b) Dietetics for Diabetes	04
(c) Dietetics for Anaemia	02
(d) Dietetics for Heart diseases	03
(e) Miscellaneous	05
Total	**16**
4. Foods and Nutrition Education	
(a) Education of Pregnant mothers and women	03
(b) Nutrition communication	03
(c) Education of households	01
Total	**07**
5. Cultural and Regional studies in Foods and Nutrition	04

A study of the titles of the major academic area in Home Science – Foods and Nutrition – was undertaken to understand the areas of focus of research within the major area of Foods and Nutrition. The titles of the Ph.D. research in Foods and Nutrition were classified according to their specific contents. The results are presented in Table 3. The data revealed that there were five areas in which research in Foods and Nutrition was taken up by doctoral students. The major areas identified were:

- Nutritional Status
- Foods
- Dietetics
- Foods and Nutrition Education
- Cultural and Regional Studies in Foods and Nutrition

Studies on nutritional status formed the bulk with 35 (38.9%) out of the total of 90 studies. In the area of Foods there were 28 studies (31.1%). These two areas covered 70% of the studies. The sub-area of Dietetics was found to have 16 studies (17.8%). The least focused areas were Foods and Nutrition Education and Cultural and Regional studies in Foods and Nutrition, the former with seven studies and the latter with four studies (7.8% and 4.4% respectively).

Looking at each of the sub-areas to find the focus, interesting results were observed.

1. NUTRITIONAL STATUS

The 35 studies in this area were spread over the entire span of the period of study 1991-2002. This means that the focus on this sub-area is consistent. This area was further looked into to find the focus within the area. They are:

- ✓ Ten studies on 'Nutritional status of infants and pre-school children' included studies of the nutritional status of children in specific geographic regions (Tribal areas of Chota Nagpur, Nagpur City, Jammu province, Jabalpur district); in specific agro-climatic conditions in Punjab, Bokaro and Bangalore); and in the ICDS program. One study tested a technique used in the assessment of children and two studies were specific in their assessment of protein-energy malnutrition and Vitamin A status. All these studies were completed between 1992 and 2002.
- ✓ Studies on 'Effect of Nutritional Measures on Nutritional Status' showed that three studies were general, that is, nutritional measures to improve the nutritional status and dietary patterns and its effect on nutritional status; two studies were in relation to Vitamin A consumption pattern, prevalence of deficiency and clinical trial of red palm oil; Vitamin A nutrition and immune profile of pre-school children and impact of intervention; five studies were on the effects of nutrition on the growth and development of children (mental and motor abilities, personality development); chemical composition and nutritional quality of formulated weaning foods and their effect on the growth pattern of infants; the profile of chronic infections and the nutritional status of 3-5 year old children and their growth potentials; two studies on feeding practices and nutritional anthropometry of pre-school

children of working mothers and comparative study of food habits and appetite in relation to nutritional status of normal and visually handicapped children 8-12 years. These studies were between1993-2002.

- ✓ Only three studies were on 'Nutritional status of adolescents and young adults', including an evaluation of the nutritional status and physical fitness in young athletes; the nutritional status of children and adolescents in Jammu province and energy balance studies among adolescent boys undergoing training in Vyayan Prasarak Mandal, Amravati. These studies took place in 1992, 93, and 2000.
- ✓ There were only five studies on the nutritional status of women and mostly on expectant and lactating mothers. The studies included the nutritional status of selected mothers of Parbani; maternal energy requirements and nutritional status in well-nourished pregnant and lactating women; psycho-social aspects of food and its effect on the nutritional status of expectant and lactating mothers of Jammu city. A comparative study with Nagpur city; maternal iodine status and its relationship with neo-natal hypothyroidism and the effect of iodine supplementation; dietary pattern, calorie consumption and Basal Metabolic Rate (BMR) of women engaged in low and high work capacity avocations. These studies were completed between1995 to 2001.
- ✓ There were only two doctoral studies on the nutritional status of elderly persons in the entire study period of twelve years. One was on the nutritional status and the impact of malted food supplement on selected institutionalised elderly and the other one was on the nutrition and health profile of non-institutionalised and institutionalised senior citizens. Both studies were conducted in different regions in 2002. This seems to have gained some attention only in the last year of the study period. With the increasing longevity of Indians, these studies become important.

There were three doctoral studies on specific communities during the study period: nutritional pattern of selected villages around Bhopal with special reference to soya bean consumption; dietary behaviour and nutritional status of scheduled castes in Bihar plains; and the nutritional status of prisoners.

2. FOODS

There were 28 out of 90 doctoral studies on 'Foods' during 1991-2002 (31.11%) of the total number of studies in the area of Foods and Nutrition. This is another major area of focus and has been further looked at to understand the sub-areas and the focus of doctoral studies in these sub-areas. Five sub-areas were found: Nutritive value of local foods; Nutritive evaluation of processed foods; Effect of processing on the nutritive value of foods; Food Preservation; Development of recipes. Out of the 28 studies in this area, 21 studies were on processed foods and their nutritional evaluation. The sub-areas of Nutritive value of local foods, Food preservation and Development of recipes had two or three studies in each. Food processing and its effect on the nutritive values of foods was the major focus. Details of studies with reference to the sub-areas are presented below:

- ✓ The sub-area of the nutritive value of local foods included only two studies, one on the nutritional aspects of Mahua and another on the nutritional significance of Samai in the diets of tribals of Elagiri in Tamil Nadu. It is interesting to note that some attention is paid to millets as early as 1991 and 1997.
- ✓ There were twelve studies on the nutritional evaluation of processed foods. Five were on the nutritional evaluation of home processed supplementary foods for pre-school children; the formulation and evaluation of homemade weaning foods; evaluation of *indica Japanica* and local types of rice and the utilisation of broken rice; low cost protein-rich foods using locally available raw materials; from constituents to rheological characteristics of dough and quality of chapatti of whole wheat. Another six studies were on soya flour-supplemented pasta products; physico-chemical, toxicological and product-making qualities of Faba bean (*vicia Faba L*); extruded and blended products of Faba bean; product development studies of sea-buckthorn; organoleptic evaluation of selected frozen vegetables; Kiwi fruit cultivars for processing suitability. One study was on the quality evaluation and eco-feasibility of microwave vs. conventionally cooked Chevou. These studies were conducted throughout 1992-2002. It is heartening to see nutritional evaluation studies on home processed foods and processing of certain raw materials available in the local area.
- ✓ 'Effect of processing on nutritive values of foods' included nine studies. These studies were on the effect of processing on the meat of broiler rabbits; pearl millet; bio-availability of minerals in chickpea; mineral bio-availability from wheat and its preparation; processing conditions on properties of rice flakes; mineral bio-availability from rice bean; processing, preparation and popularisation of *zaizyphea Maunteana Lam*; anti-nutritional factors in Ephasseolus mango; utilisation of the by -products of milk and soya milk value-added baked products. All these studies were completed between 1991 and 2000.
- ✓ The sub-area of 'Food Preservation' had only three studies. These included the use of a sugar substitute for apple preserves for diabetic patients; inhibition of enzymatic brewing in selected fruits and vegetables using anti-oxidants; development of intermediate moisture foods to enhance the shelf-life and nutrient bio-availability. These studies were conducted between 1996 and 2001.
- ✓ The sub-area of 'Development of Recipes' included only two studies - one on the development of a cheesecake-like dessert with soya bean and the other on the acceptability of soya-based recipes in food service. Both studies were conducted in 1996.

3. DIETETICS

This major sub-area of 'Dietetics' had 16 Ph.D. studies, 17.78% of the total studies in the area of Foods and Nutrition. The sub-areas of this major area showed five sub-areas: general studies (2); Dietetics for diabetes (4); Dietetics for anaemia (2); Dietetics for heart diseases (3) and 'miscellaneous' studies (4).

- ✓ The general category included two studies, one on the prevailing dietary management of adults aged 35 to 45; and Food, Nutrition and Dietetics (a rather vague title for a study at the

doctoral level).). These two studies were conducted in the early years of the study period 1991, 1994.

- ✓ There were four studies on Dietetics for Diabetes. One was on the dietary and other related habits of diabetics belonging to Varanasi City. The other three studies were on the effects of specific inputs to diabetics: the role of trace elements copper, chromium, cadmium and zinc in human diet and diseases with special reference to diabetes mellitus and hypertension; effect of bitter gourd, *jambu* and fenugreek on blood glucose and serum lipids in non-insulin dependent diabetics; nutritional modulators of lipid per-oxidation in non-insulin dependent diabetes mellitus. These studies were conducted between the years 1992-2001.
- ✓ The category on Dietetics for Anaemia included only two studies - one on the development of temple-based products and the impact of iron enriched temple burfi in the control of anaemia; and the other one on anaemia control among adolescent girls: development of school based intervention program in Kathmandu, Nepal. These two theses were submitted in the later years of the study period, 1999, and 2002).
- ✓ The category on Dietetics for heart diseases included three studies: Role of selected dietary components on lipid profile among cardio-vascular patients; A dietary study of lipid profile with special reference to hyperlipidaemia and myocardial infarction; efficiency of nutrition intervention in reducing coronary heart diseases risk. These studies were completed in 1997, 1999, and 2002.
- ✓ There were five studies under the 'Miscellaneous' category which included the effect of dietary proteins on trace mineral utilisation in pre-adolescent children; absorption of β-carotene from common Punjabi diets; fluorine content of cooked foods and dietary fluorine intake of the population of selected endemic flourosis villages of Rajura Taluk, District Chandrapur, Maharashtra; the effect of anti-oxidant supplementation on the blood lipid and anti-oxidant profile of male smokers; and Chromium nutriture in participants with the HAIR-AN syndrome. These studies were submitted between 1991 and 2002.

4. FOOD AND NUTRITION EDUCATION

This category of Ph.D. research studies had a total of seven studies (7.78%). This sub-area included further three sub-areas, namely, Education of pregnant mothers and women (3 studies); Nutrition communication (3 studies); and Education of households (one study). The details of the studies are given hereunder:

- ✓ The three studies in 'Education of pregnant mothers and women' are: Impact of nutritional supplements and education on pregnant mothers and new born babies; nutritional anaemia and nutritional anaemia contact programs in an urban slum setting in India with special reference to pregnant women, lactating women and pre-school children 2-6 years; and studies on the qualitative assessment of breast milk in lactating women with emphasis on nutrition education and feeding practices. These three studies were completed in 1992, 1997 and 2002 respectively.

- ✓ 'Nutrition communication' included studies on the prevailing food technology adopted by Varanasi community; a streamline educational mission in increasing the awareness and practice; the Impact of print media on nutritional status, food habits and health awareness of rural as well as urban women in selected blocks of Simla district and Nutrition communication modules. These studies were completed in 1991, 2000 and 2002 respectively.
  - ✓ 'Education of households' had only one study – introducing and evaluating scientific storage practices for food grains among selected rural households in Coimbatore district. This study was conducted in 1998.

5. CULTURAL AND REGIONAL STUDIES IN FOODS AND NUTRITION

There were four studies in this category: A critical study of the Pakadeapana of King Nala; Knowledge, attitudes and practices of infant feeding in urban slums and tribals of Chattisgarh region. A comparative study; Fluoride content and its partition between co-existing soils and food grains, vegetables and fruits grown in fluoride endemic villages of Rajura and Korcepana Tehsils, District Chandrapur, Maharashtra; and Psycho-social aspects of food habits in Jammu province. These studies were completed in 1992, 1997, 1998 and 2002.

FINDINGS

The data showed that:

- Nutritional status studies formed the bulk of the Ph.D. research in Foods and Nutrition in Home Science, which included five sub-areas: nutritional status studies of young children, expectant and lactating mothers, adolescents, elderly and specific communities. There seems to be a strong focus on young children and negligible focus on adolescents and the elderly. One positive aspect of the studies on young children was that a number of them were on the effect of nutritional measures on nutritional status, especially on the growth and development of children which is quite valuable in the home.
- In the area of 'Foods' a large number of doctoral studies were on (a) nutritional evaluation of processed foods and effect of processing on the nutritive values of foods. Looking at the titles more closely reveals that these studies had taken up the evaluation of locally developed food mixes or processing of foods that are locally available. This can be of value as they focus on local foods used by the common people (b) only few studies were on nutritive value of local foods; food preservation and development of recipes.
- 'Dietetics' formed the third major area of focus with 16 out of 90 studies. Out of these, (a) few studies each focused on diets in diabetes, anaemia and heart diseases (b) studies focusing on intake of certain nutrients and their effect on certain nutrient absorption is classified as 'Miscellaneous' (c) the studies classified as 'general' were those which were too general to put them under any of the categorisation as the titles lacked clarity.
- 'Foods and Nutrition Education' is given some attention by a few doctoral students of Foods and Nutrition, probably because the Extension Education in Home Science can take care of the studies needed in that area. Nutritional contact programs do focus on education of the

people concerned. It is quite interesting that a few studies were on the communication of nutritional messages. This is quite an important aspect of research as it focuses on the reach of 'right' messages to the people at large.

- It is also interesting to find one doctoral dissertation on the critical study of Pakadaepana of King Nala. All of us have heard about Nala Paka and King Nala was an expert in tasty food preparations. This can be considered a study that touches on the traditional culture of the nation. Regional studies were conducted such as one study on a particular feeding practice in a specific geographical area; psycho-social aspects of food habits of people from a state; or on issue such as fluoride content of soils and effect on the foods produced.

ISSUES OF IMPORTANCE

The findings presented brings to the fore certain issues of importance. They are:

- Although nutritional status studies are of national significance, by 2002, it was well known that the nutritional status of children is a matter of concern for the whole nation. There are other national institutions such as National Institute of Nutrition (NIN) that are concerned with studies on the nutritional status of children. In this situation, what should be the concern of the home scientists in nutritional status studies?
- The home scientists' interest in studies related to the effect of nutritional measures on the nutritional status of children is valuable. Here again, it would be interesting to study the efforts made towards taking the findings of these studies to those who need them. What measures are taken by the researchers or the institutions towards this? The focus on nutrition education is negligible and hence requires much more attention.
- The nutritional status of the elderly seems to have gained some importance only around 2002 as the two studies were submitted in that year. Longevity of life in India was increasing over that period and the percentage of senior citizens in the population was on the rise. The question is, how far it has moved since then? It would be interesting to estimate the number in the next twelve years 2003 to 2014.
- 'Foods' as an area of study has a vast potential as they are basic to a healthy life. It is geographically and culturally bound. The scope and actual research seemed to indicate a wide gap. The reasons for this need to be investigated.
- Nutritional evaluation of processed foods and the effect of processing on the nutritive values of foods were in focus during the study period. These could be of value, provided the common people get to know the results of such studies. Dissemination of such information through the mass media could serve the purpose. We know now that all kinds of nutrition information are passed on to people through the mass media. Under 'Foods and Nutrition Education', few studies were conducted by doctoral students during the study period. Encouraging the mass media to collaborate with researchers or educating those who present food-related programs on the media could be done by the home scientists. From the present review, there is little or no sign of such efforts or studies of that kind. It is worth thinking about. The question here is, how do we reach people with scientific information on a subject as basic as foods which affect everyone's life?

