Research Reach

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Research Unit
College of Home Science
Nirmala Niketan
49, New Marine Lines
Mumbai - 400 020

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The Principal,
College of Home Science,
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India
E-mail : nnchsc@bom5.vsnl.net.in
Tel. No : 022-2207 6503 / 2200 7544

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CONTENTS

Research Reach J. H. Sci. Vol. 4 No.1. 1-8

EXPANDING EARLY CHILDHOOD EDUCATION: CROSS STATE EXPERIENCES

D.D.Pandey
National Institute of Public Cooperation and Child Development,
5, Siri Institutional Area, Hauz Khas, New Delhi-110016.

In April 2000 the World Education Forum met in Dakar evolved a comprehensive framework of action for achieving the goals of Education for All. Out of six priority items identified therein, expanding and improving early childhood care and education system figured as first and foremost point of action. Taking cognizance of this, diversified approaches have been adopted by different States of the country so as to make the ubiquitous availability of qualitative early childhood care and education experiences to all eligible children between the age group of 3-6 years. In the present paper an attempt has been made to put in fore a minature picture of different approaches being adopted in India to ensure the universal access of ECCE to reach the goals of Dakar by 2015.

A revolutionary transformation has occurred in childcare and educational circumstances during the past half-century (Hernandez, 1998). There has been now an enormous increase in centre based alternative care and early childhood educational experiences for them. The testimony of this fact is evident from the considerable increase in the enrolment figures across all regions of the world (UNECSO, 2003). This revolutionary public favour is perhaps the outcome of generated awareness about the young child potential for early learning and emergent literacy.

Consequent upon recognition of this highly diverse area of learning opportunities varying from centre based pre school experience to more informal home and community based activities, number of international events has drawn their attention towards expanding and improving the access to early childhood education for children aged three to six years. Out of four set of rights of the child as envisaged in *Convention on Rights of the Child (CRC, 1989)*, the right to education including early education has been included under the broader framework of right to development. Focusing on the principle that learning begins at birth, the *World Conference on Education for All (1990)* emphasized the need to expand the early childhood and development programmes. *The world summit on children (1990)* after synthesizing the principles and concerns urged the world societies to work for children's enhanced development and educaton. Finally, the neglected field of early childhood care and education received further impetus by identifying it as first and foremost goal of *Dakar Framework of Action, 2000*, which was developed after reviewing the progress of the decade made in respect of Education for All project. A significant change that has taken place involves putting the agenda of early childhood education at the central to the discussion of educational and social projects and viewing it as one of the main pillars of Education for All movements (Early Childhood Education Programmes, 1997-41) supported by the UNDP, UNESCO, UNICEF and the World Bank.

Articulating the intent to specifically cater to the needs of 0-6 years old children, the constitution Eighty Sixth Amendment Act has substituted article 45(Directive Principle of State Policy) to read *The State shall endeavor to provide early childhood care and education for all children until they completes the age of six years*. The tenth five year plan has also acknowledged

the early childhood education as a first step in the educational ladder and reaffirmed its priority for the same adopting right based approach as advocated in the draft national policy and charter for children (2002). Under Sarva Shiksha Abhiyan (SSA) too, which is one of the major initiative of the Government of India for universal retention by 2010 in a mission mode, a provision has been made for taking up school readiness projects on small scale under the innovative head. While taking recognition of these facts, NCERT designed national core curriculum framework, 2000 has also advocated the introduction of two years early childhood education for all children in the age bracket of 3-6 years.

Gaining such momentum has proliferated multi pronged approaches (centre based early childhood education and socialization activities for children, experimentation with new models, convergence with existing system, education for parents and social support for families) to initiate and impart the early childhood care and educational initiatives. In the present paper, an attempt has been made to present before the readers a miniature picture of such approaches being adopted by various states located in different geographical regions of the country.

Central Region:

Madhya Pradesh

Shishu Shiksha Kendras (SSKs) have been established in the primary schools so as to take the dual advantages of linking ECCE with that of primary schooling and getting the school going children free from sibling care. This in turn, enables them to attend primary schools. SSKs have been established only in those areas from where demand comes from village education committees (VECs). The contributory role of VECs also includes identification of two women functionaries as per the eligibility requirements, recommending their names to the Zila Panchayat (ZP) and construction of rooms in the primary school premises by utilizing the Z.P funding. Thus active involvement of ZP is a positive feature of this model (NCERT, 2000). Other model of expanding early childhood education in the state includes implementation of UNICEF assisted early childhood education project since 1985. After stressing the need for convergence with ICDS in the decade of nineties, the teachers working in these centres have been placed in District Institute of Education and Training (DIET) for creating separate ECE cell in the DIETs (op cit). The state has also tried out the school readiness programme throughout the state as part of class one curriculum. This experiment has been done keeping in view of the children who have come to school without any pre schooling experiences. Further, 35.33 per cent of primary schools and 45.30 per cent of elementary schools in the state have attached pre primary sections (NIEPA, 2003).

Eastern Region:

Bihar

The state is currently implementing *Dular Strategy* – strategy for family and community empowerment – for delivering the services of ICDS in a remarkable way. Dular strategy is being practiced in four districts namely Gaya, Vaisali, Muzaffarpur and Nalanda. The onus of the strategy is basically centered on community based convergent actions of ongoing programmes and person-to-person /house-to-house contact and counseling act. At the village level, local resource

persons (LRPs) have been identified. In order to reduce the load on AWW, the envisaged role of LRP as communicator, motivator, facilitator, coordinator and change agent is the inner beauty of the strategy. Formation of LRG at the project level exerts pressure on primary teachers and AWWs to have interface with each other. The identification of LRP and formation of LRG further accelerates the transparency of the functioning of ICDS delivery system. In order to have a continuous monitoring of the Dular Strategy, state task force, district task force and local programme groups have been notified. The training intervention in Dular encompasses general management, accounting and contextually responsive orientation on specific issues bearing on women and child development. Joint training of AWWs, primary teachers and LRPs for five days and members of mahila mandals and Gram shiksha samiti for two days constitutes further training inputs in the dular model of delivery of ICDS services. The strategy has come out not only as an effective tool for system management but also as a strongest mode for supplementary feed back system for controlling the existing ICDS deliveries.

West Bengal:

Besides imparting non-formal pre school education through a wide network of ICDS centres in the state, the Department of Panchayat and Rural Development has also established Shishu Shikshan Kendras (SSKs) since 1997-98. These centres are being managed by local community and have been put under operation by teachers known as *Shishu Sahayikas*. These teachers are working on contract basis. About 15,000 such centres have already been established and providing the services to about eight lakh pre primary children. Supervisors are giving the academic support to SSKs. Cascade model of training has been adopted to train the *shishu sahayikas* on the pedagogy of child centered education.

North Western Region:

Haryana

Haryana has the unique advantage of having several experimental programmes in ECCE. These include dissemination of ECCE workbook, training manual and introduction of CHEER project with collaborative efforts of NCERT, All India Radio and Department of Women and Child Development. Since, ICDS has been universalized in the state; no initiative under District Primary Education Programme (DPEP) has been taken so as to open new ECCE centres. DPEP has worked towards synchronizing the ICDS timings with primary schools in the villages so that primary school students, particularly girls do not miss out the school in order to attend the younger siblings. Besides setting of ECCE cell in the State Council of Educational Research and Training (SCERT), one lecturer of ECCE has been posted in each DIET so as to monitor and supervise the activities of ECCE in the AWCs. The state has placed high emphasis on training part of functionaries by adopting cascade model. Master Trainers (MTs) and Key Resource Persons (KRPs) have been trained by NCERT and SCERT respectively. These key trainers have trained nearly all the AWWs of the state in the proper ECCE methodology.

Himachal Pradesh:

The early childhood education experiences are being imparted to children adopting double mode strategy of involving NGO's and state owned ICDS projects. In total 7354 AWCs are being run by state besides 102 centres, which are being managed by NGO's. One uncommon thing with the state is that due to reduction in the entry age of primary schooling from 6 to 5 years in the state, the AWCs are enrolling the children from 3 to 4 years age group instead of 3-6 years age group as provisioned in the operational guidelines of ICDS. The community and other charitable agencies like Lions and Rotary clubs not only donate generously the teaching learning material (TLM) in AWCs but in most of the cases also provide rent-free accommodation for them. The Panchayat Raj Institutions have been involved in selecting AWWs and Helpers in the state. Under innovative head of Sarva Shiksha Abhiyan(SSA) , more ECE centres are being set up in those areas which are uncovered by ICDS. In order to take advantages of developing ties with primary schools and better community supervision and monitoring, a proposal is being sent by the state to Government of India for construction of AWCs in the premises of primary schools. The state has developed a prospective plan envisaging pre school attendance certificate as compulsory for admission in primary schools (NIEPA-UNESCO, 2003).

Northern Region:

Uttar Pradesh

Shishu Shiksha Scheme is being implemented under UP basic education project. Under the scheme, the Shishu Shikshan Kendras (SSKs) have been established. These centres run for five hours in convergence with AWCs. The state has set out targets of covering about 70 per cent of children by pre school experiences by the end of 2007. Besides this, the expansion of pre school services has also been envisaged in all community development blocks including urban slums. The strategic plan includes continuity of curriculum from pre to primary school level, implementation of community based innovative models, designing developmentally appropriate play based programmes, forcing links with primary schooling and establishing partnership with public and private sectors. About 7000 Anganwadi Centres selected from DPEP districts have been upgraded by providing them additional budgetary allocations from DPEP. For establishing convergence of DPEP with that of ICDS, state task group with representatives from education, UNICEF, women and child development and health has been formulated. A further input includes agreeing on co-terminus, extended timings of ICDS centres and pro rata additional honorarium to AWWs.