- We have a rich tradition as far as foods are concerned. Each state and probably each district has its own agro-climatic conditions in which the products of agriculture show endless variety and food preparations which are specific to each place. There are also beliefs that certain food items ought to be combined with certain food items and ought not to be combined with certain others. What kinds of combinations are suggested by our ancestors? What could be the reasons? How do these help or hinder our efforts in nourishing our body and keeping ourselves and our people healthy. Can home scientists in Foods and Nutrition make efforts to study what our traditions say, and the truth of the same in keeping ourselves healthy?
- We also have our own traditional systems of medicine, which has, as its base, foods. Lots of prescriptions regarding foods are given by our traditional *vaidyas* (physicians). Home scientists specializing in Foods and Nutrition have a role to play in studying the basis of such prescriptions. There are no studies on such topics. Why are we hesitant in taking up such studies for fulfilling our own curiosity and also understanding our age old tradition? Why aren't such studies undertaken?
- 'Dietetics' is an area of importance. With high incidence of diabetes, hypertension and other heart diseases, the public is turning towards indigenous medicines which seem to suggest that food is medicine and medicine is food. Are we ready to take up studies that would help the public with scientific information on the suggestions given by indigenous systems of medicine? What comes on the way of taking up such studies? Can we equip ourselves by introducing a course in traditional foods and food as medicine for us to gain confidence in conducting such studies?
- Nutrition education is everywhere, especially on the mass media. Every day there are several programs on television on food demonstrations and everyone presenting try to give information on nutrition. There are hardly any studies on the kinds of information presented and their scientific basis. All kinds of information are reaching people which quickly. What should be the role of home scientists (with Foods and Nutrition major) in this regard?
- Regional studies were given little attention as seen from the results. Food and nutrition related issues of importance can be identified and studies carried out. This will be of regional and national importance.

Though the research in the area of 'Foods and Nutrition' at the level of higher education in Home Science, especially with PH.D. programs, during the study period 1991-2002 showed coverage of wide range of areas of study, the focus is on certain areas alone. Major gaps are seen in

(a) Nutrition Education through which the scientific information about foods and nutrition reach the public at large. Herein, the local efforts and mass efforts require lot of attention. Food is an area that is given a lot of importance by the media. Media studies with reference to food and nutrition are not in the picture during the study period.

(b) In the area of 'dietetics' the dietary prescriptions and proscriptions need to be looked at closely, taking into account the prescriptions and proscriptions of diets for varying conditions of ill-health given by the Indian Systems of Medicine, which seem to be gaining a lot of importance in recent years.

(c) Studies on issues that affect the nutrition and health of specific communities, though, has some place during the study period, and probably needs some more attention by the researchers.

(d) People's beliefs related to food and health ought to gain focus as they are the basis for good health. There is a general tendency to assume the people's beliefs and call them superstitions. This tendency by the food and nutrition scientists should be re-examined and take up studies that would bring out the scientific basis or otherwise of such beliefs. Beliefs of people are important as they govern the day to day practices of people.

STUDIES IN THE MAJOR AREA OF FOODS AND NUTRITION

I. NUTRITIONAL STATUS

A. NUTRITIONAL STATUS OF INFANTS AND PRE-SCHOOL CHILDREN

1. Prevalence of protein-energy malnutrition in infants. (Nanda, Snehalatha. BHU, Varanasi. (1992).
2. Nutritional status of children 0-6 years of ICDS projects in tribal areas of Chota-Nagpur, Bihar. (Gupta, Usha Prasad, University of Bihar, Muzzafarpur. 1992).
3. Nutritional status of children in anganwadis of Nagpur City. (Gupta, Vanita. 1992).
4. Nutritional profile of pre-school children living in Jammu Province. (Gandotra, Anuradha. 1993).
5. Nutritional assessment of pre-school children and school children by chemocytological technique. (Chakrabarti, Shibani. Calcutta. 1993).
6. Comparative status of pre-school children from different socio-economic groups of rural and urban population residing in Jabalpur District. (Agarwal, Krishna. 1996).
7. Vitamin A status of pre-school children in selected tribal area of Udaipur. (Kothari, Saroj. Rajasthan Agricultural University, Bikaner. 1997).
8. Nutritional status of rural pre-school children belonging to different agro-climatic conditions of Punjab. (Malhotra, Kiran. Punjab Agricultural University, Ludhiana. 2002).
9. Assessment of nutritional status of pre-school children of different localities of Bokaro. (Anita Kumari, Vinobha Bhave University, Hazaribagh. 2002).
10. Nutritional profile of sponsored and non-sponsored and ICDS children. Bangalore. (Suneetha, B.C. Bangalore University, Bangalore. 2002).

B. EFFECT OF NUTRITIONAL MEASURES ON NUTRITIONAL STATUS

1. Nutritional measures to improve the nutritional status of pre-primary children. (Dube, Tripti. Vikram University, Indore. 1993)
2. Effect of nutrition on mental and motor development process of children 0-6 years of Gaddi tribes in Kangra Valley in Himacahal Pradesh. (Sharma, Swati. Himachal Pradesh Krishi Viswa Vidyalaya. Palampur. 1997).
3. The effect of nutrient supplementation on mental abilities of children. (Sharma, Jyoti. Devi Ahalya Viswa Vidyalaya, Indore. 1998).
4. Consumption pattern of carotene rich foods among under-privileged communities of Delhi and prevalence of Vitamin A deficiency in school age children 5-12 years of urban slums: A pilot clinical trial of red palm oil for combating Vitamin A deficiency. (Chahha, Ravinder. University of Delhi, Delhi. 1998).
5. Determinants of under-nutrition in pre-school children and impact of intervention program. (Jyoti Lakshmi. University of Mysore, Mysore. 2001).

6. Vitamin A nutrition and immune profile of pre-school children from selected urban areas and impact of intervention. (Vedhavalli P., Avinashilingam Institute of Home Science and Higher Education for Women, Coimbatore. 2001).
7. Feeding practices and nutritional anthropometry of pre-school children of working mothers of central Orissa. (Mishra, Sunitha. Sambalpur University, Burla. 2002).
8. Effects of mal-nutrition on personality development in children. (Maria, B.V. Shantha. Bangalore University, Bangalore. 2002).
9. A comparative study of food habits and appetite in relation to nutritional status of the normal and visually handicapped children age 8-12 years of Indore district. (Bharati, Vandana. Devi Ahalya Viswa Vidyalaya, Indore. 2002).
10. A study of dietary patterns and its effect on nutritional status of children. (Dave, Nilambari. Saurashtra University, Rajkot. 2002).
11. Chemical composition and nutritional quality of formulated weaning foods and their effect on the growth pattern of infants, 4 months to 1 year. (Chitlange, Leena Ram Prasad. Nagpur University, Nagpur. 2002).
12. Profile of chronic infections and nutritional status of 3-5 years age children and their growth potentials. (Gangrade, Rachna. Devi Ahalya Viswa Vidyalaya, Indore. 2002).

C. NUTRITIONAL STATUS OF ADOLESCENTS AND YOUNG ADULTS

1. Evaluation of nutritional and physical fitness status in young athletes (Atreya, Neeti. S.N.D.T. Women's University, Bombay. 1992).
2. Nutritional status of rural school children and adolescents 6 – 18 years in Jammu Province. Sudan Irvinder Kaur. University of Jammu, Jammu. 1993).
3. Energy Balance studies among adolescent boys undergoing training at Shree Vyayan Prasarak Mandal, Amaravati. (Deshpande, Minal Balachandra. Nagpur University, Nagpur. 2000).

D. NUTRITIONAL STATUS OF WOMEN/MOTHERS

1. A study on the assessment of maternal iodine status and its relationship with neo-natal hypothyroidism and the effect of iodine supplementation. (Madan, Jagmeet. S.N.D.T. Women's University, Bombay. 1995).
2. A study on psycho-social aspects of food and its effect on the nutritional status of the expectant and lactating mothers of Jammu City. A comparative study with Nagpur City. (Nagpur University, Nagpur. 1997).
3. Nutritional profiles of selected mothers of Parbani. (Malaveur, Vandana Ghanshyam. Marathwada Agricultural University, Parbani, 1997).
4. Maternal energy requirements and nutritional status in well-nourished pregnant and lactating women (Muthayya, Sumitra. Bangalore University, Bangalore. 1999).
5. Studies of the dietary pattern, calorie consumption and Basal Metabolic Rate (BMR) of women engaged in low and high work capacity avocations. (Gulshan. Ch. Sarvan Kumar Krishi Viswa Vidyalaya, Palampur. 2001).

E. NUTRITIONAL STATUS OF THE ELDERLY (SENIOR CITIZENS)

1. Nutritional status and impact of a malted food supplement on selected institutionalized elderly (Premalatha, M. Avinashilingam Institute of Home Science and Higher Education for Women, Coimbatore. 2002).
2. Nutrition and health profile of institutionalized and non-institutionalized senior citizens in Bangalore city. (Usha, N. Bangalore University, Bangalore. 2002).

F. NUTRITIONAL STATUS OF SPECIFIC COMMUNITIES

1. Study of nutritional pattern of some selected villages around Bhopal with special reference to soybean consumption (Deshpande, Subadha. S.Barkatullah Viswa Vidyalaya, Bhopal. 1999).
2. Dietary behavior and nutritional status of Scheduled Castes in Bihar plains, Samastipur District, (Sumita Kumari Babasaheb Bhimrao Ambedkar Bihar University, Muzzaffarpur. 2001).
3. Nutritional status of prisoners. (Geetha, K. Bangalore University, Bangalore 2002).

II. NUTRITIONAL VALUES OF FOODS

A. NUTRITIVE VALUE OF LOCAL FOODS

1. Nutritional aspects of Mahua (Kotwal, Deepali Sanjay. Nagpur University. Nagpur. 1991).
2. Nutritional significance of Samai, Penicilieum miliace lavile, in the diets of tribals of Elagir hills in Tamil Nadu. (Thomas, Tara. Avinashilingam Institute of Home Science and Higher Education for Women, Coimbatore 1997).

B. NUTRITIONAL EVALUATION OF PROCESSED FOODS

1. Nutrtional evaluation of home processed supplementary foods for pre-school children. (Ruther, Saroj Bala. Haryana Agricultural University. 1992)
2. Quality evaluation and economic feasibility of micro-wave vs. conventionally cooked chevou. (Anupma, College of Home Science, Palampur.1995).
3. A study on formulation and evaluation of home-made weaning food (Molmane, Manjula Subash. Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. 1997).
4. Nutritional and quality evaluation of Indica Japanica and local genotypes of rice and utilization of broken rice. (Sadhna. Himachal Pradesh Krishi Viswa Vidyalaya, Palampur. 1997).
5. Nutritional evaluation of soya flour supplemented pasta products. (Malathi, D. Avinashilingam Institute of Home Science and Higher Education for Women, Coimbatore. 1998).
6. Development and nutritional quality evaluation of low cost protein rich foods using locally available raw materials. (Dube, Brijilata. Rani Dugavati Viswa Vidyalaya, Jabalpur. 1999).
7. Physico-chemical, toxicological and product making qualities of Fa ba Bean (*Vicia Faba* L) (Upadhyay, Anubha. Rani Durgavati Viswa Vidyalaya, Jabalpur. 2000).
8. Studies on the whole wheat constituents in relation to rheological characteristics of the dough and quality of chapatti (Srivastava, Alok Kumar. University of Mysore, Mysore. 2001).

9. Bio-nutrtional evaluation of extruded and blended products of Faba bean (*visifaba* L) (Rajwat, Prakrati. Rani Durgavati Viswa Vidyalaya, Jabalpur. 2001)
10. Nutritional evaluation and product development studies of sea-buck thorn (hippophae rhamoide. (Katoch, Seema. CSK Himachal Pradesh Krishi Viswa Vidyalaya .Palampur, H.P. 2001).
11. Nutritional and organoleptic evaluation of selected frozen vegetables. (Dhaliwal, Mandeep. Punjab Agricultural University, Ludhiana. 2002).
12. Quality evaluation of kiwi fruit cultivars for processing suitability. (Goel, Devina. Ch. S. K., Himachal Krishi Viswa Vidyalaya, Palampur, H.P. 2002).

B. EFFECT OF PROCESSING ON NUTRITIVE VALUE OF FOODS

1. Studies on nutritive value and processing of meat of broiler rabbits (Joshi, Sandhya Mukul. Punjab Krishi Vidyapith. Akola. 1991).
2. Processing of pearl millet for its more effective utilization (Jain, Ashima. Haryana Agricultural University. Hissar. 1993).
3. Bio-availability of minerals in chick-pea: Effect of domestic processing and level of the anti-nutrients. (Kakkar, Sunita. HAU, Hissar. 1993).
4. Effects of domestic processing on mineral bio-availability from wheat (*tritieum aesturem*) and its preparations (Harpeet Kaur, Punjab Agricultural University, Ludhiana. 1997).
5. Effect of processing conditions on properties of rice flakes. (Mujoo, Rajani. University of Mysore, Mysore. (1998).
6. Effect of domestic processing on mineral bio-availability from rice-bean, Vigna Umbellata. (Manpeet Kaur. Punjab Agricultural University. Ludhiana 1998).
7. Processing, preservation and popularization of Zaizyphea Maunteana Lam. (Easwaran, Saraswathy. Avinashilingam Institute of Home Science and Higher Education for Women. Coimbatore 1998).
8. Studies in anti-nutritional factors in Ephasseolus mango. (Hajela, Namita. Devi Ahalya Viswa Vidyalaya. Indore 1999).
9. Utilization of by-products of milk and soya-milk value added baked products. (Ramandeep Singh. Dept. of Food Technology, Punjab Agricultural University. Ludhiana 2000).

D. FOOD PRESERVATION

1. Use of sugar substitutes for the development of dietetic apple preserves. (Barwal, Vishal Singh. Himachal Pradesh Krishi Viswa Vidyalaya. Palampur 1996).
2. Inhibition of enzymatic brewing in selected fruits and vegetables using anti-oxidants. (Gopalan, Hema Sarath. SNDT Women's University, Mumbai 2000)
3. Development of intermediate moisture foods with intent to enhance shelf-life and nutrient bio-availability (Sood, Sangita. Ch. Sarwan Kumar Himachal Pradesh Krishi Viswa Vidyalaya. 2001).

E. DEVELOPMENT OF RECIPES

1. Development of cheesecake-type dessert with soybean. (Syed, Nissar. R. M.S. University. Baroda 1996).
2. Acceptability of soya-based recipes in food service (Sarojini, KS. Avinashilingam Institute of Home Science and Higher Education for Women, Coimbatore. 1996).

III. DIETETICS

A. GENERAL

1. Prevailing dietary management of adults aged 35-45. (Tewari, Madhvi. BHU, Varanasi. (1991).
2. Food, Nutrition and Dietetics. (Singh, Rashmi. BHU, Varanasi. (1994).

B. DIABETES

1. Dietary and other related habits of Diabetics belonging to Varanasi City: A guideline programme on the management of Diabetes (Mohanty, Manushi. BHU, Varanasi. (1992).
2. The role of trace elements – copper, chromium, cadmium and zinc in human diet and diseases with special reference to Diabetes mellitus and Hypertension. (Tithwar, Pragya. Government Adarsh Science College, Bilaspur. (1997).
3. Effect of bitter- gourd, *jambu* and fenugreek on blood glucose and serum lipids in non-insulin dependent diabetics. (Kapoor, Anita. Punjab Agricultural University, Ludhiana. 2001).
4. Nutritional modulators of lipid per-oxidation in non-insulin dependent diabetes mellitus. (Hoskote, Hemangini. S. N. D.T. Women's University, Mumbai. (1998).

C. ANAEMIA

1. Development of temple-based products and the impact of iron enriched temple burfi in the control of anaemia. (Khanna, Sangeetha. Bangalore University, Bangalore. 1999).
2. A study on anaemia Control among adolescent girls: Development of school based intervention programme in Kathmandu, Nepal. (Tiwari, Kalpana Padma. M.S. University, Vadodhara. 2002).

D. HEART DISEASES

1. Role of selected dietary components on lipid profile among cardio-vascular patients. (Amirthamani. M. Avinashilingam Institute of Home Science and Higher Education for Women, Coimbatore. 1997).
2. Lipid profile with special reference to hyper lipidaemia and myocardial infraction: A dietary study. (Saxena, Mukta. Barkatullah University, Bhopal. 1999).
3. Efficiency of nutrition intervention in reducing coronary heart diseases risk. (Sandhia, Navdeep. Punjab Agricultural University, Ludhiana. 2002).

E. MISCELLANEOUS

1. Effect of dietary proteins on trace mineral utilization in pre-adolescent children. (Rajinder Kaur. Punjab Agricultural University, Ludhiana. 1991).
2. Absorption of B Carotene from common Punjabi diets. (Neerja, Rani. Punjab Agricultural University, Ludhiana 1993).
3. Dietary habits: Fluorine content of cooked foods and dietary fluorine intake of the population of selected endemic fluorosis villages of Rajura Taluk, District Chandrapur, Maharashtra. (Aslesha, Pendli. University of Nagpur, Nagpur. 1998).

4. The effect of anti-oxidant supplementation on the blood lipid and anti-oxidant profile of male smokers. (Randhawa, Simmer Preet, Punjab Agricultural University, Ludhiana. 2001).
5. Chromium nutriture in subject with the HAIR-AN syndrome. (Majithia, Hemali. R. S.N.D.T. Women's University, Mumbai. 2002).

IV. FOOD AND NUTRITION EDUCATION

A. EDUCATION OF PREGNANT MOTHERS AND WOMEN

1. Impact of nutritional supplements and education on pregnant mothers and new born babies. (Paranjit Kaur. Punjab Agricultural University, Ludhiana. 1992).
2. Nutritional anaemia and nutritional anaemia contact programs in an urban slum setting in India with special reference to pregnant women, lactating women and pre-school children 2-6 years. (Sharma, Kairta Shanulal. M.S. University, Baroda.
3. Studies on the qualitative assessment of breast milk in lactating women with emphasis on nutrition education and feeding practices. (Sarkar, Nandita. Rani Durgavati Viswa Vidyalaya, Jabalpur. 2002).

B. NUTRITION COMMUNICATION

1. Prevailing food technology adopted by Varanasi community: A streamline educational mission in increasing the awareness and practice. (Jaiswal, Sunita. BHU, Varanasi. 1991).
2. Impact of print and electronic media on nutritional status, food habits and health awareness of rural as well as urban women in selected blocks of Simla district. (Gupta, Ranjana. Himachal Pradesh Krishi Viswa Vidyalaya, Palampur. 2000)
3. Nutrition communication modules. (Marathe, Madhavi. S.N.D.T. Women's University, Mumbai. 2002).

C. EDUCATION OF HOUSEHOLDS

1. Introducing and evaluating scientific storage practices for food grains among selected rural households in Coimbatore district. (Manimozhi. Avinashilingam Institute of Home Science and Higher Education for Women, Coimbatore. 1998).

V. CULTURAL AND REGIONAL STUDIES IN FOODS AND NUTRITION

1. A critical study of the Pakadeapana of King Nala. (Madhulika. BHU. Varanasi. 1992).
2. Knowledge, attitudes and practices of infant feeding in urban slums and tribals of Chattisgarh region. A comparative study. (Sen, Snigoha. Pt. Ravishankar Shukla University, Raipur. 1997).
3. Fluoride content and its partition between co-existing soils and food grains, vegetables and fruits grown in fluoride endemic villages of Rajura and Korcepana Tehsils, District Chandrapur, Maharashtra. (Patchimall, Jyoti Kumari. Nagpur University, Nagpur. 1998).
4. Psycho-social aspects of food habits in Jammu Province. (Aggarwal, Hemla. University of Jammu, Jammu. 2002).

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APPLICATION OF SELECTED NATURAL ANTIMICROBIAL FINISHES ON ORGANIC COTTON KNITS

Sheetal Chopra[1], Bhawana Chanana[2] and Bhanu Arora[1]
[1]Lady Irwin College, University of Delhi
[2]School of Fashion Design and Technology, Amity University

Research on environment-friendly antimicrobial agents based on natural products for textile application is gaining worldwide interest. Antimicrobial textiles with improved functionality find a variety of applications such as in health and hygiene products, especially among garments worn close to the skin. Although synthetic antimicrobial agents are very effective against a range of microbes and are durable on textiles, they are a cause of concern due to the associated side-effects. Global technologies are turning back to products which can be derived from nature. Multifunctional textile finishing agents like sericin and aloe vera offer antimicrobial properties that can be combined with other functions such as improving moisture absorbency. In this study, the application of natural dyes, sericin and aloe vera has been researched as finishing agents with antimicrobial properties. The efficacy of these finishes on 100% organic cotton knits were studied on the basis of microbiological testing and comfort properties. Aloe vera and sericin used in combination with natural dyes displayed excellent antibacterial properties. The finished knitted organic cotton fabric was successfully used for the designing and development of a product range of intimate and sports apparel.

Key Words: Antimicrobial, Natural Dyes, Sericin, Aloe vera

Textile products are sensitive to contamination by the growth of pathogenic micro-organisms. Consumers all over the world are demanding functionality in commercial products. Antimicrobial property in fabrics is considered an important parameter for garments which are in direct contact with the human body (Bhat *et al*, 2010). This has led to an increase in the use of antimicrobial substances on textiles. Antimicrobial agents either inhibit the growth (-static) or kill (-cidal) microorganisms. They damage the cell wall or alter cell membrane permeability, denature proteins, inhibit enzyme activity or inhibit lipid synthesis, all of which are essential for cell survival (Gao *et al*, 2008).

The large surface area of textiles and their ability to retain moisture give microbes a chance to grow bio-films and develop readily. The major problems associated with the growth of microorganism in textiles are related to hygiene and fabric deterioration. Micro-organisms metabolize nutrients, such as sweat and soil present in textile products, producing odour-causing intermediates that cause irritation.

There are relatively lower incidences of adverse reactions of herbal products as compared to modern synthetic pharmaceuticals and they are an eco-friendly alternative to synthetic antimicrobial agents for textile applications (Purwar *et al*, 2009).

Microbes and Textiles

Natural fibres and synthetic fibres are both susceptible to microbial damage. Natural fibres such as cotton, linen, silk and wool are prone to microbial decomposition as these fibres have chemical bonds which could be readily hydrolysed by microorganisms (Jadwiga, 2004). Synthetic fibres are not biodegradable, yet the presence of finishing materials such as brighteners, spin finish oil, starch, dyes, or dust and dirt in the fabric provide a suitable environment for microbial growth (Sarkar *et al*, 2001).

Antimicrobial finishing agents

In the last few decades, with the increase in new antimicrobial finish technologies, a range of textile products based on synthetic antimicrobial agents have been developed. Although the synthetic antimicrobial agents are very effective against a range of microbes and make textiles durable, they are a cause of concern due to the associated side effects, action on non-target microorganisms and water pollution. Hence, there is a great demand for antimicrobial textiles based on natural products which not only help to effectively reduce the ill effects associated with microbial growth on textile material but also comply with the statutory requirements imposed by regulating agencies.

The use of natural products such as natural dyes for antimicrobial finishing of textile materials has been widely reported. Natural dyes comprise of those colourants (dyes and pigments) that are obtained from animal or vegetable matter without chemical processing. When a textile is dyed with extracts obtained from various herbs, it is referred to as herbal textile. Herbal textiles help in controlling the many common skin diseases. Sandalwood, with its mild fragrance, has a soothing effect that helps in fighting stress. Catechu is used for treatment of parasitic infestation and itching. Herbal dyes like madder, pomegranate rind, castor oil, sweet basil and henna have their own healing effects (Aggarwal, 2010). There are studies done on other natural products like Chitosan, *Neem* leaves, *Tulsi* leaves, Eucalyptus Oil, Clove oil, Turmeric which claim that they exhibit antimicrobial activity (Purwar *et al*, 2009).

Micro-encapsulation technology helps to add endless possibilities in the textile segment. Aloe vera extract is embedded into airtight and waterproof micro capsules. The capsules open when the fabric is touched or rubbed. When the garment is tailored, these capsules remain as a part of the clothing. When the garment is worn, the aloe vera in the garment gets released and comes in contact with the skin (Bhat, 2010).

Silk sericin is a natural macromolecular protein derived from silkworm *Bombyx mori* and constitutes 25-30% of silk protein. Sericin has antioxidant, antimicrobial and good moisture absorbency properties. Sericin can be recovered from the waste liquor of silk degumming process and developed as a value-added textile specialty chemical. Many environmental toxins and chemicals in conventional clothing are assimilated into the body through the skin. Anything

which can improve the skin's natural ability to block and resist harmful chemicals and toxins from entering the body will be beneficial to health. Antimicrobial finishes are gaining their popularity amongst the intimate apparel industry, as these are in direct contact with the body where moisture and temperature favour the growth of microbes. Antibacterial activity is an important functional property for these, especially intimate wear, which is in direct contact with the skin (Ureyen *et al*, 2010).

Keeping these issues and aspects in mind, this study was envisaged to use sericin, natural dyes with antimicrobial properties, and microencapsulated aloe vera finish on organic cotton knits. The efficacy of the finishes in terms of antibacterial activity against Gram positive and Gram negative bacteria and comfort parameters in terms of air permeability and water vapour transmission were tested. Intimate wear and sports apparel were developed using the standardised fabric.

MATERIALS AND METHODS

Natural dyes, namely, gallnut, indigo, kango, madder, pomegranate and red sandalwood were used on 100% organic cotton knit of 160 gsm. There were treated with finishes made of sericin and aloe vera in microencapsulated form.

Premordanting: The fabric was scoured with 2g/l anionic wetting agent for 20 minutes at 60°C. The mordanting bath was prepared with material to liquor ratio (MLR) 1:40 and alum (10% on the weight of fabric). The temperature was raised to 80°C for 30 minutes. The solution was then drained and the fabric was squeezed and dried.

Dyeing: The dyeing conditions for the natural dyes used are summarized in Table 1. For dyeing with gallnut, kango, madder, pomegranate, red sandal wood, the required dye was made into a paste with water and added to the dye bath after straining. The required pH was maintained with the help of sodium hydroxide or acetic acid at room temperature. After absorption of the dye, the dye bath was slowly heated up to 80°C for 40 minutes. The solution was drained and the samples were squeezed, rinsed and soaped, followed by final rinsing.

Table 1: Dyeing conditions for different natural dyes

Dye	Pasted with	pH
Gallnut	Water	4
Indigo	TRO	-
Madder	Water	8 ± 0.2
Myrobalan	Water	3.5 ± 0.5
Pomegranate	Water	4.3 ± 0.2
Red sandalwood	NaOH	6.0 ± 1.0

Indigo is a vat dye and insoluble in water. Hence its leuco form was prepared for its application. For dyeing with indigo, the recipe used was:

Dye	: 10% on weight of the fabric (o.w.f.)
MLR	: 1:40
Sodium dithionite	: four times the weight of dye
Sodium hydroxide	: equal to the weight of dye
Temperature	: 30°C

Vatting of the dye was done by pasting indigo dye with Turkey Red Oil (TRO). Three fourth of the total MLR was added to the pasted dye along with three fourth of total amount of sodium dithionite and sodium hydroxide. The vatting solution was kept for 15 minutes at 30°C for complete reduction of indigo dye into an alkali leuco form. The dye bath was prepared with the remaining water, sodium dithionite and sodium hydroxide and the vatted dye solution was added to it after straining. The fabric was placed in the dye bath for 15 minutes. Dyeing was carried out at room temperature by giving 3 dips (each dip for 15 minutes) in the dye solution and the fabric was was air oxidized for 15 minutes after each dip. The solution was drained, samples were squeezed, rinsed and soaped followed by final rinsing. All the dyed samples were post-mordanted with alum using the same procedure as pre-mordanting. The samples were soaped at 60°C with 2g/l anionic wetting agent to remove all the unfixed dye and alum. Finally, the samples were rinsed and dried.

Application of Sericin: Sericin was prepared from the degumming liquor using a spray dryer machine. Approximately 20–25% of sericin powder was extracted. A standard solution of sericin (3%) was prepared at 80°–90°C for 1 hour. Sericin was applied at 6% o.w.f using an MLR of 1:30. The sericin was added to the water bath and heated up to 80°C. The fabric was placed in the water bath for 90 minutes. After the application of sericin, the samples were squeezed and rinsed.

Sericin was applied as a finish on indigo, madder, red sandalwood and pomegranate dyed samples by the exhaust method. The antibacterial testing was done to observe the number of colonies forming units (cfu).

Application of Aloe vera: An emulsion of aloe vera capsules (Cellol Aloe) and Binder ST in the ratio 4:1 was made. Cellol Aloe (8 gm) and Binder ST (2 gm) per litre of water was used. The fabric samples were given 3 nips and 3 dips at room temperature using padding technique. The aloe vera finish applied was in a microencapsulated state. These microcapsules acted as miniature containers, manufactured with a protective polymeric coating or melamine shell which protected its contents from evaporation and contamination until it was released. The capsules were bonded with the fabric and burst when the fabric was touched or rubbed.

Testing the Antibacterial activity: All the prepared samples were qualitatively and quantitatively tested for antibacterial properties against gram positive *(Staphylococcus aureus)* and gram negative (*Escherichia coli*) bacteria to establish the antibacterial activity in terms of

countable colony forming units. Qualitative testing of the samples was done by parallel streak method American Association of Textile Chemists and Colourists- Test Method (AATCC-TM) 147 and quantitative testing was carried out using AATCC-TM 100. Antibacterial testing was also done after application of sericin and aloe vera on the dyed samples.

Evaluation of the durability of the finish: Selected finished samples were tested for levels of antimicrobial activity after 5 launderings to test the durability of the finish. This test was conducted in a Launderometer using International Organisation for Standardisation (ISO) II method.

Evaluation of comfort properties: The samples were tested for air permeability and water vapour permeability using the standard test methods. The comfort properties of the dyed and finished fabric were tested for air permeability and water vapour permeability using standard American Society for Testing and Materials (ASTM) test methods. Water vapour permeability was measured by using Water Vapour Permeability Tester according to test method ASTM E-96 and expressed in $g/m^2/day$. The higher the level, higher would be the breathability. This test was conducted on two sets of pomegranate dyed samples, one finished with aloe vera only and the other with sericin along with aloe vera. The results were analysed in comparison to the control undyed/unfinished samples.

Treated and untreated samples were tested for their air permeability following the procedure as given in IS: 11056. Due to low ventilation and air permeability between the user's skin and the garment, generation of heat and perspiration, the growth of microbes is imminent, which can cause foul odour and also cause infections.