North Eastern Region:

Assam

The early childhood education services are being delivered adopting four fold modes. Integrated Child Development Services Scheme is the largest provider of ECE services in the state. The programmne delivers its non-formal pre school education input through 25502 operational AWCs located primarily within 195 ICDS projects. The second mode of delivering the service includes Balwadis, which are being run by NGOs with support received from state social welfare advisory board. The third mode includes pre primary schools operating under directorate of elementary education. The fourth mode encompasses the ECE centres running

under District Primary Education Programme (DPEP) initiative. These centres are known as *Mukulikas* and generally been located in those areas, which are uncovered by ICDS. Community ownership of running the centre is witnessed from the fact that village education committees (VECs) and/or Mahila groups are managing the centres either by operating the same or by helping the ECE worker in preparation of teaching learning material (TLM).Mukulikas are run by locally recruited two ECE personnel known as *Malini* and *Sahmalini*. Academic support to these personnel is being given by block level resource persons and through exposure visits. The experts have worked out the appropriate curriculum involving principle of joyful learning and its monthly plan of transaction is shared with Malini/ Sahmalini in the cluster meetings held monthly. Further, review of TLMs, attendance, enrolment and decision about theme of the month also occupies the point of discussion in the agenda of the monthly meetings. The state has taken a policy decision to start pre primary classes in all the provincial and government schools. For the accomplishment of this task, sizeable proportion of primary teachers from all districts have been trained in ECE methodology so that they may take care of children of pre primary classes as well. Memorandum of Understanding (MOU) has also been signed between department of social welfare and department of education regarding utilization of services of AWWs and resources of AWCs for running the pre primary classes. As per MOU about more than 1,500 AWWs are looking after the children of pre primary classes in addition to her own job responsibilities. Thus AWW after operating her own Anganwadi Centre from 7 to 9 a.m also operates the pre primary classes from 9 to 12 or even 1p.m. As a token of appreciation, the AWW is paid an additional honorarium of Rs 300/ and annual TLM grant of Rs 500/ .Currently, about 15.90 per cent of primary schools have attached pre primary sections (NIEPA,2003) The AWWs of pre primary classes have undergone through training module jointly developed by National Council of Educational Research and Training (NCERT) and State Council of Educational Research and Training (SCERT) both . The activity books for children have been developed in local languages of Assamese, Bangla and Bodo. However, despite of such great efforts, large numbers of children are still uncovered by services of ECE.

Nagaland

A pre primary unit has been attached in all the primary schools of the state. This ensures smooth transition from pre primary-to-primary schooling.

Tripura

Social Education centres, run exclusively from state funds, are providing services similar to ICDS. The workers of these centres have been designated as Social Education Organiser and are class III employee of the state government. Forty per cent of Anganwadi Workers are being absorbed in these centres on seniority basis.

Southern Region:

Andhra Pradesh

The state has a high distinction of improving enrolment figure considerably during the span of 1998/99 to 2001/02. Similarly as a result of especially designed initiatives for establishing the linkage of pre primary with that of institutionalized based primary schooling, the transition rate has also increased manifold between 1998/99 to 2001/02. The massive increase in transition rate

may be attributed due to attachment of pre primary section in 22.95 per cent of primary schools and about 36 percent of elementary schools in the state. The AWWs of the state have undergone through ten days long intensive training programme designed in three phases with a gap of two months in each phase. While the first phase includes three days joint training of AWWs with primary school teacher, the second phase of five days duration is meant for developing the skills for preparing and use of teaching learning material. The third phase of two days duration is devoted for organizing school readiness activities. Integrated comprehensive multidimensional packages known as Sisu Vikasa Karyakrama (SVK) has been evolved by the state resource centre for the benefit the children. SVK is a developmentally congruent programme for eliminating the pressure oriented mis education that has spread its roots. The programme contains basically ten months schedule offering a stimulated environ to 3-4 years age group and school readiness to 4-5 years old children. Concepts identified under the programme have been hierarchically organized keeping in mind the principle of child development encompassing through six strategies namely conversation, games, songs, stories, creative activities and readiness activities. The programme is in operation in Alidabad and Srisailam tribal belt of the state. A comprehensive package has also been developed which *inter alia* includes worker's manual, programme calender and 300 activity banks. Despite of such concerted efforts, more than 15,000 habitations are not yet covered with any of the pre schooling programme.

Tamilnadu

About 12 % of primary schools and 66.7 % of elementary schools have attached pre primary section in the state. In order to strengthen the pre school education component of ICDS, some of the AWWs have undergone through nursery teachers training. Further on demand of the community, some English medium AWCs have also been started. The duration of AWCs have been extended up to 4 p.m. The extension of timings helps the elder children studying in primary schools to get themselves free from sibling care.

Karnataka

The state is implementing the innovative programme of integrated approach to pre school education. Under the programme, the pre school education is being imparted using theme approach. About 42 such themes have already been identified. UNICEF has developed compilation of children's activities in partnership with National Institute of Public Cooperation and Child Development (NIPCCD), Department of Women and Child Development (DWCD), Experts and NGOs working in the field. Under the innovative head of SSA, more ECE centres have been planned to open in those areas not covered by ICDS. On the line of mother's groups in Assam, Bal Vikas Mahila Samiti (BVMS) comprising primary school teacher, AWW and community members have been formed to monitor the activities of AWCs. In addition to ICDS, the Karnataka Government under the education department runs a scheme of pre primary centres (PPCs) attached to lower primary schools. Each PPC has a teacher and helper. The teacher is at least a matriculate and diploma in nursery teacher training. The PPC is run for the same duration as the lower primary schools (NCERT, 2000).

Kerala

Early childhood education is being presently provided through ICDS,Balwadi scheme and pre primary centres attached to the primary and elementary schools. In similar lines of Nagaland, a pre primary unit has been attached in all the primary schools of the state.

Western Region:

Gujarat

Under DPEP, early childhood education centres have been opened in those areas where state norms do not allow for opening of AWCs. These centres have been established in proximity of alternative schooling centres so that issue of sibling care may be attended to large extent. The concept of toy bank is being implemented with the help of Reliance and Red Cross.

Rajasthan

Recognizing the fact that state owned AWCs have the main focus on nutrition, Immunization and Health care, several initiatives have been taken to strengthen the non formal pre school education component of ICDS programme Strengthening the provisions of ECE, extending the time of AWCs in accordance of primary schools, developing context specific TLMs, and orientation of ICDS team on TLM and kit material are among few of them. Under DPEP initiative, the operational time of AWCs has been extended to two hours more. This has facilitated to make the ECE intervention as an effective strategy for checking up the drop out rate due to sibling care. Lok Jumbish Parishad has selected local NGO *Vihaan* for taking up various activities like strengthening school readiness projects, capacity building of ICDS workers, opening of Balwadi in non-ICDS areas and alike. Apart from this, under Janshala programme, the children of 3 to 6 years are being provided pre school education (NIEPA-UNESCO, 2003). The state has also taken several initiatives to impart ECE to children using Infrastructure and resources of primary schools as well.

After going through various initiatives taken up by the states for expanding the coverage of ECCE, it may be summarized that operational approaches are basically comprised of two fold efforts. These include experimentation with alternative models and convergence with ICDS. Within the broader framework of former category, the approach includes SSKs in West Bengal, Uttar Pradesh, and M.P, Mukulikas in Assam and social education centres in Tripura. Likewise, attachment of pre primary sections in primary and elementary schools in M.P, Tamilnadu, Uttar Pradesh, Assam, Kerala and Karnataka and opening of ECCE centres under DPEP also comes under this category. Second strategy includes convergence with ICDS. The multi pronged thrust of this approach encompasses synchronization of timings of AWCs with that of primary schools like in Tamilnadu, Karnataka and Rajasthan, location of AWCs in or near primary schools like in Assam and Himachal Pradesh and provision of training and supply of materials for strengthening the quality of ECCE component of ICDS like in Haryana, Andhra Pradesh, Karnataka and Uttar Pradesh.

Though former approach of experimentation with alternative models seems to be in co hence with ideological base of connectivity with institutional mode of primary schooling, the letter approach needs to be systematically verified. The interactions with community, teachers and others indicates that intervention of synchronization of timings of AWCs with those of primary schools has raised a problem of second round of nutrition necessitated for children because of their extended stay in schools (NCERT, 2000). Since DPEP has no provision for nutrition and ICDS has no provision of second round of nutrition, the problem needs to be thoroughly looked into. Similarly the initiative of locating AWCs in primary schools seems to be not conducive. The Anganwadi , because of its multiple services towards different beneficiaries needs to be located compulsorily in the midst of the main habitation. The primary school is often located at the outskirts. This idea, therefore, needs to be contextually reviewed (op cit).

Conclusions

In conclusion, it may be stated that though various sub national systems are striving hard for ubiquitous presence of qualitative ECCE interventions, yet we have to keep in mind that it should not be done in separation of contextual sensitivity. In fact, there is a need of undertaking micro level planning employing case-to-case method so that access of ECCE by all eligible children is ensured far ahead of Dakar deadline of 2015.

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FOOD SAFETY IN DIETARY DEPARTMENTS OF HOSPITALS OF BARODA

Mini Sheth, Dwivedi Reeta and Bhatnagar Garima

Department of Foods and Nutrition, Faculty of Home Science,

The Maharaja Sayajirao University of Baroda, Vadodara- 390 002, Gujarat (INDIA)

The present study was planned with the general objective of assessing hygiene and sanitation conditions in food service department of hospitals using HACCP approach. Five hospitals in Baroda city, those preparing and catering meals to in-patients were surveyed using a pre-tested, semi-structured questionnaire to collect information with respect to job responsibilities, health profile and hygiene practices of food service staff. Information was also elicited regarding purchase, storage and service of food. Out of five hospitals, food samples were collected from one of the hospitals and analyzed with respect to microbiological (AMCC, *S. aureus, B. cereus* counts, Yeast and Molds counts and Coliform counts - AOAC, 1995), physical (pest and foreign matter) and chemical hazards (pesticide residues). Microbial counts for samples of air, swabs (food contact surfaces), hands and nails of food handlers were also determined. The results of the study indicated that most of the dieticians were satisfied with the food handling practices of their staff and did not organize talks on hygiene and sanitation. Food service staff exhibited poor handling practices. Unhygienic and unsanitary conditions were observed with respect to purchase and storage of raw foods. High counts above 10^7 cfu /gm /ml were obtained for swabs of food contact surfaces. Hand and nails of food handlers harboured high counts of pathogenic bacteria. Physical and chemical hazards with respect to foreign matter and pesticide residues were also detected in foods. On the basis of hazard analysis, Critical Control Points identified were purchase and storage of raw foods and personal hygiene of the staff.