Development of a Range of Intimate and Sports Apparel:

Comfort and hygiene are two key factors for intimate and sports apparel as they are in direct close contact with the skin. Nowadays, consumers not only seek functionality only but also look for aesthetic appeal in a garment. Intimate and sportswear is typically designed to be light weight. Keeping this in mind, a range of functional intimate and sportswear were designed and developed such as sports bras, t-shirts, shorts, and camisoles using organic cotton knit fabric dyed with natural dyes and finished with sericin and aloe vera.

RESULTS AND DISCUSSIONS

Application of Natural Dyes and Testing the Antibacterial Activity

Natural dyes (Table 2) producing different colours were applied to the cotton fabric after mordanting with alum. Alum is not only natural but also imparts antibacterial properties to the samples.

After the antibacterial testing of the dyed samples it was observed that the samples showed enhanced antibacterial activity in comparison to the undyed control which was evident from a

clear zone of inhibition of bacterial growth beneath the fabric. According to the results obtained for the quantitative test, the samples dyed with gallnut and kango showed maximum bacterial reduction of 71.1% and 68% respectively against *S. aureus*. (Table 3). The samples dyed with gallnut and indigo showed maximum bacterial reduction of 66.23% and 57.14% against *E. coli* (Table 4).

Table 2: Colours obtained with natural dyes

Name of the dye	Colour
Indigo	Blue
Gallnut	Mustard-yellow
Kango	Cream
Madder	Pink
Pomegranate	Yellow
Red sandalwood	Pinkish-brown

Table 3: Results for quantitative antibacterial testing for *S. aureus*

Dyes	Cfu/ml*	Control sample Cfu/ml*	Bacteria reduction (%)
Indigo	158	**225**	29
Kango	72		68
Pomegranate	194		13.77
Madder	138		40
Red sandal wood	137		39.11
Gallnut	61		71.11

Table 4: Results for quantitative antibacterial testing for *E. coli*

Dyes	Cfu/ml*	Control sample Cfu/ml*	Bacteria reduction (%)
Indigo	132	**308**	57.14
Kango	252		18.18
Pomegranate	153		50.32
Madder	173		43.83
Red sandal wood	177		42.53
Gallnut	104		**66.23**

*10^2 dilution

The sericin-finished samples in comparison with only dyed control samples showed further reduction in CFUs. Sericin-finished, pomegranate-dyed samples exhibited best antibacterial activity against *S. aureus* and showed bacteria reduction of 72.16% (Table 5).

Table 5: Results for quantitative antibacterial testing for *S. aureus*

Dyes + sericin	Cfu/ml*	Control sample Cfu/ml*	Bacteria reduction (%)
Indigo	80	158	49.36
Pomegranate	54	194	**72.16**
Madder	74	138	46.37
Red sandal wood	88	137	35.76

*10^2 dilution

In terms of antibacterial activity towards *E. coli*, the samples dyed with madder and finished with sericin showed the best results. It showed a bacteria reduction of 41.24% (Table 6).

Table 6: Results for quantitative antibacterial testing for *E. coli*

Dyes + sericin	Cfu/ml*	Control sample Cfu/ml*	Bacteria reduction (%)
Indigo	109	132	17.42
Pomegranate	113	153	26.14
Madder	133	173	41.24
Red sandal wood	104	177	35.76

*10^2 dilution

Sericin, being an antioxidant, can limit oxidation of free-radicals. From the results of quantitative antibacterial testing done on various dyed and sericin finished samples, it was evident that sericin enhanced the antibacterial property of the cotton fabric.

Application of Aloe Vera and Testing the Antibacterial Activity: All the dyed samples treated with aloe vera finish showed a great reduction in bacterial activity. The aloe vera-finished samples were compared with the dyed control samples. Pomegranate-dyed samples finished with aloe vera showed excellent antibacterial activity against *S. aureus*. The bacteria reduction obtained with this sample was 92.48% (Table 7). The bioactivity of the fabric is due to slow diffusion of the aloe vera out of the polymer reservoir. The aloe vera finish which was used for this study has so far been commercially used only for moisture absorbency purposes and did not claim to give any antibacterial property. Anthraquinones, saponins and phenolics in aloe vera provide antiseptic properties and act powerfully as antimicrobial agents. This fact that aloe vera

enhances the antibacterial property of the fabric was further substantiated from the results obtained.

When tested for antibacterial activity against *E. coli*, it was observed that the bacterial reduction was slightly lower than the level obtained against *S. aureus*. As indicated in Table 8, the samples dyed with red sandalwood and pomegranate showed the maximum bacteria reduction of 49.48% and 44.63%.

Table 7: Results for quantitative antibacterial testing for *S. aureus*

Dyes + aloe vera	Cfu/ml*	Control sample Cfu/ml*	Bacteria reduction (%)
Indigo	43	158	72.78
Pomegranate	14	194	**92.48**
Madder	60	138	56.52
Red sandal wood	24	137	82.48

*10^2 dilution

From the results obtained we can conclude that aloe vera showed better antibacterial activity against *S. aureus* than *E. coli*. The sample dyed with pomegranate and finished with aloe vera, showed the best overall antibacterial effect against both bacterial species.

Table 8: Results for quantitative antibacterial testing for *E. coli*

Dyes + aloe vera	cfu/ml*	Control sample cfu/ml*	Bacteria reduction (%)
Indigo	90	132	31.81
Pomegranate	78	153	**49.48**
Madder	129	173	25.43
Red sandal wood	98	177	44.63

*10^2 dilution

A pomegranate-dyed sample was finished with sericin and then finished with aloe vera. The sample was also tested for levels of antibacterial activity. A comparison was made only with the sample finished with aloe vera (Photographs 1 and 2). From the results obtained, it was concluded that presence of sericin in combination with aloe vera marginally improved the antibacterial activity though did not provide any significant difference (Table 9).

Table 9: Results for quantitative antibacterial testing for *E. coli* and *S. aureus*

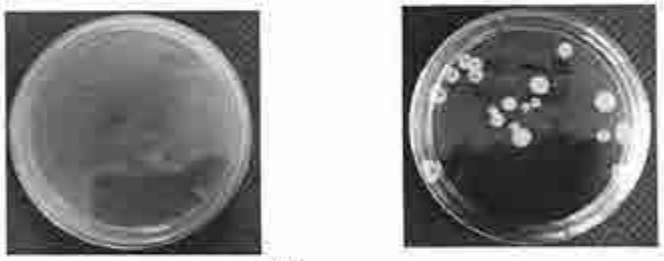
Sample	*S. aureus* Cfu/ml*	*E. coli* Cfu/ml*
Dye + sericin + aloe vera	10	60
Dye + aloe vera	14	78

*10^2dilution

Evaluating the Durability of the Finish: According to the results obtained after laundering, it can be noted that the finish either in combination or only aloe vera showed an increase in the number of colonies of both *S. aureus* and *E. coli*. The difference in the antibacterial activity observed before and after laundering was not significant. This shows that the aloe vera finish with and without sericin is satisfactorily maintained after 5 launderings. In comparison, combination of both the finishes exhibited marginally higher durability towards laundering (Table 10).

(a) (b)

Photograph 1. Cfu/ml of *S. aureus* (a) and *E.coli* (b) with dye and aloe vera



(a) (b)

Photograph 2. cfu/ml of *S.aureus* (a) and *E.coli* (b) with dye, sericin and aloe vera

Table 10: Evaluation of durability towards laundering

Organisms	*S. aureus*		*E.coli*	
Samples	**Before cfu/ml**	**After cfu/ml**	**Before cfu/ml**	**After cfu/ml**
Dye + aloe vera	14	29	78	92
Dye + sericin + aloe vera	10	26	60	74

*10^2 dilution)

Testing the Comfort Properties of the Finished Product

Since the intimate and sports apparel were developed from the finished fabric, it was necessary to test the samples for their comfort properties. Therefore, the samples were tested for air permeability and water vapour permeability using the standard test methods.

The control sample was plain untreated scoured organic cotton. From the results obtained, it was noticed that the there was a decrease in the air permeability. This reduction is due to the deposition of the dye and finishes on the fabric. Since the finishes applied – dyes, sericin and aloe vera – are surface application dyes, they tend to coat the surface fibres as well as the spaces in between them. This can cause the reduction in the air passages of the fabric (Fig. 1).

Water permeability test was conducted on two sets of pomegranate dyed samples, one finished with aloe vera only and the other with sericin along with aloe vera. The results were analysed in comparison to the control undyed/ unfinished samples.

Water vapour permeability was found to have increased due to presence of aloe vera and sericin. Probably the presence of aloe vera enhanced the moisture absorbency of the sample. Sericin is also known to have high levels of moisture absorbency. Therefore, the presence of sericin and aloe vera in the combination sample further enhanced the water vapour permeability (Fig. 1).

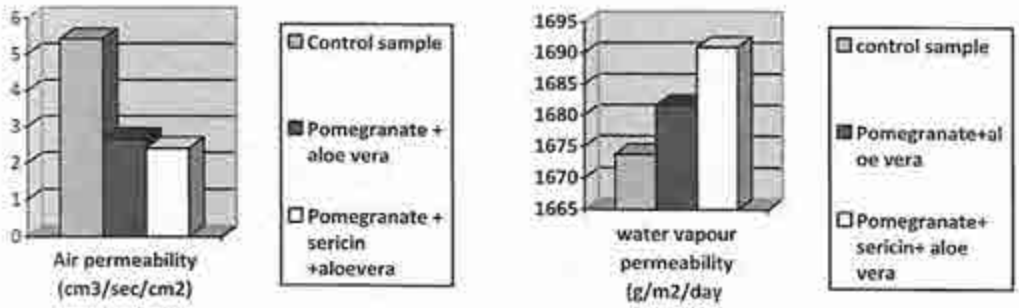


Figure 1: Air permeability and Water Permeability

Photograph 3: Intimate apparel and sportswear developed using the antimicrobial finishes.

Micro-encapsulated aloe vera also imparted a soothing, pleasant fragrance. A colour range varying from blue (indigo), pink (madder) to mustard yellow (pomegranate) and light brown (red sandalwood) was developed with the selected natural dyes (Photograph 3). Different designs of sports bra, camisoles, underpants, t-shirts, shorts, cycling shorts, leggings, bermudas, tights, skirts, lowers and track suits were conceptualised and developed.

CONCLUSION

The application of natural dyes and finishes enhanced the resistance of the fabric against microbial infestation. Natural dyes gave a wide gamut of colours which contributed to the aesthetic appeal of the garment as well as gave antibacterial properties. Sericin used as a finish improved the bacterial resistance of the samples dyed with natural dyes. Aloe vera, being a plant source has been used for its therapeutic and antibacterial effects for a long time. The microencapsulation technology has been used for manufacture of aloe vera based finish. Aloe vera and sericin used in combination with natural dyes displayed excellent antibacterial properties. The finished knitted organic cotton fabric was successfully used for designing and development of product range for intimate and sports apparel.

REFERENCES

Aggarwal R. (2010). Ayurvastra – a Way to Healthy Living. Apparel. October, Vol 5.

Bhat NV, *et al.* (2010). Antibacterial Finish for Cotton Fabric from Herbal Products. Indian Journal of Fibre and Textile Research. 35 (March). 50 - 57.

Gao Y. and Cranston R. (2008). Recent Advances in Antimicrobial Treatments of Textiles. *Textile* Research Journal. Vol 78 (1). 60-72.

Gulrajani ML. (1992). Natural Dyes and Their Application to Textiles. Department of Textile Technology. IIT Delhi. 81 - 85.

Jadwiga SK. (2004). Bio Deterioration of Textiles. Int. Biodeteriorat. Biodegrad. 53 (3): 165 - 70.

Malik. T. Sinha TK. Aggarwal Y. Kapoor R. (2011). Antimicrobial Finish: Review. Indian Textile Journal. 121 (4). 69-74.

Purwar R, Joshi M, Wazed AS, Rajendran S. (2009). Eco-friendly Antimicrobial Finishing of Textiles. Indian Journal of Fibre & Textile Research. Vol. 34 (3). 295 - 304.

Sarkar RK, De P, Chauhan PD. (2001). Bacteria-Resist Finishes on Textiles: Part I. Manmade Textile in India. 44 (12). 460 - 67.

Ureyen ME, *et al.* (2010). Antibacterial and Physical Properties of Knitted Cotton Fabrics Treated with Antibacterial Finishes. AATCC Review. 10 (1): 48 - 63.

EFFECT OF BLENDING ACRYLIC FIBRE WITH NETTLE ON MECHANICAL PROPERTIES OF FABRIC

Suman Pant, Shikha Bharadwaj
Department of Clothing and Textiles
Banasthali University, Rajasthan-304022

The effect of blending nettle fibre with acrylic fibre on the mechanical properties of fabric has been reported in this study. Nettle (N) and acrylic fibres (A) have been blended in three different ratios, namely, 70N/30A, 50N/50A, and 30N/70A. For each blend ratio, yarns of two counts (16 Ne and 24 Ne) are prepared on a ring spinning system inserting a Z twist. Fabric samples were prepared on a simple hand loom in plain weave. The properties of the yarn and fabric were evaluated. It was found that the strength, and abrasion resistance of fabrics improved but the pilling tendency increased after blending acrylic fibre with nettle fibre.

Keywords: abrasion resistance, pilling, stinging nettle, acrylic, tearing strength, tensile strength

The nettle (*Urtica dioica L.*, commonly known as stinging nettle) is a perennial plant that contains unlignified, sclerenchymatic fibres in the bark. Several species of the nettle family (*Urticaceae*) produce bast fibres similar to flax, and many of those species have been used to produce fibre for making textiles and clothing for thousands of years (Project Report of Uttaranchal Bamboo and Fiber Development Board, 2009).

Nettle has several qualities that are of great interest to fabric and clothing manufacturers. The length of its fibre is greater than that of any other plant fibre known to us, which increases spinning options and hence, fabric possibilities. This fibre has remarkably high tensile strength, fineness, and specific weight (Bordos and Baley, 2007; Crebas, 2012). This allows the production of fine fabrics and technical applications (Guo *et al.*, 2005). Stinging nettle has a hollow core which is useful for creating fabrics with thermal properties, both warm and cool (Vogl and Hartl, 2003).

It is a well-known fact that natural fibres, especially minor fibres such as nettle, alone cannot cater to the increasing demand of clothing and other items. Thus, the most viable solution lies in the field of blending. Blending is one of the methods to create novel combinations. Blends combine the positive attributes of each of its components and minimize the negative characteristics. The use of artificial fibres in blends economises the cost of the material, thus making it affordable. It also decreases the burden on the natural fibres which are limited in supply. Blending also creates a fabric which has different aesthetic properties and can be put into different kinds of new uses, thus opening the way for product diversification.

Acrylic is used as a substitute for wool fibre and is also often blended with it. Acrylic fibres are soft, warm, lightweight and resilient. They make easy-care fabrics. Because of their low specific gravity and high bulk properties, the acrylics have been called 'warmth without weight' fibres. Acrylics have been very successful in end uses such as sweaters and blankets that had earlier been dominated by wool. They are superior to wool in their easy-care properties and are non-allergic. They possess

favourable aesthetic properties and have been successfully blended with many other fibres. Various combinations of properties have been derived from these blends depending on the fibres used and on the percentage in the blend. One of the most important characteristics that acrylic provides is the high degree of shape retention when washed (Tortora, 1982).