Key words: Hospital diets, hygiene, sanitation, food service staff, food contact surface, microbial hazards, nosocomial infection

The risk of food borne illness is a problem in any situation where food is served to consumers but the risk is particularly serious when the food is served to immuno compromised individuals in hospitals (Fritz 1989). The issue of food safety is of wider importance in hospitals where a high percentage of patients might be expected to react more severely to the ingestion of contaminated food (Lonke 1992). Hospitals are optimally positioned in the health care system to patients. In many respects, the period of hospitalization for patients constitutes a critical stage of rehabilitation (Werther et al. 1998).

The food service staff of hospital play a critical role in patient management because majority of patients eat meals prepared at hospitals, at least three times daily, consume oral supplements, receive tube feedings or paranteral nutrition- preferably under the direction of registered dietician (Stump et al. 2000).

Food can become contaminated by microbiological, chemical or physical hazards. Microbiological hazards are responsible for most incidences of food borne illnesses. The common pathogenic bacteria causing these illnesses are *Salmonella, Shigella, Bacillus cereus, Staphylococcus, E. coli, Listeria* and many other unidentified ones (Longree 1996).

In catering establishments 40% of the food borne illnesses are caused by mishandling of food and cross contamination. Hands of the food handlers act as a potential vehicle in the transmission of diarrheal diseases, which are spread via feco oral route. All food handlers in constant contact with food are potential source of food contamination (Mazumdar 1992).

WHO has suggested for a concerted approach to food safety like HACCP which focuses on food safety at all stages of food production. Hence the objective of the present research was to assess hygiene and sanitation of food service department of hospitals in Baroda City using HACCP approach.

Materials and Methods

A survey of food service department of five hospitals of Baroda, catering all the four meals to the in- patients therein, was conducted using a pre-tested semi- structured questionnaire. Questions were asked regarding job responsibilities, health profile and hygiene practices of the food service staff. Information was also elicited regarding purchase, storage, handling and serving practices of food by the food service staff. Out of five hospitals, food samples were collected from one of the hospitals.

Microbial analysis with respect to Aerobic Mesophilic Colony Counts (AMCC), Coliforms, Yeast and Molds, *Staphylococcus aureus, Bacillus cereus* was carried out for food samples such as rice, chapatti and spices as well as for the samples that are indicative of personal hygiene such as air, swabs (food contact surfaces), hands and nails, using the AOAC Methods, (1995). Determination of AMCC was done using Nutrient Agar media. Coliforms, Yeast and Molds, *S. aureus* and *B.cereus* were determined using Violet Red Blue Agar (VRBA), Potato Dextrose Agar (PDA), Baired Parker (MYP) media, respectively. All the dehydrated media used for microbiological analysis. In all cases, the serial dilutions were used to arrive at an appropriate count i.e. between (30-300) and later multiplied by the dilution factor. The samples after plating were incubated for appropriate time and temperatures as per the methods of AOAC, 1995. All these media were procured from Hi Media (Loba Chem. Bombay).

Visual inspection coupled with sampling method was used to detect the presence of foreign matter and pest infestation in the raw material procured by the hospitals. Presence of pesticide residues viz. DDT and HCN in foods (fruits, seed and vegetables) was detected using Pesticide Finger Printing Technique (Karanth 2001). On the basis of results of hazard analysis, various critical control points with respect to food preparation in hospitals were determined.

Results and Discussion

The results of the hospital survey showed that most dieticians were postgraduate in Foods and Nutrition but lacked the basic knowledge on food safety issues like HACCP, food borne illnesses and their causative agents (Table 1).

The educational level of food service staff, from all the hospitals was low (less than 10th class). None of the staff including the dietician has undergone formal training on hygiene and sanitation. Angelillo et al. (2002) reported that poor food handling practices were exhibited by those food handlers who had not received training on hygiene and sanitation. Most of the

dieticians did not consider it their duty to orient staff on proper food handling practices and did not organize talks on hygiene and sanitation except one.

TABLE 1. KNOWLEDGE OF DIETICIANS ABOUT HACCP AND MICROORGANISMS CAUSING FOOD BORNE DISEASES

Dietician's knowledge	Hospitals						
	H1	H2	H3	H4	H5	Total	%
About HACCP	X	X	X	X	X	0	0
Heard the term 'HACCP'	X	X	X	✓	X	1	21
About Codex Norms for hygiene and sanitation	X	X	X	X	X	0	0
Pathogenic microorganisms causing food borne illnesses:							
• E. coli	-	-	✓	-	-	1	20
• Salmonella	-	-	-	-	✓	1	20
• Streptococci	-	-	-	✓	✓	2	40
Name of the food borne disease caused by pathogens	-	-	-	-	-	0	0

X - absence of knowledge of dieticians about HACCP and microorganisms causing food borne diseases

✓- presence of knowledge of dieticians about HACCP and microorganisms causing food borne diseases

All hospitals procured foods in a variety of delivery vehicles, which were not fumigated. In majority of the hospitals, unhygienic and unsanitary conditions prevailed in storerooms. Presence of pests, cobwebs and unclean floors were common sight observed except in one hospital. Perishables and non-perishables were directly placed on store amidst heavy infestation. Perishables were stored at room temperature in almost all the hospitals. Regular cleaning and mopping of the kitchen was reported with a frequency varying from one to three time a day, while store rooms were cleaned on weekly basis.

Although survey results indicated positive responses of the food service staff towards selected hygiene behaviors such as washing hands before handling food, after using toilet, etc. However spot observations showed that these practices were infrequently followed amongst all the food handlers (Table 2).

The contrast between the actual responses and observed practices have been reported by various investigators (Oteri and Eknamen 1989; Jay et al. 1999). None of the staff was observed to be wearing headgear and gloves while handling food. Aprons and uniforms were regularly worn by the staff of most hospitals.

TABLE 2. OBSERVATIONS REGARDING THE HAND WASHING PRACTICES OF THE COOKS AND KITCHEN HELPERS FROM HOSPITALS IN BARODA

Hand washed	Hospitals						
	H1	H2	H3	H4	H5	Total	%
Cooks							
• Before handling foods	X	X	X	✓	X	1	20
• After using the toilet	X	X	X	X	✓	1	20
• After touching face/body	X	X	X	X	X	0	0
• After discarding peels	X	✓	N.A	X	X	1	20
Kitchen helper							
Before handling foods	X	✓	X	X	X	1	20
After using the toilet	X	X	X	X	✓	1	20
After touching face/body	X	X	X	X	X	0	0
After discarding peels	X	X	X	X	✓	1	20
After visiting the ward	X	X	X	X	X	0	0

N.A. - Not applicable, X - absence of hand washing practices

✓ - presence of hand washing practices

Freshly prepared rice and chapatti samples from one of the hospitals showed counts beyond the safety limit for pathogenic bacteria (Table 3). These high counts can be attributed firstly to the use of contaminated raw material procured by hospital authorities, secondly due to the contamination of raw material during storage, thirdly by the contaminated hands of food handlers and use of unclean utensils and other food contact surfaces. The high level of Coliforms in spices obtained could have been due to its contamination during processing. Several investigators have reported that Indian spices contain a high microbial load (Geeta and Kulkarni 1987; Thanjamani et al. 1974). According to Sheth and Nandwana (2002), red chilly powder showed high microbial count ($<10^2$ to 10^3 Cfu/gm) among spices. The coliform count of mustard power ($<10^2$ to 10^3 Cfu/gm) was also above the recommended safety limits.

High microbial counts observed in food handler's hands clearly indicates that food handling is a risk factor in transmitting pathogenic microorganisms to the foods, especially under the conditions where hand washing is not practiced routinely (Table 4). Dumavibhat et al. (1989) found food handler's hands harboring several species of microorganisms like S.aureus, Klebseilla pneumonial, Streptococcus and B. cereus. Hatakka (2000) in Finland also isolated enterotoxigenic strains *of S. aureus* from hands of food handlers.

TABLE 3. MEAN MICROBIOLOGICAL COUNTS OBTAINED IN FOOD SAMPLES AND SPICES (CFU/GM) FROM ONE OF THE HOSPITALS OF BARODA

Samples	AMCC	*S. aureus*	*B. cereus*	Coliforms	Yeast and Molds
Foods					
Chapatti	2.6×10^4	1.1×10^3	4.2×10^2	0.1×10^2	2.0×10^4
Rice	1.1×10^4	1.1×10^3	3.1×10^2	0.7×10^3	1.6×10^3
Spices					
Turmeric powder	2.5×10^6	2.8×10^3	1.4×10^3	1.25×10^4	2.6×10^4
Coriander powder	4.2×10^5	2.1×10^3	1.3×10^4	3.3×10^4	3.03×10^6
Red chilly powder	4.2×10^3	3.2×10^3	1.8×10^2	6.1×10^3	3.9×10^5

TABLE 4. MEAN MICROBIOLOGICAL COUNTS OF HAND RINSE AND NAIL SAMPLES (CFU/ML) OF FOOD SERVICE STAFF FROM ONE HOSPITAL OF BARODA (N=4)

Food service staff	AMCC		*S. aureus*		*B. cereus*	
	Hand rinse	Nail	Hand rinse	Nail	Hand rinse	Nail
Cooks	2.25×10^4	1.2×10^3	2.1×10^5	4.5×10^3	1.32×10^3	1.1×10^3
Servers	4.04×10^5	2.2×10^5	2.1×10^6	2.8×10^3	1.25×10^4	9.6×10^3
Kitchen servant	1.36×10^5	3.6×10^3	3.0×10^4	2.7×10^5	1.37×10^3	1.3×10^5

The microbial counts for air samples from six different areas of kitchen from one of the hospitals ranged between 10^1 to 10^3 (Table 5). Scott (1990) stated that microorganisms transferred in appreciable numbers from contaminated surfaces to hands, fingers or utensils that become potential risk factors for contamination when in contact with food. The microbial analysis of food contact surfaces and equipment give an indication of the environmental sanitation. Swab samples of kitchen slab, utensils, serving dishes, collecting tray and polythene for wrapping chapatti dough all gave high microbial counts which clearly could lead to cross contamination of food and hand surfaces increasing the risk of food borne outbreak (Table 6).

Physical and chemical hazards in raw foods:

As depicted in Table 7, foreign material like traces of dirt, stones and hair were found in all the raw foods viz. wheat, rice and green gram dal analyzed, while glass pieces and pins were not detected in raw material.

TABLE 5. MICROBIAL COUNTS OF AIR SAMPLES (CFU/PLATE) INDICATING ENVIRONMENTAL CONDITIONS FROM ONE OF THE HOSPITALS OF BARODA

Sample	AMCC	*S. aureus*	Coliforms	Yeast and Molds
Kitchen slab	1.0×10^{2}	1.3×10^{1}	0	5.7×10^{1}
Area for cutting vegetables	2.24×10^{3}	2.7×10^{2}	0	1.23×10^{3}
Area for washing utensils	3.24×10^{3}	1.2×10^{1}	0.03×10^{2}	1.6×10^{3}
Area for keeping cooked food	2.3×10^{2}	3.3×10^{1}	0	3.5×10^{3}
Area for storing perishables	1.57×10^{2}	4.6×10^{2}	0.2×10^{1}	2.4×10^{3}
Area for storing non-perishables	2.36×10^{2}	4.3×10^{1}	0	4.67×10^{1}

TABLE 6. MEAN MICROBIOLOGICAL COUNTS IN SWAB SAMPLES OF THE KITCHEN PREMISES OF ONE OF THE HOSPITALS OF BARODA

Swab sample	Microbial parameters				
	AMCC	*S.aureus*	*B. cereus*	Coliform	Yeast and Molds
Kitchen slab	1.3×10^{4}	2.5×10^{3}	6.0×10^{4}	0.1×10^{3}	2.2×10^{3}
Polythene for wrapping chapatti dough	1.5×10^{4}	1.3×10^{3}	7.0×10^{3}	3.1×10^{3}	7.5×10^{4}
Collecting tray for chapatti		4.2×10^{4}	6.0×10^{4}	2.5×10^{3}	3.5×10^{4}
Serving dishes	2.2×10^{4}	4.5×10^{4}	3.7×10^{3}	3.0×10^{2}	3.6×10^{3}
Kitchen utensils	1.8×10^{4}	4.6×10^{4}	4.5×10^{3}	0.1×10^{2}	3.6×10^{3}
Trolley	1.6×10^{3}	2.0×10^{3}	1.8×10^{3}	1.5×10^{2}	4.3×10^{3}
Floor swab	1.2×10^{3}	3.0×10^{3}	1.7×10^{3}	0	2.7×10^{2}
Mop cloth	1.8×10^{4}	3.0×10^{4}	1.5×10^{4}	0	4.7×10^{4}

TABLE 7. ANALYSIS OF PHYSICAL HAZARDS WITH RESPECT TO DETECTION OF FOREIGN MATERIAL AND PEST INFESTATION IN RAW FOODS USING SAMPLING AND VISUAL INSPECTION method in one hospital

Foreign material / pest infestation	Raw Foods		
	Wheat	Rice	Green gram dal
Dirt	✓	✓	✓
Glass piece/pins	X	X	X
Stones	✓(5)	✓(3)	✓(1)
Hair	✓	✓	✓
Live insects	✓(5)	✓(1)	✓(1)
Dead insects	✓(4)	✓(2)	✓(2)
Rodent excreta	✓	✓	✓
Webbing or silken strands	✓	✓	X
Weevils grains	✓(4)*	X	✓(2)*

✓: Indicate presenco

x: Indicate absence

Figure in parenthesis indicates count obtained per 100 gm.

* Indicate counts of weevils per 100 grains of wheat / green gram dal

Presence of live as well as dead insects, insect fragments and rodent excreta was found in all the raw materials. Webbing was detected in wheat and green gram, the percentage of weeviled grains obtained by counts was within the permissible limit of 3 % by count for green gram and 3-10 % by count for milled wheat (PFA 1999).

The presence of DDT and HCN was detected in all the fruit and vegetables which indicated that foods were cultivated in soil having DDT and HCN residues. Long term consumption of foods containing these pesticides even at ppt levels may cause chronic diseases including cancer (Kaferstein 1992).

Conclusions

On the basis of hazard analysis, critical control points identified were- sanitary quality of raw material with respect to procuring, storage of raw material and personal hygiene and health of food service staff. The results of the present study clearly indicated that conditions of hospitals provided ample opportunities for possible outbreaks of food borne illnesses. Thus the present scenario immediately calls for corrective measures, one of which can be, imparting food safety training to food service staff of hospitals in order to improve their knowledge, attitudes and practices on food hygiene. This will go a long way in preventing episodes of nosocomial food borne illnesses thereby safeguarding the health of people who are already ill.

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ARSENIC ACCUMULATION IN EDIBLE PARTS OF PLANTS

K. S. Ray , M. Chatterjee
Department of Food Science and Nutrition
SNDT Women's University, Mumbai 400049 India.

In Arsenic accumulation in different parts of plant, pH of the soil plays most dominant factor besides organic carbon and soil arsenic concentration and to reduce the arsenic absorption, the soil pH preferably is maintained above 7. Arsenic has been found to be present in relatively high concentrations in the root samples (Beet root and Colocasia). The bulb, leaves and flower and fruit did not have detectable amounts of arsenic even when arsenic concentration in the soil was relatively higher. It has been found that arsenic is accumulated in the storage site of the plant like roots and tubers (Beet root and Colocasia), underground stem (potato) and seeds (rice). Arsenic accumulation is species-specific as well, as it is accumulated in rice seeds, but not in mustard seeds. The gross calculation of arsenic intake through only food, considering rice, roots and tubers as a staple diet, was calculated. The calculation indicates that Arsenic intake goes far above the ASADDI (Essential and Safe Adequate Daily dietary Intake limit of 12-40 ug/d for adults) at 108 ug/d (calculated on 1800 Kcal diet). Present study shows that crops with flower, leaves, fruits, bulbs and oil seeds as edible parts may be comparatively a safe choice for the arsenic belt.

Key Words: Arsenic belt; Soil; Plant uptake; Edible part; Crop selection

Arsenic is a semi-metallic element found in abundance in the earth's crust. The major concern with Arsenic (As) and its compounds is it's potential toxicity to humans. This element is however not evenly distributed on the earth's surface and is concentrated at certain regions forming an Arsenic belt in those areas.

Episodes of arsenic contamination in water have been reported for over four decades now. In 1960s major incidence of arsenic contaminated drinking water was noted in Antofagasta, Chile, displayed by dermatological manifestations (Borgono and Greiber 1972). Prevalence of skin cancer due to consumption of Arsenic through ground water was observed in Taiwan during the period of 1961-1965 (Tseng et al 1968). Several other incidence of ground water contamination of Arsenic involving smaller populations have been reported in Nakajo, Japan (Terada et al ,1960) Minnesota (Feinglass,1973), Ontario, Canada (Wyllie 1973), Lane County, Oregon(Morton et al. 1976), Nova Scotia, Canada (Granthane and Jones 1977) and Far Banks, Alaska (Haroington et al. 1978).

The Arsenic affected areas of India lie on a sediment of young deltoid deposition which covers an area of seven districts in West Bengal (Dhar et al. 1997). The concentration of Arsenic in ground water in these areas is on an average 22 times the safe limit of 0.01 mg/l as recommended by WHO (Roy1999). A survey conducted by Mandal et al (1996), indicated that 560 villages of eight districts of West Bengal are Arsenic affected. An environmental tragedy has developed here in West Bengal, where more than a million people are drinking Arsenic contaminated water and an alarming number of toxicity cases have been reported here (Guha Mazumdar et al. 1998). Arsenicosis was not known as an endemic problem here before the mid 1970s. During this period the large scale exploitation of ground water resources for irrigation, now known to be contaminated with arsenic was taken place. India has achieved a green revolution by pumping out billions of liters of water from the underground water-tables in these arsenic belts

(Mallick 1996). Arsenic thereby contaminates the soil and plants grown on it. The plants and crops grown in these regions may take up the Arsenic compound from the soil. The people of these local regions take up the edible parts of the plants that may have absorbed Arsenic, there by entering the human chain. More than 2,00,000 people are already affected from Arsenic lesions.

The population of the Arsenic belt in West Bengal is mostly rural. Their nutritional status is more unstable than their urban counter parts, making them vulnerable to cope with arsenic toxicity. With the advent of industrialization, introduction of a system of central pooling of crops and vegetables has increased the access to the crops grown in these affected areas. Thereby more people from the nonarsenic belts may be getting affected. Uptake of any element by the plants however may depends on many factors including plant species, elemental concentration in the soil solution (Ray and Deshpande 2003), soil properties such as pH, organic carbon content (Marin et al. 1993) and presence of another ions (Burto et al 1999).

Present study had been focused to find out the possibilities of arsenic accumulation in various edible parts of the plants such as roots, stem, fruits, seeds and leaves of the plants grown in these arsenic contaminated areas and the factors that might affect the absorption from the soil. This may help to select the safe crop for cultivation in these arsenic belts.

Methodology

The samples were collected from the districts of West Bengal that includes Sonarpur, Budge Budge I and II, Bhangor, Baruipur (Ramnagar and Nabagram), Bishnupur and Joynagar. These places were reported to contain a higher concentration of Arsenic in the ground water, than the limit set by the WHO. The Arsenic contents of the vegetable and soil as well as pH and Organic carbon content of the respective soils were analyzed in triplicate.

SAMPLES SELECTED FOR ANALYSIS

Root	Beet root and Colocasia
Stem	Potato
seed	Rice & Mustard
Leaf	Cabbage, Cauliflower green
Flower	Drumstick flower
Fruit	Tomato, Papaya and drumstick
Bulb	Garlic

The plant samples were dehydrated and then wet digested according to the AOAC (1995) method. The soil samples were dehydrated and micro waved at 250 W for 4 minutes. The contents were filtered using ash less 'Whatman' filter paper number 42. Arsenic content for all the samples

was analyzed using the ICP-AES method. The standard used had an arsenic concentration of 512 ppm.

Results and Discussion

Epstein (1972) reported that the pH of the soil is an important factor that affects the micronutrient uptake by the plant and therefore growth of crops. Islam et al (1996) conducted a study of pH optima for the growth of six crop species (ginger, cassava, maize, wheat, french beans and tomato) for six weeks. For elemental absorption by the plants, soil pH ranging from 5.5 - 6.5 is identified as optimum pH. The present study shows that it is true for arsenic accumulation also.