The physical properties of nettle fibre have been reported (Bhardwaj and Pant, 2014) but research on yarn and fabric development and the development of a blend for improvement in its properties is lacking. This study reports the effect of blending acrylic fibre with nettle fibre on the mechanical properties of fabric.

MATERIALS AND METHODS

Nettle fibre was purchased in lap form from Uttarakhand Fibre and Bamboo Board, Uttarakhand. Acrylic fibre was purchased from Indian Acrylic Pvt. Ltd., Ludhiana. The physical properties such as fibre fineness, diameter, strength, and crimp of both the fibres were tested (Table 1). The blending and spinning of fibres was done at NITRA's Pilot Plant on a ring spinning system. The nettle fibres were cut according to the length of acrylic fibres and both fibres were blended in three different ratios – 70/30, 50/50, 30/70 of nettle/acrylic. Yarns of two counts—16 Ne and 24 Ne—were prepared. A yarn of 100% acrylic was also prepared for base reference. A blend of 70N/30A in 24 Ne could not be produced due to extensive breakage in the nettle fibre. Similarly, pure nettle yarn could not be prepared in 16Ne and 24Ne because of its stiffness and low pliability. Thus, a total of eight yarn samples were prepared by inserting Z twist. Various properties of yarns such as single yarn strength, elongation (IS: 1670) and; yarn evenness (ASTM D-1425) were measured (Tables 2 and 3).

Table 1: Properties of Nettle and Acrylic Fibres

Parameters	Nettle		Acrylic		
	Mean	C V (%)	Mean	C V (%)	t value
Fineness (denier)	16.25	43.28	1.81	22.08	12.32*
Diameter (microns)	68.57	38.20	15.58	26.60	43.04*
Tenacity (g/denier)	3.81	48.93	2.87	11.36	5.6**
Elongation at Break (%)	2.93	41.32	27.41	9.27	11.56*
Crimp (arcs/cm)	0.8	-	5.5	-	
Length (cm)	65.97	56.16	51.41	2.5	23.12*

* $p<0.01$, ** $p<0.05$

The fabric samples were prepared on a simple handloom, 34 inches wide, using plain weave. The reed and pick (44 × 36) were kept constant in all woven samples to control the variation. Five samples of blended yarns of two yarn counts and three samples of pure yarns were prepared. Abrasion resistance (IS: 12673:1989), pilling (IS: 10971-1984), tensile strength (IS: 1969 -1968)

and tearing strength (IS: 6489-1971) were measured after conditioning the fabric in standard atmospheric conditions.

Table 2: Strength characteristics of blended yarns

Blend Ratio of Yarns	Parameters					
	Breaking Force (kg)	CV (%)	Elongation at Break (mm)	CV (%)	Tenacity (g/tex)	CV (%)
16 Ne						
70N /30A	0.245	17.9	4.37	28.9	7.35	17.9
50N /50A	0.427	15.4	11.82	30.9	11.04	15.4
30N/70A	0.505	8.1	17.13	10.8	11.68	8.1
100 A	0.693	6.9	22.63	5.7	16.32	6.9
24 Ne						
50N /50A	0.230	26.5	10.62	26.5	9.61	26.5
30N/70A	0.290	17.5	14.11	21.9	10.52	17.5
100 A	0.735	7.7	23.41	6.2	14.69	7.7

F value - count 358, $p<0.01$, blend ratio 1.41, $p>0.05$, interaction 308, $p<0.01$

Table 3: Percent unevenness and imperfections in blended yarns

Blend Ratio	Unevenness (%)	Thick Places (+50 %)	Thin Places (- 50 %)	Neps (+ 200 %)
16 Ne				
70 N /30 A	18.17	595.0/km	630.5/km	2026/km
50 N /50 A	14.72	224.0/km	250.0/km	728/km
30 N /70 A	11.24	107.5/km	95.7/km	320/km
100 A	9.26	10/km	2.5/km	28.0/km
24 Ne				
50 N /50 A	18.32	763.0/km	415.0/km	2094/km
30 N /70 A	13.40	223/km	15.0/km	831/km
100 A	10.03	7/km	1.5/km	25.0/km

F value - count 121, $p<0.01$, blend ratio 11.42, $p<0.01$, interaction 393, $p<0.01$

RESULTS AND DISCUSSION

Among all the fabrics tested, 100% acrylic was found to be the strongest one. A similar trend was observed in case of strength of the fabrics of 24 Ne yarn. The tensile strength indicated that elongation and tenacity values decreased with the increase in nettle fibre component in the blends in spite of the fact that the strength of nettle fibre is greater than that of acrylic fibre (Table 4). Lower strength of blended yarns with greater percentage of nettle could be caused by various factors. One factor is the brittle nature of nettle fibre. Due to this of fibre, 100% 16 Ne and 24 Ne nettle yarns could not be procured. Moreover, yarns with a high percentage of nettle fibre are more uneven. Additionally, higher number of imperfections also affected strength negatively. Thin places, whether in slivers, roving, or yarns, are weak places. The more irregular a strand is, the greater is the chance of breakage.

Table 4: Tensile strength of fabrics

Blend Ratio	Load at peak (N)				Elongation (mm)			
	16 Ne		24 Ne		16 Ne		24 Ne	
	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
70N/30A	381.1	221.9	-	-	20.78	19.59	-	-
50N/50A	426.8	301.4	296.1	319.4	28.16	28.31	29.33	27.47
30N/70A	480.9	349.2	305.6	343.3	39.57	35.75	37.86	35.76
100A	560.9	466.7	430.3	470.6	44.65	41.32	47.59	52.45
F value	Count 5.50, $p<0.05$		Blend ratio 22.11, $p<0.01$		Direction 320, $p< 0.01$		Interaction 4.11, $p<0.05$	

Warp-way tensile strength was higher than weft-way in fabrics of 16 count in contrast with the trend in fabrics of 24 count. A direct relationship was observed between the load and elongation in case of fabrics made of 16 Ne and 24 Ne yarns. Elongation at break increases with an increase in the load at peak (Table 4).

The fabrics made of 16 Ne yarns had higher strength as compared to fabrics of 24 Ne yarn. One of the factors affecting tensile strength of fabric is yarn strength. The properties of fabric are, in part, a result of the properties of yarns. Better yarn strength contributes towards better fabric strength. A positive correlation (0.66) significant at one percent level was found between yarn strength and fabric strength.

The effect of different count, blend ratios and warp and weft direction of the fabric on fabric strength as assessed by ANOVA showed the significant difference in the strength of fabrics of different counts ($F=5.50$, $p<0.05$) while the blend ratio was found to affect the strength of the fabrics at 1% level ($F=22.11, p<0.01$) of significance. The direction of the fabric also affected the strength of the fabric significantly at 1% level ($F=320$, $p<0.01$).

The tearing strength of fabrics containing higher ratio of acrylic fibre is better than that of the fabrics with a higher ratio of nettle fibre. A similar trend was found in the tearing strength values of the fabric woven from 16 Ne and 24 Ne yarns. Acrylic fabrics of 100% purity of both the counts showed maximum value of tearing strength in both directions (Table 5).

In general, the blended fabrics made of 16 counts had more tearing strength in warp as well in weft direction as compared to the fabric of 24 Ne yarns. It may be said that it is also directly related to the yarn strength. Threads break singly or in very small groups during a tear. Therefore, the single thread strength is of great importance in tearing strength. The yarns of 16 Ne are stronger than the

yarns of 24 Ne. High positive correlation (0.75) significant at one percent level was found between tearing strength and yarn strength.

Table 5: Tearing strength of fabrics

Blend Ratio	Tearing Strength (Kg)			
	16 Ne		24 Ne	
	Warp	Weft	Warp	Weft
70N/30A	5.38	5.80	-	-
50N/50A	5.56	7.04	5.1	5.48
30N/70A	6.64	8.34	6.7	6.68
100 A	7.16	7.74	7.6	8.74
F value	Count 37.51, $p<0.01$	Blend ratio 6.7, $p<0.01$	Direction 32.43, $p<0.01$	Interaction 4.53, $p<0.01$

The effect of yarn count, blend ratio and direction of fabric on tearing strength was found to be significant at one percent level ($F=37.51, 6.7, 32.43, p<0.01$). The interaction of these factors is also significant at one percent level ($F=4.53, p<0.01$).

In general, blended fabrics which contain higher percentage of acrylic fibre, show better abrasion resistance. Abrasion resistance of 100% Acrylic fabrics was the best among all the fabrics irrespective of the count of yarn Table 6. This might be attributed to the evenness of the yarn. As the evenness of yarn increases with less number of thick and thin places (Table 3), abrasion resistance improves.

Table 6: Abrasion resistance and pilling of fabrics

Blend Ratio	% weight loss after 150 cycles		No. of Pills	Pilling Grade	No. of Pills	Pilling Grade
	16 Ne	24 Ne	16 Ne		24 Ne	
70 N /30 A	15.74	-	9	4	-	-
50 N /50 A	12.95	18.08	17	4	14	4
30 N /70 A	11.65	15.85	23	3	21	3
100 A	10.75	13.15	31	2	26	3
F value	Count 49.58, $p<0.01$	Blend ratio 65.39, $p<0.01$	Interaction 11.03, $p<0.01$			

The fabrics woven of 16 Ne yarns were found to have better abrasion resistance as compared to the fabrics of 24 Ne. The reason for better abrasion resistance of the fabric woven from 16 Ne yarns again was the presence of fewer imperfections in the 16 Ne yarn as compared to the 24 Ne yarns which show a greater number of thick and thin places and neps. Such places are considered as weak spots for the yarns as well as for the fabrics made out from these yarns. Fabric properties such as

abrasion resistance are directly influenced by yarn evenness. Irregular yarns wear very quickly in selected portions. It may also be related to the count of the yarns. The size of the yarn influences abrasion resistance. Thick yarns resist damage from abrasion whereas fine yarns abrade easily. Yarns of 16 Ne are thicker than 24 Ne yarn. A high positive correlation (0.84) significant at five percent level exists between yarn evenness and abrasion resistance of fabrics.

The effect of yarn count and blend ratio on abrasion resistance was found significant at one percent level of significance ($F=49.58$, 65.39, $p<0.01$). The interaction between different counts and different blend ratio was also found to be significant at one percent level of significance ($F=11.23$, $p<0.01$). As the ratio of acrylic fibres increases, pilling tendency also increases. Severe pilling was observed in case of 100 percent pure acrylic fabric sample and it is known that acrylic fibres have this tendency. Thus, acrylic fibres are soft fibres and can easily bend to form balls in comparison to stiff nettle fibres.

Fabrics made of 24 Ne yarns show less pilling as compared to fabric made of 16 Ne. The reason for more pilling in the blended fabrics of 16 counts may be less twist per inch (TPI) given to the 16 Ne yarn. Twist has a direct influence on pilling. An increase in the twist binds the fibres in the yarn more firmly and hence lowers the pilling tendency.

CONCLUSION

It can be concluded that the impact of blending acrylic fibre with nettle fibre is an improvement in the strength and abrasion resistance of fabrics but not on pilling propensity of fabrics.

REFERENCES

Bhardwaj S, Pant S. (2014). Nettle - Acrylic Blend Makes Fabric Suitable For Garment. Textile Asia. 45 (No.3): 39–41.

Bodros E, Baley CC. (2007). Composite Science and Technology. 67 (3-4): 462–470.

Crebas BA. (2012). Gentler Fashion Textile - Using Stinging Nettles. Accessed from http://www.thguardian.com/environment/2008/feb/ethicalliving.fashion.Accessed on 10th Feb 2012

Guo Y, Wu H, Sun X, Qian X, Shen Y. (2005) Analysis on the properties of nettle fiber. J. Texile Res. 26: 27–28

Project Report of the Uttaranchal Bamboo and Fibre Development Board. (2009). Opportunity: Natural fibre. Uttaranchal. Pp 1–12

Tortora PG. (1982). Understanding Textiles. McMillan Publishing Company, New York. Pp 126–134

Vogl CR, Hartl A. (2003). American Journal of Alternative Agriculture. 18 (3): 121–128.

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BIRTH WEIGHT AND COGNITIVE ABILITIES OF ADOLESCENTS (12-14 YRS) BELONGING TO LOW SOCIO-ECONOMIC GROUP

Mandalika Subhadra, Achrekar Divya
College of Home Science, Nirmala Niketan, Mumbai

Intrauterine growth influences several aspects of postnatal life including cognitive abilities which is further affected by infant nutrition. Incidences of low birth weight and malnutrition are often reported in low socioeconomic families. This study aimed at assessing the impact of birth weight on the cognitive abilities of adolescents (age 12-14 yrs.) belonging to the low socioeconomic group. Two hundred adolescent girls and boys, in the age group of 12-14 years, were selected from Anuyog Vidyalaya, Khar (E), Mumbai, using purposive sampling technique. Information on age, birth weight and socioeconomic status was collected from all the participants using a standardised questionnaire-cum-interview schedule. Cognitive intelligence was measured using Raven's Standard Progressive Matrices Scale. The results indicated that 44.5% of the participants had cognitive impairment of different levels i.e. mild, moderate and severe. Girls were significantly more impaired than boys. The birth weight of cognitively impaired children was significantly lower than that of normal ones. Thus, a need for development and/or strengthening of suitable strategies to provide nutritional care to pregnant women to facilitate healthy intrauterine growth of the foetus and thereby protect the cognitive abilities of offspring are indicated.

Keywords: Birth weight, cognition, low socioeconomic, adolescents, I.Q.

Intelligence is determined by a combination of genetic and environmental influences, the relative contributions of which are not yet established, and may vary over the lifespan (Bouchard, 1998). However, adverse environmental influences such as malnutrition originate while the foetus is developing in utero, affecting brain development (Morgane, Austin-LaFrance *et al.*, 1993). Impaired nutritional support during foetal life results in a reduced brain volume, sensorimotor cortex, amygdala and hippocampus, thinning of the corpus callosum (which indicates less white matter), and a reduction in grey matter (Anderson, *et al.*, 2000). These anatomical deficiencies lead to immaturity, physiological instabilities, or stressful experiences as neonates (Bhutta, *et al.*, 2002). Additionally, the socioeconomic environment in which a child is conceived and develops will have an effect on both their physical and mental development (Bartley *et al.*, 1994; Baxter-Jones *et al.*, 1999). There is now a large and increasing body of evidence to indicate that nutrition and health affect children's cognitive, motor, and behavioural development, both pre- and post-natally.

Adolescence is a stage where individuals experience changes in biological, cognitive, physical and as well as socio-emotional domains. Cognitively, the adolescent is increasingly able to think abstractly, begins to consider hypothetical ideas, and also starts considering multiple dimensions of a problem at the same time (Eccles, 1999). The impact of malnutrition on the physical growth

of adolescents has been well studied. However, data on the effect of birth weight on cognitive intelligence, especially in the low socioeconomic group, is sparse. Hence, the impact of birth weight on cognitive abilities of adolescents (12-14 yrs.) residing in Mumbai and belonging to low socioeconomic group was studied.

MATERIALS AND METHODS

Two hundred (200) adolescents (100 girls, 100) in the age group of 12-14 years and belonging to low socioeconomic group were selected using purposive sampling from Anuyog Vidyalaya, Khar (E), Mumbai after obtaining required permissions from the school authorities. An informed written consent was obtained from the participants and their parents. Adolescents meeting the selection criteria including age group specification and willing to permit assessment of cognitive function were included. Those suffering from any kind of clinical (mental or physical) problem were excluded from the study.

Research tools and techniques: The study included a baseline survey and measurement of cognitive abilities scores (Intelligence Quotient, or I.Q.) of the participants. A standardised interview schedule was used to record information on the participant's age, birth weight and socioeconomic status.

Measurement of Cognitive Abilities Scores (I.Q.): Raven's Standard Progressive Matrices Scale (Raven *et al*, 1998) was used to assess the cognitive abilities of the participants. The participants were reassured about the confidentiality of the information collected from them. It was a self-reported inventory. The test was administered in groups of five to ten students after giving the detailed instructions. The test was completed in 35-45 minutes. The various levels of cognitive impairment were identified (Table 1).

Table 1: Identification of grades of cognitive failure

Levels of C.I.	Inference	Grade	Percentiles
Normal	Intellectually superior	I	at or above the 95th percentile for people of the same age groups
		II+	at or above the 90th percentile
	Definitely above the average	II	at or above the 75th percentile
		III+	above the 50th percentile
Mild C.I.	Intellectually average	III	between the 25th and 75th percentile
		III-	below the 50th percentile
Moderate C.I.	Definitely below average in intellectual capacity	IV	at or below the 25th percentile
		IV-	at or below the 10th percentile
Severe C.I.	Intellectually impaired	V	at or above the 5th percentile

Source: Standard progressive matrices, Raven *et al*, 1998.

Data obtained in the study were analyzed using tests of difference, correlation coefficient and ANOVA, regression analysis using SPSS version 16.

RESULTS AND DISCUSSION

Adolescence is a transitional phase between childhood and adulthood characterised by marked acceleration in growth (Anand *et al.*, 2005). Malnutrition affects brain growth and development and hence, future behavioural outcomes. School-age children who are undernourished from early childhood have generally been found to have poorer I.Q. levels, cognitive function, school achievement and greater behavioural problems than matched controls and, to a lesser extent, siblings. The disadvantages last at least until adolescence (Kar *et al.*, 2008).

It was observed that little less than half of the participants had impaired cognitive ability (ICA) and the remaining were showing average to normal cognitive ability (NCA). There was no significant difference between the groups (Table 2). Interestingly, a significantly greater number of girls were cognitively impaired as compared to boys ($p \leq 0.01$).

Table 2: Cognitive Intelligence of the participants

Name of variables	Total	Girls	Boys
NCA[a]	n = 111 (55.5%)	n = 51 (25.5%)	n = 60 (30%)
ICA[b]	n = 89 (44.5%)	n = 49 (24.5%)	n = 40 (20%)

[a]Normal Cognitive Ability, [b]Impaired Cognitive Ability

Undernutrition during intrauterine life is one of the most important reasons for low birth weight. As compared with normal-birth-weight controls, very-low-birth-weight young adults display lower intelligence, lower levels of educational achievement, and higher rates of chronic health conditions and risk-taking behaviour (Daniel, 2002). Research confirms that low birth weight children are at greater risk for cognitive and school performance problems than are their normal birth weight peers, and that the risk for adverse outcomes increases as birth weight decreases (McCormick *et al.*, 1992). Thus, birth weight is one of most crucial risk factors for cognitive impairment in adolescents in addition to their living conditions.

Association of Birth Weight with Cognitive Impairment

In this study, birth weight of as low as 1 kg has been noticed among the participants (Table 3). An increase in the cognitive ability with birth weight in the participants was observed (Fig. 1). This indicated an impact of intrauterine growth on the cognitive ability of offspring (Table 4). ICA scores were further divided into mild, moderate and severe categories (Table 5.).

Table 3: Birth weight of the participants

Birth weight (kg)	Boys	Girls	Total	Percentage
1	9	6	15	7.5
1.1-1.5	35	34	69	34.5
1.6-2	32	48	80	40.0
2.1-2.5	16	7	23	11.5
2.6-3	8	5	13	6.5
Total	**100**	**100**	**200**	**100**

Table 4: Gender difference in the birth weight and cognitive impairment

Cognitive Status	Birth weight (g)#			t-value
	Boys (Mean ± SD)	t-value	Girls (Mean ± SD)	
Impaired (n=89)	1.52 ± 0.35 (n =40)	31.65***	1.74 ± 0.45 (n = 49)	21.60***
Normal (n=111)	1.94 ± 0.65 (n =51)	13.30***	1.89 ± 0.50 (n = 60)	15.33***

*** Significant values ($p = \leq 0.001$); # ICMR (2009)
Reference value: boys - 3.3, girls - 3.2

Among the participants, the average mean birth weight of both girls and boys was significantly lower than their reference values ($p \leq 0.001$) (Fig. 1), further confirming the association between birth weight and cognitive ability. Moreover, the findings of the present study confirm the reports mentioned above, i.e., the birth weight of cognitively impaired participants (boys and girls) was significantly lower than that of participants with normal cognitive abilities.

Though a higher incidence of cognitive impairment was noticed among the girls, the distribution of the participants according to the severity of CI revealed a different but interesting trend – only girls showed severe cognitive impairment whereas boys had mild to moderate level of CI, indicating a gender specific incidence of cognitive impairment which needs to be further investigated.

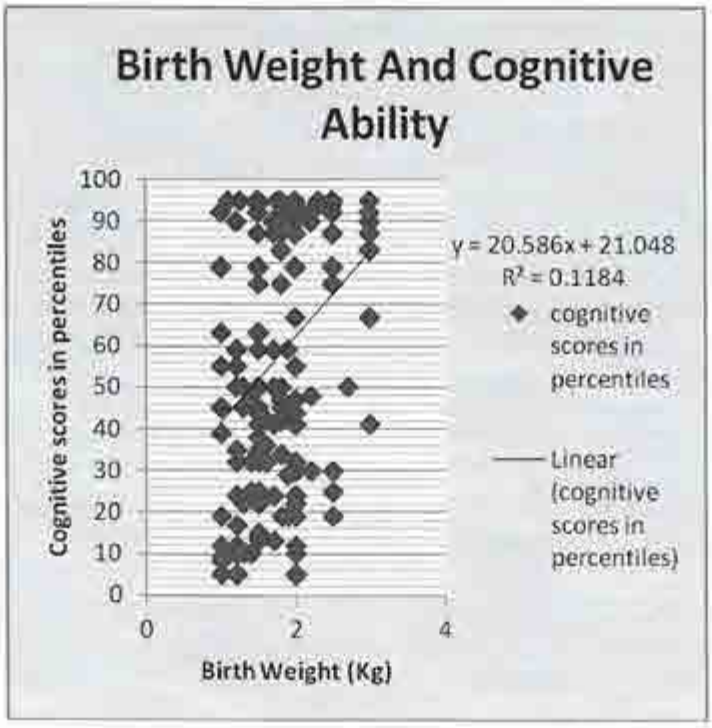

Figure 1: Birth weight and cognitive ability of the participants (N= 200).

Table 5: Gender specific severity of cognitive impairment amongst participants

Grouping variables (gender)	Cognitive Impairment			
	Mild	Moderate	Severe	Total
Girls	23 (25.84%)	16 (17.98%)	10 (11.24%)	49 (55.06%)
Boys	23 (25.84%)	17 (19.10%)	Nil	40 (44.94%)
Total	46 (51.68%)	33 (37.08%)	10 (11.24%)	89 (100%)

CONCLUSION

The incidences of cognitive impairment were significantly higher among the adolescent girls than the boys. Surprisingly, severe cognitive impairment was seen only among the female participants. The birth weight was found to have significantly influenced the cognitive abilities of the adolescent boys and girls ($p \leq 0.001$). Thus, the study reinforced

the need to support intrauterine growth through appropriate measures in order to ensure optimum birth weight and thereby optimum health of the offspring.

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REFERENCES

Anand K, Kant S, Kapoor SK, *et al.* (1999). Nutritional Status of Adolescents School Children in Rural North India. Indian Pediatr, 36, 810-815.

Anderson P, Doyle LW. (2003). Neurobehavioral Outcomes of School-Age Children Born Extremely Low Birth Weight or Very Preterm in the 1990s. Journal of the American Medical Association, 289 (24), 3264–72.

Barker DJP. (1997). Maternal Nutrition, Fetal Nutrition, and Disease in Later Life. Nutrition. 13, 807–813.

Baxter-Jones AD, Cardy AH, Helms PJ, *et al.* (1999). Influence of Socioeconomic Conditions on Growth in Infancy: The 1921 Aberdeen Birth Cohort. Arch Dis Child, 81, 5–9.

Bhutta AT *et al.* (2002). Cognitive and Behavioral Outcomes of School-Aged Children Who Were Born Preterm: A Meta-Analysis. Journal of the American Medical Association, 288 (6), 728–37.

Bouchard TJ. Jr. (1998). Genetic and Environmental Influences on Adult Intelligence and Special Mental Abilities. Hum. Biol, 70, 257–279.

Bowen JR, Gibson FL, Hand PJ. (2002). Educational Outcome at 8 Years of Children Who Were Born Prematurely: A Controlled Study. Journal of Paediatrics and Child Health, 38 (5), 438–44.

Bradley S, Peterson, *et al.* (2000). Regional Brain Volume Abnormalities and Long-Term Cognitive Outcome in Preterm Infants. Journal of the American Medical Association, 284 (15): 1939–47.

Eccles JS, Roeser RW, Sameroff AJ. (1999). School as a Context of Early Adolescents' Academic and Social-Emotional Development: A Summary of Research Findings. The Elementary School Journal. 100 (5): 443–471. Accessed from http://www.jstor.org/stable/1002279.

Grantham-McGregor S. (1984). Social Background in Childhood Malnutrition. In: Brozeck J, Schurch B, eds. Malnutrition and Behaviour: Critical Assessments and Key Issues. Lausanne, Switzerland. Nestlé Foundation. 358–74.

Hack M, Flannery DJ, Schluchter M, Cartar L, Borawski E *et al.*, (2002). Outcomes in Young Adulthood for Very-Low-Birth-Weight Infants. N. Engl. J. Med. 346, 149-157. DOI: 10.1056/NEJMoa010856.

ICMR. (2009). Nutrient requirements and recommended dietary allowances for Indians. icmr.nic.in/final/rda-2010.pdf.

Jane L, Hutton *et al.* (1997). Differential Effects of Preterm Birth and Small Gestational Age on Cognitive and Motor Development. Archives of Diseases in Children. 76 (2), F75–F81.

Kar BR, Rao SL, Chandramouli BA. (2008). Cognitive Development in Children with Chronic Protein Energy Malnutrition. Behavioral and Brain Functions. 4 (31): 1–12. PMCID: PMC2519065.

Marie C, Mc Cormick *et al.* (1994). The Health and Development Status of Very Low-Birth-Weight Children at School Age. Journal of the American Medical Association, 267 (16), 2204–08.

Morgane PJ, Austin-LaFrance R, Bronzino J *et al.* (1993). Prenatal Malnutrition and Development of the Brain. Neurosci Biobehav Rev. 17, 91–128.

Raven J, Raven JC, Court JH. (1998). Manual for Raven's Progressive Matrices and Vocabulary Scales. Section 1: General Overview. San Antonio, TX: Harcourt.

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DEVELOPMENT OF HEALTHY BREAD USING SOY OKARA

Siddhita, Kadam [1], Sheetal, Joshi [2], Sukhada, Bhatte-Paralkar [2]

[1] Protein Foods & Nutrition Development Association of India (PFNDAI)

[2] College of Home Science Nirmala Niketan, Mumbai

Soy okara is a by-product generated during tofu or soymilk production processes. The huge quantities of soy okara produced annually pose a significant disposal problem. This study was based on the concept of preparing bread in which the wheat flour could be substituted with soy okara thereby increasing the nutritive value of bread and enabling effective agro waste utilization. Freshly prepared soy okara was incorporated at 15%, 20% and 25% level in the breads. Incorporation at 20% level was accepted in terms of sensory properties as compared to the control. The nutritive value was also calculated to evaluate the proximate composition of bread substituted with soy okara. The calorific value and moisture content of wheat-soy okara bread (WSOB) containing 20% substituted soy okara per 100g was 244 kcal/g and 42g% respectively, crude fat (15.6g%), crude fibre (15.5g%), crude protein (11.55g %) and total ash (0.8%). The micronutrient content was 88mg% calcium, 0.27mg% iron and 51mg% of phosphorous. Shelf life studies of standardised bread and the final product were also carried out. It was concluded that the nutritive value of wheat bread can be improved by supplementing it with other healthy plant based food materials such as soy okara. The soy okara substitution in bakery industry can improve the nutritive value of bakery products and increase utilisation of waste from the soy milk industries.

Keywords: soy okara, waste utilisation, wheat soy okara bread **(WSOB).**

Soybeans are rich protein, fibre, calcium, magnesium as well as unsaturated fatty acids (Segura, 2011). Okara, the pulpy by-product of the soy milk and tofu processing industry, is a nutritious product that is rich in fibre, protein, carbohydrates, vitamins, minerals and fat. Besides its application as an animal feed, okara is used directly in food dishes such as soups and salads, or in fermented products such as tempeh in Asian cuisine. USA and other western countries have not utilised okara as a food as it is generally considered a waste product with a strong bean-like flavour, making it unacceptable to the consumers.

Soy okara, being an agro waste, is either used in animal feeds or sent to landfills for disposal, which adds to land pollution, production of greenhouse gases and altogether posing an ecological problem. Due to an increase in the sales of soymilk and tofu, these huge quantities of okara produced annually pose a significant disposal problem. No industrial product made of soy okara is currently available commercially. A possible use for okara is in baked goods as it has a large amount of fibre and protein.

Wheat is the main food item in a regular Indian diet. Wheat bread is an ideal product that can serve as a functional food since it is an important item of breakfast throughout the world (David, 2006). Soy okara is a good complementary protein for wheat as it provides the complementary amino acid, lysine.

MATERIALS AND METHODS

Raw soya beans (125 g) were cleaned and soaked in water for 7–8 hours and the skin was removed. The soaked soy beans were ground in 1 litre water in a blender, and the paste was boiled for 5 to 10 minutes on medium heat. The mixture was filtered through a muslin cloth and the soy milk was collected. The insoluble material which remained on the sieve is called okara.

Straight dough method was used for the preparation of bread fortified with soy okara. According to a study by Wickramarathna and Arampath (2003), bread fortified at 10% level showed no significant change in the sensory and physico-chemical attributes as compared to standard bread ($p<0.05$). In this study, the acceptability of varying amounts of soy okara (15%, 20% and 25% respectively) incorporated in a standard wheat bread recipe was evaluated. The bread used as a control sample was prepared with 50% whole wheat flour and 50% refined wheat flour. Four samples of bread were prepared per group (Table 1).