The arsenic uptake by beet root was found to increase with the decrease in pH of the respective soil sample (Fig-1). Beet root samples collected from Nabagram showed the highest uptake of arsenic at a mean concentration of 1.28± 0.04 ug/g at a lower pH of 5.27± 0.03. It was also observed that the arsenic uptake was ≤ 0.05 ug/g for the sample whose soil pH was 7 or above. Arsenic uptake is favored by a high acidic soil. Lower the pH, higher the absorption (Table 1).

An uptake pattern similar to that of beet root was observed in the colocasia samples as well. The uptake was observed to be high for the samples with a low soil pH, for example the mean uptake for colocasia samples from Nabagram was 0.71± 0.07 ug/g at a mean pH of 5.31 (Table 2). At a pH higher than 7, the uptake as found to be either, ≤ 0.05 ug /g or not detectable (Fig 1). The indiscriminate use of acid yielding chemical fertilizer may have a detrimental effect in arsenic belt.

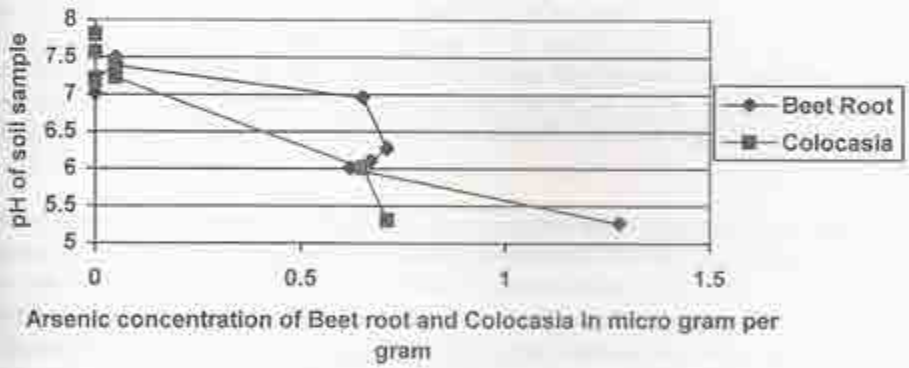

Fig. 1. Relationship between pH of the soil and arsenic uptake by beet root & colocasia.

TABLE 1 ARSENIC CONTENT OF BEET ROOT AND THE RESPECTIVE SOIL COMPOSITION

Collection area	pH	Organic Carbon %	Arsenic Content (ug/g) Soil	Beetroot
Budge Budge I	7.49± 0.01	0.23± 0.04	482.36± 3.45	≤ 0.05
Budge Budge II	7.39± 0.01	0.26± 0.02	470.87± 2.24	≤ 0.05
Bhangor	7.01± 0.01	0.27± 0.03	Not Detectable	N D
Jaynagar	6.96± 0.02	0.50± 0.00	622.20± 4.55	0.65± 0.01
Bishnupur	6.27± 0.16	0.69± 0.00	730.96± 5.54	0.71± 0.25
Sonarpur	6.10± 0.26	0.77± 0.61	620.13± 6.51	0.67± 0.02
Ramnagar	6.01± 0.01	0.80± 0.07	616.50± 1.80	1.28± 0.04
Nabagram	5.27± 0.03	0.95± 0.04	886.96± 1.30	1.28± 0.04

The organic carbon percent of the soil samples were found be an important factor to affect the uptake of Arsenic by the roots. The uptake in beet root was found to be 1.28± 0.04 ug/g at an organic carbon % of 0.95± 0.04 (Table1). The uptake of arsenic by the sample decreased with a decrease in the organic carbon % of the respective soils (Fig.2). At an organic carbon content of less than 0.5%, the uptake was either < 0.05 ug/g or not detectable at all. The uptake of arsenic by colocasia (roots) was found to be high 0.71± 0.07ug/g at a soil organic carbon content as high as 1.21± 0.64 in Nabagram (Table 2). A similar observation was made by Sing and Sing (1996) who found that the lowered pH and the increased organic carbon percent of the soil facilitate better assimilation of the micro nutrient cations to the fruits and vegetables for most of the elements. Arsenic being a cationic element is also absorbed at a high organic carbon % and lower pH.

Another important factor that influences the absorption of arsenic in the plant parts was the arsenic concentration in the soil. The arsenic uptake by the plants was found to increase with the increase in the arsenic concentration in the respective soil samples (Fig. 3). In the case of beet root samples from Nabagram, the mean arsenic content was found to be as high as 1.28± 0.04 ug/g with a corresponding higher soil arsenic content of 886.96 ± 1.3ug/g (Table 1). An identical trend was observed in the case of colocasia (Fig.3), where the uptake of arsenic by the roots and the arsenic content of the respective soils were directly proportional. The uptake was found to be less than 0.05 ug/g or not detectable for corresponding soil samples of beetroot and colocasia , with an arsenic concentration of less than 480 ug/g and with higher soil pH (Tables 1&2).

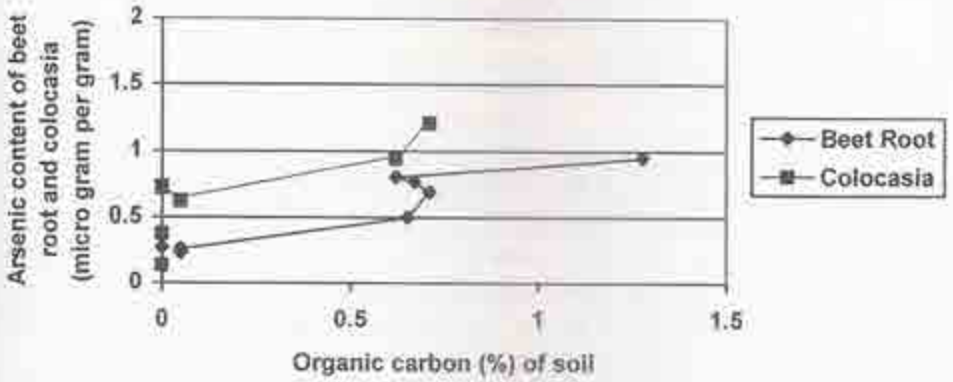

Fig. 2. Organic carbon content of the soil and arsenic content of roots, colocasia

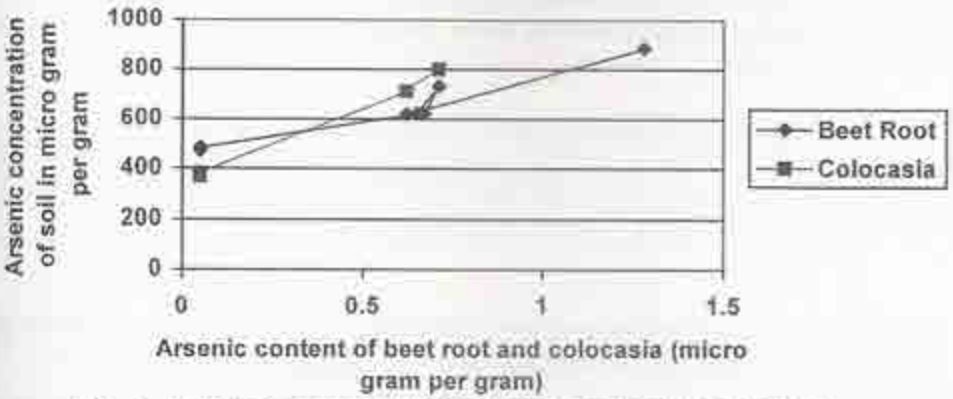

Fig. 3. Arsenic concentration in the soil and content of roots (beet & colocasia)

TABLE 2. ARSENIC CONTENT OF COLOCASIA AND THE RESPECTIVE SOIL COMPOSITION

Area of sample Collection	pH	Organic Carbon %	Arsenic Content (ug/g) Soil	Colocasia
Budge Budge I	7.43± 0.01	0.62± 0.12	370.23± 0.46	≤ 0.05
Budge Budge II	7.23± 0.48	0.62± 0.00	380.78± 0.56	≤ 0.05
Bhangor	7.17± 0.32	0.73± 0.21	Not Detectable	Not Detectable
Jaynagar	7.81± 0.61	0.13± 0.41	Not Detectable	Not Detectable
Bishnupur	7.56± 0.17	0.37± 0.07	Not Detectable	Not Detectable
Sonarpur	7.21± 0.81	0.72± 0.10	Not Detectable	Not Detectable
Ramnagar	6.01± 0.01	0.94± 0.33	710.61± 0.00	0.62± 0.01
Nabagram	5.31± 0.00	1.21± 0.64	800.96± 0.00	0.71± 0.07

To assess the uptake by the underground stem, Potato (Solnum tuberosum) and the respective soils were analyzed for the arsenic content. The pH, the conductivity, organic carbon % and NPK content of the soil were also analyzed for the same sample. It showed a similar trend as that of roots. The arsenic uptake increased with a decreased pH (Table 3). The uptake was found to be less than ≤ 0.05 g/g at soil pH of 7 or above. The arsenic content increased with the increase in the soil organic carbon %.(Table 3).

Arsenic content of underground stem sample from Budge Budge I and Bishnupur shows that although organic carbon % and soil concentration of arsenic is comparatively high, the accumulation of arsenic in the stems are only ≤ 0.05. This may confirm that soil pH is more important factor in accumulation of arsenic in the plant part

TABLE 3. ARSENIC CONTENT OF POTATO AND THE ARSENIC CONTENT

Area of sample Collection	pH	Organic Carbon %	Arsenic Content (ug/g) Soil	Potato
Budge Budge I	7.29 ± 0.02	0.86 ± 0.03	792.4 ± 8.70	≤ 0.05
BudgeBudge II	7.45 ± 0.40	0.27 ± 0.02	378.1± 1.70	≤ 0.05
Bhangor	7.23 ± 0.30	0.30 ± 0.03	374.8 ± 4.21	≤ 0.05
Jaynagar	7.15± 0.03	0.30 ± 0.02	509.3 ± 2.20	≤ 0.05
Bishnupur	7.09 ± 0.05	0.50 ± 0.01	383.0 ± 0.20	≤ 0.05
Sonarpur	7.41± 0.04	0.31± 0.01	363.6 ± 6.60	≤ 0.05
Ramnagar	5.29 ± 0.03	0.60 ± 0.02	470.9 ± 8.40	1.00 ± 0.01
Nabagram	5.32 ± 0.09	0.80 ± 0.03	772.6 ± 3.00	1.00 ± 0.00

The uptake of the element was proportional to the concentration of arsenic in the soil samples. The underground stem from Nabagram were found to have the highest uptake with a high corresponding soil arsenic content. But assimilation of arsenic in underground stem is definitely much lower than underground root. A study conducted by Schoof et al (1999) also reported that potato has assimilated arsenic from the soil where mean content was found to be 2.8ug/g wet weight.