Table 1: Soy okara incorporated in the bread at 15%, 20% and 25%

Okara % / Ingredient	Amount (g)			
	Control - 0	**WSOB1 - 15**	**WSOB2 - 20**	**WSOB3 - 25**
Refined flour	125	125	125	125
Wheat flour	125	87.5	75	62.5
Soy okara (fresh)	-	**37.5**	**50**	**62.5**
Sugar	10	10	10	10
Fresh active yeast	12	12	12	12
Hydrogenated fat	10	10	10	10
	04	04	04	04

The three samples of fortified bread and the control were served to a panel of 5 semi-trained and 15 untrained evaluators. A score card with a nine-point hedonic scale designed to evaluate the appearance, flavour, taste, texture and general acceptability of the product. Sensory evaluation of each wheat soy okara product (WSOB1, WSOB2 and WSOB3) was carried out twice with the same team of sensory panellists.

The standard procedures recommended by the Association of Analytical Chemists (AOAC, 2012) were used to analyse the proximate principles like carbohydrates, protein, fat, dietary fibre, calories, moisture, ash and trace elements like iron, calcium, phosphorus in the samples.

A microbiological analysis was conducted on all the samples to determine the bacterial and yeast-mould count. Spread plate and pour plate methods were used for quantifying the number of organisms present in a particular sample. One gram of each sample was taken aseptically and homogenised in 9 ml sterile saline and mixed well for 2 min. Serial dilutions of 10^{-1}, 10^{-3} and 10^{-5} for both methods (using 1 ml of homogenates) were made with sterile saline. The dilutions used in microbial analysis were one millilitre of each dilution pour plated in sterile petri dishes, using nutrient agar (NA), incubated at 37°C, for 24-36 hours, whereas 0.1 millilitre of each dilution was spread on Sabouraud Dextrose Agar, incubated at 37°C, for 48 hrs. Counts of visible colonies were made and expressed in log cfu/g of sample. For microbiological analysis, sampling of the microbial load of different bread samples was performed after every specific period of time i.e. day 1, day 3 and day 5 at room temperature.

RESULTS AND DISCUSSION

The taste of all three products of wheat soy okara breads were more acceptable than that of the control product (Table 2). The mean scores of the sensory evaluation of the bread samples showed that there was no significant difference between products WSOB1 (15% soy okara) and WSOB2 (20% soy okara). The WSOB3 (25% soy okara) product was found to be slightly less acceptable than other bread products. There was no aftertaste in any of the products. The mean scores of the sensory evaluation of the bread product showed that WSOB2 product was most acceptable in almost every attribute i.e. appearance, colour, aroma, taste, crust texture and mouth feel than the other two products with an overall score of 89% acceptability, closely followed by WSOB1 (88%) and WSOB3 (86%). Hence, the WSOB2 product was selected to further study other parameters.

Table 2: Mean Scores of the Sensory Evaluation of the Bread Samples

Attributes	Control	WSOB1	WSOB2	WSOB3
Colour	7.90 ± 0.91	7.75 ± 1.11	7.85 ± 0.93	7.75 ± 0.96
Crust texture	7.60 ± 0.75	7.80 ± 1.05	7.95 ± 0.68	7.75 ± 1.16
Crumb texture	7.25 ± 1.25	7.95 ± 0.68	7.90 ± 0.96	7.65 ± 1.22
Taste	7.65 ± 0.87	7.90 ± 0.91	7.90 ± 0.85	7.75 ± 1.29
Aroma	7.50 ± 1.05	7.65 ± 1.22	7.80 ± 1.05	7.60 ± 1.09
Mouth feel	7.45 ± 1.14	7.70 ± 1.08	7.80 ± 0.83	7.65 ± 0.93
Overall acceptability	**7.50 ± 1.00**	**7.90 ± 0.91**	**8.05 ± 0.15**	**7.70 ± 1.08**

Incorporating soy okara had a definite impact on the nutritive value of the product (Tables 3, 4). The moisture content of both the control and the WSOB2 product were nearly the same. The crude fibre (15.6 g%) and fat content (15.5g%) was higher in the soy okara bread as compared to the control sample (2.8g% fibre, 1.4g% fat). The protein content of the WSOB2 (11.55g %) is marginally higher than that of the control sample (10.66%). The carbohydrate content of WSOB2 was lower (14.55 g %) than that of the control product (43.34 g %). Thus, the carbohydrate content decreased with an increase in the proportion of soy okara in the WSOB2 product.

The calcium content of WSOB2 was 88 mg %, which is higher than that of the control product (44 mg %). Similarly, higher iron and phosphorous contents (0.27 mg % and 51 mg % respectively) were recorded for the WSOB2 sample while lower contents of 0.14 mg % and 28 mg % were recorded from the control sample, respectively. A comparison between the nutrient content of the control product and WSOB2 product showed that the bread partially replaced with soy okara had a higher content of dietary fibre, protein, calcium, iron and phosphorous as compared to the control sample.

Table 3: Proximate composition of soy okara bread per 100 g

Component	Control (0%)	WSOB2 (20%)
Moisture (%)	41.00	42.00
Energy (Kcal)	241.00	244.00
Carbohydrates (g)	43.34	14.55
Protein (g)	10.66	11.55
Total Fat(g)	2.80	15.60
Dietary fibre(g)	1.40	15.50
Total ash (%)	0.80	0.80

Table 4: Micronutrient composition of soy okara bread per 100 g.

Micronutrient	Control (0%)	WSOB2 (20%)
Calcium (mg)	44.00	88.00
Iron (mg)	0.14	0.27
Phosphorous (mg)	28.00	51.00

Staling of bread is influenced by several factors such as the composition of wheat, proteins and carbohydrates, type and amount of shortening, use of various ingredients, yeast, processing conditions, initial moisture and storage temperature of breads. The total viable count of the micro-organisms on the control sample was 0.2×10^2cfu/g on day 1, while no microbial growth was

observed on the WSOB2 sample. The total viable count of both types of bread samples were increased by the third day of storage. For the control sample it increased from 0.2×10^2cfu/g to 2.0×10^5 cfu/g and for the WSOB2 sample, it increased from no microbial growth to 7.6×10^4 cfu/g. On the fifth day, the total viable count of both control bread samples increased from 2.0×10^5cfu/g to 6.1×10^5 cfu/g and from 7.6×10^4 cfu/g to 3.2×10^5cfu/g for WSOB2 sample (from day 3 to day 5 for both samples). The number of total bacteria in 3 days of study (day 1, 3 and 5) showed that the control sample had greater bacterial growth on it than the WSOB2 sample. This indicates a stable shelf life of up to 2-3 days for both the samples

Table 5: Total Bacterial Count of Bread Sample

Day	Control - 0%(cfu/g)	WSOB2 - 20% (cfu/g)
1	0.2×10^2	Nil
3	20.0×10^4	7.6×10^4
5	61.0×10^4	32.0×10^4

Bread staling, development of rope and moulds are the major problems of bread during storage. The total yeast and mould counts of the two samples of breads are as shown in Table no. 6. Sabouraud Dextrose Agar was used for total fungal count. Data from the study indicated that 1.3×10^6 cfu/g, 2.8×10^6 cfu/g and 4.1×10^6cfu/g of yeast and mould grew in the plates containing the control sample for day 1, 3 and 5 respectively at room temperature. WSOB2 sample contained 3.3×10^5 cfu/g on day 1. The total fungal count of WSOB2 sample on day 3 increased from 3.3×10^5 cfu/g to1.3×10^6cfu/g and on day 5 from 1.3×10^6cfu/g to 1.4×10^6 cfu/g. Yeast and mould colonies increased for both types of bread samples during 5 days of storage. This confirms a stable shelf life upto 2-3 days for both the samples.

Table 6: Total Fungal Count of Bread Sample

Day	Control - 0% (cfu/g)	WSOB2 - 20% (cfu/g)
1	1.3×10^6	3.3×10^5
3	2.8×10^6	13.0×10^5
5	4.1×10^6	14.0×10^5

CONCLUSION

Breads prepared from refined wheat flour are deficient in some proteins, vitamins, minerals and fibre. Therefore, there was a need to develop fortified bread which contains the macro and micro nutrients in greater quantities. Soy okara is a rich source of nutrients that could be utilised in the bakery industry, as its substitution would be beneficial in reducing the use of refined flour and also

Overcome the waste disposal problem prevailing in the soy milk industries. Thus, this research concluded that the utilisation of soy okara improved the nutritional quality of bread. Extensive studies were conducted on the sensory evaluation, nutritional values, and microbial activity of soy okara. This by-product is an ingredient rich in fibre, fat, protein, vitamins, and trace elements making it good raw material for bakery and other allied industries.

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REFERENCES

David MO. (2006). Nigeria, No 1 market for U.S. Wheat; Potential for other grains and feeds, USAID Foreign Agric. Serv. Bull., pp. 1–2.

AOAC. (2012).Official Methods of Analysis of AOAC International Latimer G Jr. (ed.). 19th Edition. Volume I., Chapter 32, pp. 32–44.

Osuji CM. (2006). Importance and use of additives in bread-making. A paper presented at a training workshop on the use of cassava/wheat composite flour and non-bromate additives for making bread and other confectionaries. Held at Michael Okpara, University of Agriculture, Umudike.

Segura MEC. Rosell M. (2011) Chemical Composition and Starch Digestibility of Different Gluten Free Breads, Institute of Agrochemistry and Food Technology. Valencia. Spain.Instituto de Cienciy Tecnologia de Alimentos (ICTA). Universidad Central de Venezuela. Caracas, Venezuela.

Wickramarathna GL, Arampath PC. (2003). Utilization of Okara in Bread Making. Department of Food Science and Technology, Faculty of Agriculture, University of Peradeniya, Peradeniya. Cey. J. Sci. (Bio.Sci.). 31, 29 – 33.

BARLEY MALT-BASED NUTRITIOUS *SATTU* BEVERAGE

Isha Kaushik, Rajindra Singh and Suman
Haryana Agricultural University, Hisar.

This study was carried out to develop a barley malt-based *sattu* beverage with bengal gram and peanut. The physico-chemical properties of barley grains, barley malt, bengal gram and peanut, the nutritional composition and organoleptic acceptability of the product were tested. The 1000 kernel weight and grain length of barley was found to be 38.6g and 10.7mm, respectively, and barley malt was 34.2g and 9.65mm, respectively. The addition of malt resulted in a decrease in viscosity (136mPa.s) in the *sattu* beverage. Malting of barley improved the total sugar (30.7%) and reducing sugar (26.83%) content. The protein, fat, total sugar and reducing sugar of malt based nutritious *sattu* beverage were 1.8, 0.9, 18.38 and 3.17 per cent, respectively. The addition of malt in *sattu* and incorporating bengal gram and peanut not only improved the nutritional quality but also enhanced the sensory acceptability of the beverage.

Key words: Barley, bengal gram, malt, peanut and *sattu*.

Barley produces a soothing effect in the body. Its alternate uses in malt, the beer industry and in health tonics have proved that barley is an important crop in the present era (Chand *et al.*, 2008). Barley is easily digestible due to its low gluten content and the presence of β-glucan gives it superior nutritional qualities. Soluble β-glucans are recognized as healthy polymers due to their benefits in cholesterol-lowering and glycemic index reduction – effects that are beneficial in the prevention and management of various metabolic disorders, such as diabetes and cardiovascular disease (Jenkins *et al.*, 2000).

Sattu is a traditional Indian product with a high nutritive value and excellent taste. It is a flour mixture of roasted cereals (mainly barley) with pulses and sugar or salt made into a thick slurry with water or milk (Mridula *et al.*, 2010). The use of malt in *sattu* formulation offers new opportunities for the Indian beverage industries. Earlier, *sattu* was considered as a poor man's food. Now-a-days the popularity of barley and bengal gram *sattu* among diabetic patients is increasing due to its low glycemic index. *Sattu* is consumed either in the form of a drink, consisting of water, fresh lemon and sugar added in the required proportion, or in the form of a snack, particularly in Bihar and Uttar Pradesh (Mridula *et al.*, 2007). In developing countries, a combination of cereals and pulses brings a balance in the amino acid composition for better utilisation of proteins by the human body. Among the various legumes, bengal gram is the preferred one for making *sattu* (Liener, 1976). Keeping this in view, this investigation aimed at determining the physico-chemical properties of grains along with the nutritional composition and sensory acceptability of malt based nutritious *sattu* beverage.

MATERIALS AND METHODS

Malting of barley grains was carried out by steeping and germinating the grains at 15°C for two-three days in a Biological Oxygen Demand (BOD) incubator. Kilning was done at 60°C for one day in a hot-air oven. Nutritious *sattu* beverage was prepared by mixing 4g malt, 25g bengal gram and 15g peanut per extract from 100g barley with the addition of sugar to 17° brix and homogenized for proper mixing. The prepared beverage was filled in pre-sterilized glass bottles and autoclaved for 15 minutes at 15 psi and stored at room temperature. A control sample was made with the above recipe, but with plain barley.

Malting modifies the grains physically, chemically and biologically (Briggs, 1998). The thousand kernel weight and seed size are specifications frequently used to indicate malt barley quality. Hydrolytic enzymes in the malt are activated during the malting process which are known to reduce the viscosity of starchy foods through amylolytic breakdown of starch, thus reducing the bulk and improving the texture and digestibility (Jamar *et al.*, 2011). The addition of legumes and oilseeds to *sattu* will not only improve the protein quality but may also improve the taste and flavour.

From the different quality parameters reported in the literature, fast hydration and germination (Briggs 1998), kernel size fractions, kernel weight, β-glucan and protein contents, malting losses, friability, α-amylase activity, soluble nitrogen ratio (SNR) and viscosity (Fox et al., 2003) are among the common assays used to test the quality of barley grain for malting. Additionally, the endosperm structure, starch content, protein content, and cell wall properties have, among others, been identified as factors determining the rate of water uptake during barley steeping (Ogushi *et al.*, 2002). Makeri *et al.*, (2013) reported that the physical properties affect the texture of the endosperm which influenced the malt modification process by affecting water uptake and consequently enzyme synthesis and movement within the endosperm which leads to an improvement in the texture of the product by decreasing the viscosity.

The thousand-kernel weight of barley grains, malted barley grains, bengal gram and peanut were determined in triplicates as described by Gomez *et al.* (1997). The two principal dimensions of the grains (length and breadth) were measured using a micrometre screw gauge with an accuracy of 0.01 mm. The viscosity of the beverage was measured by using a viscometer (Rheology International, Shannon, Ireland) with spindle no. 4 and spindle speed 50 rpm and expressed in mPas.

The moisture, crude protein and crude fat content of the grains and *sattu* beverage were determined by employing the standard methods of analysis as recommended by AOAC, 2005.

The beverage was organoleptically examined for its colour, taste, flavour, mouth feel and overall acceptability on a Nine Point Hedonic Rating Scale by a panel of semi-trained judges who had some experience of *sattu*.

RESULTS AND DISCUSSION

The viscosity (136mPa.s) of the *sattu* beverage decreased with the addition of malted barley. The physical characteristics of grains are presented in Table 1.

Table 1: Physical properties of barley grains and malted barley grains

Components	Barley	Malted barley	Bengal gram	Peanut
1000 kernels wt (g)	38.6 ± 0.84	34.2 ± 1.09	32.8* ± 0.97	903.0* ± 11.0
Grain length (mm)	10.7 ± 1.23	9.65 ± 2.01	8.43* ± 0.50	13.05* ± 0.34
Grain breadth (mm)	3.47 ± 0.26	3.02* ± 0.34	6.57 ± 0.50	7.2* ± 0.50

Values are mean ± SE of three independent determinations. *indicates significance.

The moisture, protein and fat content differed significantly ($p<0.05$) among barley, barley malt, peanut and bengal gram (Table 2). The kilning process resulted in moisture loss (1.32%) from in barley malt. Peanut had significantly higher fat (39.8%) and protein (34.23%) content ($p<0.05$). Malting decreased the fat content, and improved the protein content of barley. No significant difference was observed for the total and reducing sugar content in barley, peanut and bengal gram, but total sugar (30.7%) and reducing sugar (26.8%) content were significantly increased in malted barley ($p<0.05$). These changes were probably caused by the increased enzyme activity during germination.

Sensory evaluation and nutritional composition of malt-based *sattu* beverage

Barley malt based nutritious *sattu* beverage was rated as highly acceptable with respect to the colour, mouthfeel, taste and flavor Fig. 1). It fared better than the control for overall acceptability probably due to the addition of peanut. Further, malt enhances the flavour of the beverage and increases the overall acceptability (Akonor *et al.*, 2014). Needless to say, the protein, fat, total sugar

Table 2: Nutrient content of barley, bengal gram, peanut and malted barley grains

Constituent (%)	Barley	Malted barley	Bengal gram	Peanut	CD ($p<0.05$)
Moisture	5.21 ± 0.05	1.32* ± 0.03	5.95* ± 0.03	4.32 ± 0.16	0.28
Fat	2.49 ± 0.28	0.94* ± 0.04	5.41 ± 0.04	39.8* ± 0.66	1.20
Protein	9.32* ± 0.06	11.00 ± 0.18	17.11 ± 0.01	34.23* ± 0.25	0.52
Total sugar	6.54 ± 0.15	30.76* ± 0.54	4.38* ± 0.00	5.11 ± 0.11	0.96
Reducing sugar	1.24 ± 0.30	26.83* ± 0.14	1.09* ± 0.00	2.42 ± 0.02	0.55

Values are mean ± SE of three independent determinations.

and reducing sugar of malt based nutritious *sattu* beverage also improved. Incorporation of bengal gram and peanut in barley extract improved the fat and protein content of *sattu* beverage, whereas addition of barley malt improved the protein and sugar content of the beverage.

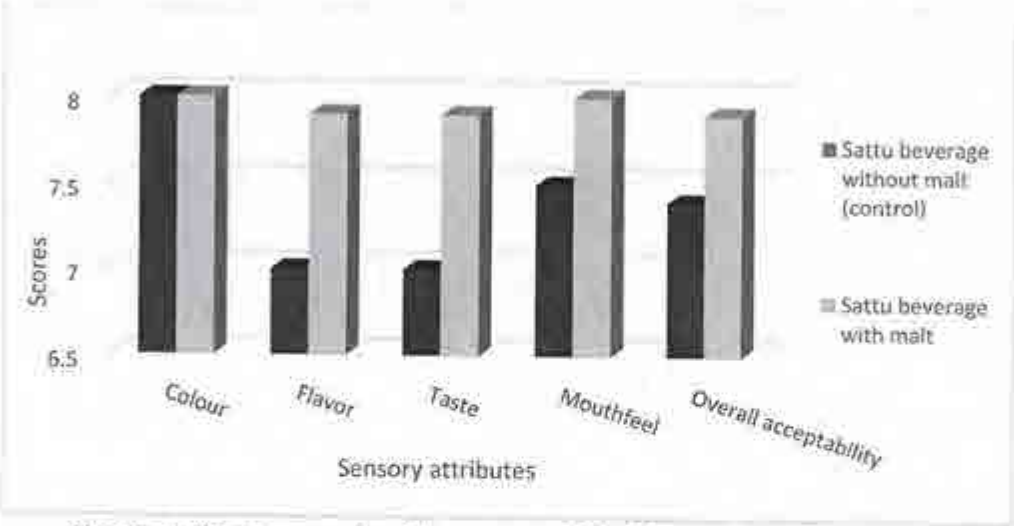

Figure 1: Sensory evaluation scores of barley malt *sattu* beverage

CONCLUSION

Thus, it is beneficial to incorporate bengal gram and peanut to malted barley beverage to improve the nutritional value and is organoleptically better acceptable.

REFERENCES

A.O.A.C. (2000). Official Methods of Analysis. (17th ed.). Association of Official Analytical Chemists. Washington D.C., USA.

Akonor PT, Tortoe C, and Oduro-Yeboah C. (2014). Physicochemical Characterization of Non-Alcoholic Beverages Produced from Malted Roasted Varieties of Maize (*Zea mays*). International Journal of Food Science and Nutrition Engineering. 4 (1): 20–26.

Briggs DE. (1998). Malts and Malting. Blackie Academic and Professional, London, pp. 218–28.

Chand N, Vishwakarma SR, Verma OP, and Kumar M. (2008). Phenotypic Stability of Elite Barley Lines over Heterogenous Environments. Barley Genetics News Letter. 38: 14–17.

Fox GP, Panozzo JF, Li CD, Lance RCM, Inkerman PA, and Henry, RJ. (2003). Molecular Basis of Barley Quality. Australian Journal of Agriculture Research 54:1081–101.

Gomez MI, Bliana AB, Martin DF, Madzavamuse M, and Monyo ES. (1997). Manual of Laboratory Procedures for Quality Evaluation of Sorghum and Pearl Millet. Technical Manual No. 2 ICRISAT, Patencheru, 502, 324, Andhra Pradesh, India.

Jamar C, Jardin P, and Fauconnier M. (2011). Cell Wall Polysaccharides Hydrolysis of Malting Barley (*Hordeum Vulgare* L.): A Review. Biotechnol. Agron. Soc. Environ. 2: 301–313.

Jenkins DJA, Axelsen M, Kendall, CWC, Augustin LSA, Vuksan V, and Smith U. (2000). Dietary Fiber, Carbohydrates and the Isulin Resistant Diseases. British Journal of Nutrition. 83: 157–163.

Liener IE. (1976). Legume Toxins in Relation to Protein Digestibility - A Review. Journal of Food Science. 41: 1076–1081.

Mridula D, Goyal RK, Bhargav VK, and Manikantan MR. (2007). Effect of Roasting on Texture, Colour and Acceptability of Soyabean for Making Sattu. American.Journal of Food Technology. 2 (4): 265–72.

Mridula D, Jain R, and Singh KK. (2010). Effect of Storage on Quality of Fortified Bengal Gram Sattu. Journal of Food Science and Technology. 47 (1): 119–23.

Ogushi K, Lim P, Barr AR, Takahashi S, Asakura T, and Ito K. (2002). Japanese Barley Meets Australia: Quality Performance of Malting Barley Grown in Different Countries. Journal of the Institute of Brewery. 108: 303–309.

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QUIZ – 02

TEXTILES AND FASHION TECHNOLOGY

Dr Ela Dedhia, Disha Gosar, Hetal Gala
College of Home Science, Nirmala Niketan, Mumbai – 400020.

I. MULTIPLE CHOICE QUESTIONS

1. Which parameter does the quality of the yarn mainly depend on?

a) Fineness
b) Maturity
c) Length
d) Trash content

2. Which textile fibre is used in cigarettes as a filter?

a) Viscose Rayon
b) Acrylic
c) Polyester
d) Acetate Rayon

3. India is the second largest producer of _____.

a) Cotton
b) Silk
c) Polyester
d) Jute

4. Substantial amount of jute material is used by _____.

a) Geotextiles
b) Agro textiles
c) Medical textiles
d) Home furnishing textiles

5. Which of the following fibres are used to produce artificial lawns?

a) Acrylic
b) Nylon
c) Polypropylene
d) Polyester

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6. What is the technique used in manufacturing of laces in shoes?

a) Knitting
b) Braiding
c) Netting
d) Crochet

7. In nose of rockets, which fibre is used as heat barrier?

a) Carbon fibre
b) Nylon-6,6
c) Polynosic
d) Polyester

8. Which type of textile fabrics are used as book binding cloth?

a) Corduroy
b) Fustian
c) Drill
d) Calico

9. Which city is called the 'knit city' in Tamil Nadu?

a) Chennai
b) Coimbatore
c) Darur
d) Tirupur

10. The melting temperature of polyester fibre is _____?

a) 183°C
b) 350°C
c) 120°C
d) 260°C

11. Which fibre is manufactured from wood pulp?

a) Polyacrylonitril
b) Anidex
c) Viscose
d) Nitril

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12. Which textile fibre are used in manufacturing bullet proof jackets?

a) Polyester + Nylon
b) Nylon
c) Polypropylene
d) Kevlar

13. Which process can improve lustre and smoothness of the cotton fabrics?

a) Bleaching
b) Scouring
c) Mercerisation
d) Sizing

14. Which material is used in tyre-cords due to its high tenacity?

a) Nylon
b) Nomex
c) Polyester
d) Polynosic

15. Which textile fibre is used in the manufacturing of cement bags and other packing materials?

a) Viscose
b) Polypropylene
c) Nylon
d) Lyocell

II. VISUAL ROUND

1. I am the creator of blue jeans. Who am I?

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2. I am a limited edition bag designed by Alexander McQueen in 2005. What am I called?

3. I am the inventor of the 20th century bikini. Who am I?

4. I am the most famous American female fashion icon in 1960s. Who am I?

5. I am the designer who has a famous musician songwriter singer pop star as a father. Who am I?

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6. I designed the wedding and coronation dresses of Queen Elizabeth II. Who am I?

7. Which business group does this brand belong to?

Allen Solly™

8. The combination of white-gold and black-gold colours is frequently used by this Indian designer. Who is he?

9. Which company does this apparel brand belong to?

PARK AVENUE

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10. This designer had worked with Satya Paul. Who is she?

III. RAPID FIRE

Set 1

1. What is grunge?
2. What was the name of a wide soft shawl that became popular around 1997?
3. *'Kaashtha sari'* from Maharashtra is also called as _____?
4. What stitch is used for hand stitch for seams and gathering?
5. What is the full form of BTRA?
6. Which textile fibre is used in sports wear due to its high level of elasticity?
7. What dyes are used for dyeing of silk fibres?
8. Which apparatus is used for yarn count?
9. On a sewing machine, what do you call the part which holds the fabric in place?
10. Which American designer invented the idea of a capsule wardrobe in the 1970s?
11. What is other term used for warp and weft knitting?
12. What is the process of removing the size material from the warp yarns after the textile fabric woven called as?

Set 2

1. What type of painting is *Madhubani*?
2. *'Mundum neriyathum'* is the traditional clothing of which state of India?
3. What world famous fashion magazine did Conde Nast purchase in 1909?
4. Which printing is the ancient printing technique from Rajasthan?
5. 'The fabric of our lives' is which brand's tagline?
6. What is a toile?
7. Name the designer team who made Diana's wedding dress?
8. 'It's hard to be nice if you don't feel comfortable' is the tagline of which brand?
9. Which company has a crocodile as its symbol?
10. Which stitch is called the invisible stitch?
11. *'Phulkari'* is the traditional embroidery of which Indian state?
12. What is the term used for a small piece of diamond-shaped fabric that is sewn into the underarm of a sleeve or into the crotch of pants?

Set 3

1. 'Celebrate India' is the tagline of which Indian brand.
2. Which elongated motif is woven on the shawls of Kashmir and is embroidered on the *kanats* of the Moghul tents?
3. Which designer designed the bridal gown for Princess Kate Middleton?
4. By what name was fashion designer Gabrielle Chanel known?
5. One way to finish a seam and keep the fabric from ravelling is to trim them with which type of shears?
6. What is the full form of ASTM?
7. Bleaching of cotton fabrics carried out by?
8. What are Dolce & Gabbana's first names?
9. Who has designed the 'little black dress'?
10. What stitch is used to finish an unhemmed blanket?
11. What is the standard measurement for seam allowances?
12. What is the chemical washing process carried out on cotton fabric to remove natural wax and non-fibrous impurities termed as?

Set 4

1. What is tie and dye artwork called as?
2. A tailored garment will usually require this sewing technique to fit correctly on the more curved portions of the body.
3. Which tester/instrument is used for water repellency test of fabrics?
4. "Where the clothes last for 21 hours" is the slogan of which brand?
5. Which sarees have a sacred importance to the women in Bengal?
6. Who designed the coned bra, which Madonna wore on her 80s tour?
7. Which state did *Kantha* embroidery originate in?
8. Which shoe designer gives his beautiful creations red soles?
9. What is the burning off the surface fibres from the fabric to produce smoothness process called as?
10. Issey Miyake is a designer based in which place?
11. When you make a mistake in sewing, what essential tool might you need?
12. Which type of saree is distinct because of its use of human motifs?

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THESES AND DISSERTATION TITLES
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2. Mahendra, Aakanksha (Guide: Mini Sheth). Acceptability Trials Of Fructooligosaccharide (FOS) Substituted Food Products And Impact Evaluation Of FOS Supplementation In Type 2 Diabetic Adults In Terms Of Their Glycemia, Gut Incretin (GLP-1) And Gut Microbiota (Foods and Nutrition). P/Th 13852.
3. Pandya, Apurvakumar Bharatbhai (Guide: Shagufa Kapadia). HIV/AIDS Counseling Practices: Experiences and Perspectives of Counsellors (Human Development and Family Studies). P/Th 14166

MSc. Dissertations

I. Clothing and Textiles

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ANSWERS TO QUIZ - 02

I. MULTIPLE CHOICE

1. Length
2. Acetate rayon
3. Silk
4. Home furnishing textiles
5. Polypropylene
6. Braiding
7. Carbon fibre
8. Calico
9. Tirupur
10. 260° C
11. Viscose
12. Kevlar
13. Mercerisation
14. Nylon
15. Polypropylene

II. VISUAL ROUND

1. Levi Strauss
2. Novak
3. Louis Reard
4. Jacqueline Kennedy
5. Stella McCartney
6. Norman Hartnell
7. Aditya Birla group
8. Nikhil Thampi
9. Raymond Apparel Limited
10. Masaba Gupta

RAPID FIRE

Set 1

1. Grunge was based on fashion started by a youth cult in the pacific North West region of America in the early 1990s.
2. Pashminas
3. Nauvari sari
4. Running stitch
5. Bombay Textile Research Association
6. Spandex
7. Acid dyes
8. Beasley's balance
9. Presser foot
10. Susie Faux
11. Courses and wales
12. Desizing

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Set 2

1. Mural painting
2. Kerala
3. Vogue
4. Daboo printing
5. Cotton
6. A muslin mock-up of a dress
7. David and Elizabeth Emanuel
8. Levi Strauss & Co.
9. Lacoste
10. Slip stitch
11. Punjab
12. Gusset

Set 3

1. Fab India
2. Tree of life motif
3. Alexander McQueen
4. Coco
5. Prinking
6. American Society for Testing and Materials
7. Hydrogen peroxide
8. Domenico Dolce and Stefano Gabbana
9. Coco Chanel
10. Blanket stitch
11. 5/8''
12. Scouring

Set 4

1. Bandhani
2. Darts
3. Bundesmann tester
4. Forever 21
5. Garad/garod silk sarees
6. Jean-Paul Gaultier
7. West Bengal
8. Christian Louboutin
9. Singeing
10. Japan
11. Seam ripper
12. Baluchari

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