Rice (Oryza sativa) and Mustered (Brassica nigra) seeds and the respective soil were analyzed for their arsenic content and the soil were analyzed for pH, conductivity, organic carbon % and NPK. The arsenic content in the rice sample was found to increase with the increase in the acidity of the respective soil. A clear trend was observed for the soil sample from Nabagram, Ramnagar and Sonarpur, where the arsenic content in the rice was 0.72!0.01, 0.66±0.01 and 0.64±0.15 ug/g corresponding to pH values of soil sample at 5.01!0.02, 5.33!0.04 and 5.49!0.02 respectively (Table 4). It shows that lower the pH, higher the accumulation. The concentration of total arsenic in pre-cooked rice from the Baruipur block estimated by Mandal et al (1998) was found to be 0.72!0.01 ug/g of dry weight.

The arsenic content in the rice sample was directly proportional to the arsenic concentration in the soil. Among the soils from 8 regions surveyed, the samples from Nabagram showed the highest soil arsenic value of 949.56±0.64 ug/g and the concentration of arsenic was maximum in this rice sample. Comparatively lower concentration of arsenic and higher pH (above 7.0) of the soil may be responsible for not showing higher accumulation in the rice grown in the first 5 samples. It may be deduced that the pH of soil has a more dominated role on arsenic concentration even with the presence of arsenic in the soil.

The uptake was found to increase with an increase in the organic carbon percentage of the respective soils. The soil from Bisnupur had organic carbon content of 0.51% and arsenic content of the soil was 351.62±0.01ug/g, whereas uptake was found to be only 0.05 ug/g. This may be due to a higher pH of 7.09±0.01 showing the importance of pH over the concentration of organic carbon % and the soil arsenic content in the absorption of arsenic by the plant.

TABLE 4. ARSENIC CONTENT OF RICE AND ARSENIC CONTENT, PH AND ORGANIC CARBON CONTENT OF THE RESPECTIVE SOIL SAMPLE

Area of sample Collection	PH	Organic Carbon %	Arsenic Content (ug/g) Soil	Rice
Budge Budge I	7.30 ± 0.03	0.31 ± 0.03	382.2 ± 3.51	≤ 0.05
BudgeBudge II	7.43 ± 0.02	0.22 ± 0.03	471.0 ± 7.64	≤ 0.05
Bhangor	7.38 ± 0.02	0.22 ± 0.03	318.0 ± 4.71	≤ 0.05
Jaynagar	7.89 ± 0.02	0.29 ± 0.02	472.7 ± 5.97	≤ 0.05
Bishnupur	7.01 ± 0.01	0.51 ± 0.03	351.6 ± 0.10	≤ 0.05
Sonarpur	5.49 ± 0.02	0.65 ± 0.07	746.7 ± 1.63	0.64 ± 0.15
Ramnagar	5.33 ± 0.09	0.62 ± 0.02	872.7 ± 0.02	0.66 ± 0.01
Nabagram	5.01 ± 0.02	0.84 ± 0.72	949.6 ± 0.64	0.72 ± 0.01

The arsenic content of another seed, mustard was found to be only 0.05 ug/g to non-detectable level even though the soil arsenic content was comparatively high. For example, Sonarpur, Ramnagar and Nabagram Mustard samples, the soil with lower pH higher organic carbon % with soil arsenic content of 463.94±0.0 ug/g have failed to accumulate the arsenic in the seed (Table 5). In the present study where rice, as a seed, concentrated a considerable amount of arsenic in it, Mustard had a negligible accumulation of this element, revealing the species specificity of plants, which have a dominant role in elemental concentration. This specificity may be attributed to the composition of the storage material. As both roots, tubers and rice have starch as a storage material, where as Mustard has a high fat content as storage material.

The cultivation of mustard in West Bengal is done in a large scale. Hence it does not contribute to the dietary arsenic intake.

TABLE 5 ARSENIC CONTENT OF MUSTARD AND ARSENIC CONTENT, pH AND ORGANIC CARBON CONTENT OF THE RESPECTIVE SOIL SAMPLE

Area of sample Collection	pH	Organic Carbon %	Arsenic Content (ug/g) Soil	Mustard
Budge Budge I	7.79±0.03	0.36±0.02	370.23±0.46	ND
BudgeBudge II	7.56±0.04	0.79±0.06	380.78±0.56	ND
Bhangor	7.28±0.03	0.22±0.09	492.01±0.00	≤ 0.05
Jaynagar	7.00±0.01	0.11±0.02	781.31±0.07	≤ 0.05
Bishnupur	6.05±0.01	0.82±0.07	231.16±0.70	≤ 0.05
Sonarpur	5.79±0.91	3.79±0.02	463.94±0.63	≤ 0.05
Ramnagar	5.33±0.09	0.62±0.02	346.61±0.01	≤ 0.05
Nabagram	5.01±0.02	0.84±0.72	632.79±0.79	≤ 0.05

When analysis was done for fruits as the edible part in this arsenic belt It was found that out of eight area surveyed, even the highest soil arsenic content of the corresponding fruits like tomato (764.76 ±0.42); papaya (731.82 ± 0.82) and drumstick (689 00±0.17) failed to concentrate arsenic (not detectable to <0.05) in the respective fruits. Maximum arsenic content of cabbage and cauliflower soil was found to be 805.60±5.63 and 792.01±0.43, but the corresponding leaves showed arsenic levels from not detectable to 0.05 ug/g of sample. Similarly maximum soil arsenic content of drumstick flower (645.84±4.8) and the maximum soil arsenic content of garlic bulb (917.77 ±3.56) did not reflected in the corresponding edible plant parts, showing the accumulation is part specific.

TABLE 6. ARSENIC CONTENT OF BULB, FLOWER, FRUIT AND LEAVES AND THEIR RESPECTIVE SOIL SAMPLE

Area of sample collection	Bulb-Garlic Soil	Bulb	Flower Drumstick Soil	Flower	Fruit-Tomato Soil	fruit	Leaves –Cabbage Soil	leaves
BudgeBudge I	ND	ND	640.13	<0.05	ND	ND	479.93	<0.50
BudgeBudgeII	516.31	<0.05	642.20	<0.05	764.76	<0.50	805.60	<0.50
Bhangor	917.77	<0.05	203.89	<0.05	472.76	<0.50	537.66	<0.50
Jaynagar	600.53	<0.05	529.10	<0.05	ND	ND	ND	ND
Bishnupur	ND	ND	ND	ND	ND	ND	ND	ND
Sonarpur	884.76	<0.05	577.26	<0.05	ND	ND	662.76	<0.50
Ramnagar	626.47	<0.05	645.84	<0.05	340.92	<0.50	637.31	<0.50
Nabagram	636.61	<0.05	555.80	<0.05	691.00	<0.50	460.31	<0.50

NPK content of the soil: Meharge (1994) reported phosphate to be a good inhibitor of arsenic uptake and hence a high soil phosphorus content may reduce uptake of arsenic. In the present study we have not found any consistent result on this aspect. But their observation was made on a tissue culture study where the phosphorus concentration was high and may affect the result.

Conclusions

From the present study one can conclude that pH, % of organic carbon and the soil concentration of the elements play a major role in accumulating Arsenic in different parts of the plant. pH is more dominant factor as compare to % of organic carbon and the soil arsenic concentration. To reduce the arsenic absorption, it seems that the soil pH preferably be maintained above 7. Hence the indiscriminate use of acid yielding chemical fertilizer may have a detrimental effect in arsenic belt. Arsenic have been found to be present in relatively high concentrations in the root samples of Beetroot and colocasia.

Inspite of a higher arsenic concentration in the soil, bulb, leaves and flower did not have detectable amounts of Arsenic showing elemental Arsenic concentration to be parts specific. Apart from roots, arsenic has been found in under ground stem and rice seeds also. It can be concluded that arsenic is accumulated in the storage site of the plant like roots and tubers (beet root and colocasia), underground stem (potato) and seeds (rice). But it has been found that arsenic is accumulated in rice seed but not in mustard seeds. This may indicate that arsenic accumulation is species specific as well. This specificity may be attributed to the composition of the storage material. As both roots, tubers and rice have starch as a storage material (beet root 1.28± 0.04, Calocasia: 0.71±0.07 and rice: 0.72 ±0.01 ug/g) where as Mustard has a high fat content as storage material.Present study shows that crops with flower, leaves, fruits, bulbs and oil seeds as edible parts may be comparatively a safer choice for the arsenic belt.

Villages in West Bengal survive mainly on a staple diet of rice. The accumulation of arsenic in rice exposes the population to a major threat of arsenic toxicity. The gross calculation of arsenic intake through only food considering rice and roots and tubers as a staple diet was

calculated. The calculation indicates that Arsenic intake goes far above the ASADDI (Essential and Safe Adequate Daily dietary Intake limit of 12-40ug/d for adults) at 108 ug/d /1800 Kcal diet). These high intakes of Arsenic along with highly contaminated water indicate the importance of an active Arsenic mitigation program.

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DIETARY HISTORY OF CANCER PATIENTS

Savitha M.S., Chethana K.L., Usharani K. and Jamuna Prakash
Department of Studies in Food Science and Nutrition,
University of Mysore, Manasagangotri, Mysore 570006

A dietary survey was conducted to study the dietary history of cancer patients. A total of 165 patients were interviewed with the help of a questionnaire which was designed to estimate the usual intake and relative frequency of food intake. The data collected was used for computing a day's average food and nutrient intake. The data indicated majority of patients to be non-vegetarians. Smoking and alcohol consumption were common among male patients whereas betel and tobacco chewing were common among females patients. Among subjects, cancer of genitourinary tract was found to be more common followed by cancer of head and neck region and breast cancer. The incidence was highest between 41-70 years of age. The intake of protein, calcium and vitamin C were found to be adequate. The intake of fat was very high. Food frequency data indicated a lower intake of green leafy vegetables and fruits which were clearly reflected in low intake of iron, carotenes, niacin and dietary fiber, which are proven to be protective foods against cancer.

Cancer is the second most leading cause of death in the world. Epidemiological surveys conducted in different parts of world have revealed substantial relationship between dietary constituents and cancer. About one third of all cancers might be related to dietary factors (Winick 1977). Many dietary components have been regarded as aetiologic factors for cancers of various sites, such as restricted calories, dietary protein and vitamins, high fat intake, lack of dietary fiber, deficiency of many trace elements (Krishnaswami and Jagadeesan 1996), and a variety of mutagenic heterocyclic amines present in cooked food (Wakabayashi et al. 1992). Dietary habits are also associated with the aetiology of certain cancers. Some foods contain potential carcinogens or anti-carcinogens which play an important role in the development or prevention of cancer. The present dietary survey was conducted to study the dietary history, to get information about frequency of food intake and to assess the nutrient adequacy of the cancer patients.

Materials and Methods

A total number of 165 patients (male –58, female – 107) in the age group of 20-70 years diagnosed as having cancer and admitted as inpatients at Bharath Hospital and Institute of Oncology, Mysore, Karnataka were selected as subjects of the study. The data was collected over a period of 7 months followed by 3 months of data analysis.

The diet questionnaire was designed primarily to estimate the usual food intake and byrecall method for a week much before diagnosis of the disease. It was formulated so also to include background information about socio-economic status, number of family members and their ages and also habits regarding smoking, drinking, tobacco and betel chewing of the subjects. A set of standardized cups and spoons were used in order to know the portions of foods consumed. The help of family members was also solicited frequently to recall the foods consumed in the past by the patients. Standardization of cooked weights of all the common foods consumed was carried out in the laboratory.

Usual dietary intake of the subjects for seven days was computed with the help of the data collected and the frequency of food intake. The intake of nutrients was calculated using food composition tables for seven days menu and then it was converted to one day by taking the average (Roopa and Rao 1980; Premkumari et al. 1984., Gopalan et al. 1989; Anuradha and Prakash 1989).

Subjects were divided into different groups depending upon type of cancer and gender and their nutrient intake was computed. Mean nutrient intake of patients was compared with Recommended Dietary Allowances to calculate the percent adequacy of nutrient intake (ICMR 1996). Results and discussion

The classification of subjects according to type of cancer is given in Table 1. Cancer of the genitourinary tract was more common among female patients (51 subjects) followed by breast cancer (22 subjects) whereas in male patients cancer of the head and neck region was more common. Agewise classification of data indicated that cancer incidence was highest in 41-50 years age group followed by 61-70 year group.

TABLE 1. CLASSIFICATION OF SUBJECTS ACCORDING TO TYPE OF CANCER

Type of cancer	Male	Female	Total
Head & neck[a]	14	11	25
Oesophagus	6	9	15
Breast	-	21	21
Lungs/ Bronchogenic	7	1	8
Rectum	-	2	2
Colon	2	4	6
Stomach	2	-	2
Genitourinary[b]	6	51	57
Others[c]	21	8	29
Total	58	107	165

a: includes brain tumor, tonsil, thyroid, neck, buccal mucosa, cheek, pyriform fossa, pharynx, gum, laryngopharynx, naso pharyngeal, vocal cord, supraglossitis cancers.

b: includes testes, penis, ovary, cervix, uterine cancers and renal cell carcinoma,.

c: includes multiple myeloma, lymphoma, leukemia, sarcoma and adenocarcinoma.

Classification of subjects according to their dietary pattern and habits (Table 2) revealed that majority of patients were non vegetarians, 66% of male patients were smokers while 14% were alcoholic. Among female patients 33% had the habit of betel chewing while 17% were habituated for tobacco chewing.

Food frequency data indicated rice, ragi wheat as the commonly consumed cereals while among dhals, red gram dhal was more frequently used (Table 3). The consumption of green leafy vegetables was reported at frequency of once a week by majority of patients. The consumption of greens was found to be in the order of mixed greens <kilkeerai (*Amaranthus tricolour*) <amaranth

<drumstick leaves <cabbage. The consumption of other vegetables was also found to be once a week and common vegetables consumed were beans, brinjal, ridge gourd and ladies finger. Among root and tubers beet root, carrot, potato and radish were consumed by most of them once a week. Consumption of fruits was occasional with the exception of banana which was used regularly. Egg and flesh foods were consumed once a week. Coffee and tea were reported to be consumed daily by the patients. Groundnut oil was the common vegetable oil used for cooking as reported by majority of patients. Qualitatively data indicated high consumption of milled rice which is a refined food and low consumption of fruits and vegetables which are proven preventive foods for cancer.

TABLE 2. CLASSIFICATION OF SUBJECTS ACCORDING TO DIET AND HABITS

Item	Male (n=58)	Female (n=107)
Diet		
Vegetarian	19	33
Non-vegetarian	39	74
Habits		
Smoking	38	-
Alcohol	8	-
Betel chewing	-	35
Tobacco chewing	-	18

TABLE 3. FREQUENCY OF FOOD INTAKE BY PATIENTS

Food stuffs	Frequency of daily use (Percentage of subjects)	Food stuffs	Frequency of daily use (Percentage of subjects)
Cereals		**Legumes**	
Rice	99	Red gram dhal	36
Ragi	73	Black gram dhal	25
Wheat	16	Horse gram	13
Vegetables		Bengal gram	8
Other vegetables	41	Green gram	7
Green leafy vegetables	30	Cowpea	6
Roots and tubers	16	Field bean	6
Fruits		**Animal foods**	
Banana	35	Milk	84
other fruits	6	Egg	12
Beverages		Flesh foods	11
Coffee	58		
Tea	53		

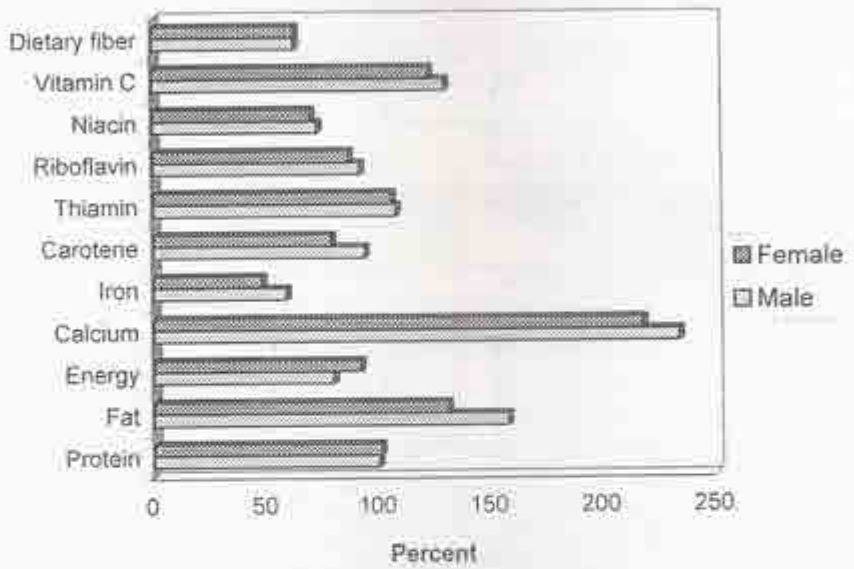

Fig.1. Average percent adequacy of nutrients in patients

The protein intake of male patients varied between 57 – 63 g/ day (Table 4). Female patients comparatively had a slighily lower range of protein intake from 44 - 55 g/day (Table5). In general protein intake was adequate. No variation was observed in fat intake of males with 30-33 g/day, but for females it ranged from 23 – 32 g/day. The fat intake was much higher than recommended. A large variation was observed in the energy intake depending upon the type of cancer. In males it was very low for patients suffering from cancer of genitourinary tract and other types, whereas in females it was very low for patients suffering with cancer of colon and rectum. In other cases, energy intake was marginally sufficient ranging from 82 to 98 in percent adequacy. Calcium intake was very high in all the age groups due to consumption of calcium rich millet, ragi, whereas iron was low. The percent adequacy of iron intake in women patients was less than 50%. Carotene intake was marginally sufficient in some patients but women suffering from stomach and rectal cancer and those from other category had a very low intake. Thiamin and riboflavin were marginally sufficient. Niacin was found to be much lower than recommended. Vitamin C intakes were higher in all groups. The intake of phytin phosphorus varied between 389 - 711 mg/day whereas oxalic acid was 427– 1335 mg/day. The nutrient intake of female patients followed a similar pattern as male with slighily lower intakes of some nutrients notably iron, carotene and riboflavin.

Adequacy of nutrient intake on an average as given in Fig.1, The fat, calcium and vitamin C consumption in both the groups were much higher whereas protein, thiamin and riboflavin were found to be nearer to adequacy. Carotene was adequate for males but inadequate for females. The low intake of food stuffs like green leafy and other vegetables and fruits are very clearly reflected in the low intake of iron, carotene, niacin and dietary fiber. Notably is the intake of iron which was 48 and 59% of RDA in females and males respectively.

TABLE 4 DAILY INTAKE OF NUTRIENTS AND OTHER COMPONENTS BY MALE PATIENTS

Nutrients	*Type of Cancer*					
	Head and neck (n=14)	Oesophagus (n=6)	Lungs/ Bronchogenic (n=7)	Colon and Stomach (n=4)	Genitourinary (n=6)	Others (n=21)
Protein (g)	62 ± 6.9	61 ± 9.6	57 ± 10.7	59 ± 7.5	58 ± 7.3	63 ± 8.9
Fat (g)	30 ± 7.4	31 ± 10.1	32 ± 3.5	32 ± 4.5	32 ± 9.0	33 ± 6.4
Energy (Kcal)	2088 ± 363	2104 ± 338	1980 ± 239	2015 ± 334	1898 ± 174	1469 ± 316
Calcium (mg)	1071 ± 319	978 ± 305	936 ± 331	1202 ± 206	479 ± 146	1061 ± 413
Iron (mg)	16.9 ± 3.5	18.5 ± 3.8	15.5 ± 5.8	17.0 ± 2.3	13.0 ± 3.2	17.9 ± 5.1
Carotene (µg)	2247 ± 957	2625 ± 894	2086 ± 692	2099 ± 402	2002 ± 593	2553 ± 821
Thiamine (mg)	1.3 ± 0.30	1.3 ± 0.25	1.2 ± 0.30	1.5 ± 0.33	1.1 ± 0.37	1.4 ± 0.40
Riboflavin (mg)	1.4 ± 0.34	1.4 ± 0.37	1.1 ± 0.40	1.6 ± 0.23	1.1 ± 0.28	1.3 ± 0.32
Niacin (mg)	11.5 ± 2.3	10.9 ± 1.49	11.7 ± 1.0	13.0 ± 1.37	11.4 ± 2.6	11.8 ± 3.1
Vitamin C (mg)	41 ± 15.5	67 ± 11.5	50 ± 18.8	39 ± 6.5	48 ± 11.8	66 ± 13.4
Phytin P (mg)	612 ± 186	608 ± 161	551 ± 177	711 ± 30.5	426 ± 139	624 ± 101
Oxalic acid (mg)	775 ± 504	1335 ± 161	906 ± 495	640 ± 166	427 ± 240	1056 ± 389
Dietary fiber (g)	34.2 ± 19.5	30.5 ± 14.3	27.7 ± 16.4	14.0 ± 5.5	15.7 ± 11.4	27.8 ± 9.1

Figures represent mean ± standard deviation.

It may be noted that only the total carotene contents of foods has been computed and the actual consumption of beta carotene which should be 2400 µg according to the RDA may be much lower. Epidemiological studies have shown that diets containing large quantities of vegetables and to a lesser extent fruits are associated with relatively low risk from cancers (Wattenburg 1992).

The level of intake of certain vitamins is important in establishing the relationship between diet and cancer, because some vitamins and pro-vitamins and phytochemicals present in foods have chemical properties of antioxidants. Antioxidation may be the most important effect of carotenoids in cancer prevention (Lupulescu 1994).

Conclusions

The low intake of cereals, vegetables and fruits were reflected in lower intake of Calories, iron, carotene and B complex vitamins. The intake of protective factors like beta carotene and fibre were low and promoting factors like fat was high. Although the intake of vitamin C was

adequate for physiological functions, it is not known if the amount available after cooking losses etc., was too low.

TABLE 5 DAILY INTAKE OF NUTRIENTS AND OTHER COMPONENTS BY FEMALE PATIENTS

	Type of Cancer					
	Head and neck (n=11)	Oesophagus (n=9)	Breast (n=21)	Rectum and Colon (n=6)	Genitourinary (n=51)	Others (n=8)
Protein (g)	54 ± 9.3	48 ± 7.7	55 ± 8.1	44 ± 7.5	51 ± 6.2	51 ± 5.6
Fat (g)	23 ± 6.0	28 ± 6.7	32 ± 10.3	23 ± 2.4	26 ± 6.9	25 ± 10.6
Energy (Kcal)	1755 ± 306	1704 ± 288	1813 ± 297	1471 ± 104	1737 ± 401	1834 ± 193
Calcium (mg)	874 ± 316	759 ± 369	933 ± 343	624 ± 206	883 ± 277	1164 ± 320
Iron (mg)	15.0 ± 4.0	11.8 ± 4.1	15.5 ± 5.9	13.0 ± 4.5	15.0 ± 3.1	16.8 ± 2.4
Carotene (µg)	2004 ± 628	2022 ± 954	2399 ± 930	1177 ± 384	2022 ± 815	1714 ± 876
Thiamine (mg)	1.2 ± 0.30	1.1 ± 0.30	1.2 ± 0.20	0.9 ± 0.27	1.4 ± 0.31	1.2 ± 0.25
Riboflavin (mg)	1.0 ± 0.40	1.0 ± 0.26	1.2 ± 0.36	0.9 ± 0.12	1.5 ± 0.27	1.1 ± 0.15
Niacin (mg)	10.4 ± 1.4	9.9 ± 1.6	10.3 ± 1.6	8.6 ± 2.1	9.1 ± 3.2	9.1 ± 2.1
Vitamin C (mg)	47 ± 3.5	40 ± 11.0	58.6 ± 9.6	53 ± 6.5	52 ± 11.3	42.2 ± 18.9
Phytin P (mg)	545 ± 113	459 ± 162	487 ± 329	389 ± 143	477 ± 163	503 ± 214
Oxalicacid mg)	724 ± 392	434 ± 189	801 ± 489	456 ± 168	819 ± 346	971 ± 305
Dietaryfiber (g)	33.0 ± 14.3	18.6 ± 6.1	25.2 ± 6.9	18.5 ± 7.5	26.6 ± 9.2	30.0 ± 15.7

Figures represent mean ± standard deviation

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DYEING OF SILK AND LINEN FABRICS WITH NEEM LEAVES EXTRACT

Kannel AV and Kurien T
College of Home Science, 49, New Marine Lines, Mumbai- 400 020

A medicinal herb, neem has been used as a natural source to dye silk and linen fabrics, premordanting with and without alum and tannic acid in 15 % and 20 % shades. Various shades of yellowish green to brown were obtained having fair colourfastness to sunlight, washing and wet rubbing and good colourfastness to both alkaline and acidic perspiration. The natural anti-bacterial property of the herb was exhibited in most of the samples.

Since Ancient times dyes are obtained from sources of natural origin which have the ability to colour textiles. These dyes extracted from plant (indigo), animal (cochineal) and mineral (ochre) sources are called as natural dyes. One such natural source is neem called as 'Nimba' and 'Arishta' in Sanskrit whose potential as a dye has not been much explored (http://www.healthlibary.com/reading/neem/chap2.htm) Neem is a well-known evergreen tree naturally occurring in the Deccan region and other parts of India . Its anti microbial property has been well established.

Silk and linen are amongst the oldest fibres, which have been used by mankind from time immortal. Because of their unique properties they are still in great demand. However, in comparison to cotton and wool very few researches have been done with silk and linen in the field of natural dyes.

In the present study, neem was used as a natural dye, to dye silk and linen fabrics as the dyeing process is eco friendly and no harmful chemicals are used for dyeing .

Materials and Methods

Then the dyed fabrics were tested for colourfastness to rubbing, washing, sunlight and perspiration and also anti-bacterial property. Silk and linen fabrics (100 % bleached) were selected for the present study. Neem leaves extract of 20% concentration having a 5.3 pH was used for dyeing silk and linen fabrics. Alum and tannic acid were the two mordants selected for the study. All other chemicals used were of laboratory reagent grade. The neem leaves extract was first filtered with the help of thin silk fabric and then dye bath was prepared having an MLR of 1 :10. The fabric was pre-soaked in water and then inserted into dye bath at room temperature. The dyeing temperature was slowly raised and kept around 85° C for silk and above 90 ° C for linen for one hour. The fabric was then washed with tap water once, and line dried in open air.

For premordanting with alum the mordanting pan was filled 2/3 with hot water, 25 grams of alum per 100 grams dry weight of material was dissolved in the solution by stirring well. 6 grams of washing soda per 100 grams dry weight of material was dissolved in little hot water separately and then added to the solution. Later cold water was added on top. When all the bubbles formed subsided the pre-soaked fabric was immersed into the solution. The temperature was then slowly raised. When it reached 82 – 88 ° C the heat source was shut off and the fabric was left to steep in the solution for 24 hours. It was rinsed well before dyeing. For premordanting with tannic acid the mordanting pan was half filled with hot water, 6 grams of tannic acid per 100 grams dry

weight of material was dissolved in the solution by stirring well. Later cold water was added on top. Then the pre-soaked fabric was immersed into the solution. The temperature was then slowly raised. When it reached 82 –88 ° C the heat source was shut off and the fabric was left to steep in the solution for 24 hours. It was rinsed well before dyeing.

All the dyed samples were assessed for colourfastness to rubbing, washing, perspiration and sunlight according to IS: 766-1956, 2 IS: 3361-1979, IS 971 –1956 and ISO 105 B 02 test methods respectively (ISI 1982). All the 15 % shaded fabrics both of silk and linen were tested for their anti-bacterial properties according to AATCC Test Method 147 – 1998.

Results and Discussion

It was observed that even dyeing and darker shades were produced on silk fabrics compared to linen fabrics. Mostly the colour obtained was shades of yellowish green and brown.All the samples showed good fastness property having a rating of 80 %. The result did not vary with change in percent shade. substrate and use of mordants. The wet rubbing fastness of dyed samples varied from fair to good. The colourfastness of most linen samples are fair while the colourfastness of silk samples were good except tannic acid premordanted samples which showed fair colourfastness to wet rubbing (Table 1)

TABLE 1. COLOURS OBTAINED AFTER DYEING AND COLOURFASTNESS TO RUBBING AND SUNLIGHT

Specification			Fastness to dry rubbing		Fastness to wet rubbing		Fastness to sunlight	
Sample	Silk	Linen	Silk	Linen	Silk	Linen	Silk	Linen
A	Light brown with greenish tinge	Light brown with greenish tinge	4/5	4/5	4	3	4	3/4
B	Light brown with greenish tinge darker compared than 15 % shade	Light brown with greenish tinge darker compared than 15 % shade	4/5	4/5	4	3	4	3/4
C	Yellowish green	Yellowish green	4/5	4/5	4	3/4	3/4	3/4
D	Yellowish green darker than 15 % shade	Yellowish green darker than 15 % shade	4/5	4/5	4	3/4	3/4	3/4
E	Bark Brown	Bark Brown	4/5	4/5	3/4	3/4	4	4
F	Bark Brown darker than 15 % shade	Bark Brown darker than 15 % shade	4/5	4/5	3	3	4	4

Key : A – Dyed in 15% with neem leaves extract, **B** – Dyed in 20% with neem leaves extract, **C** – Alum pre-mordanted dyed in 15% with neem leaves extract **D** – Alum pre-mordanted dyed in 20% with neem leaves extract, **E** – Tannic Acid pre-mordanted dyed in 15% with neem leaves extract, **F** – Tannic Acid pre-mordanted dyed in 20% with neem leaves extract, **I** - Fastness to colour change, **II** -Colourfastness to staining, **Co**-Staining on Cotton, **S**-Staining on Silk, **L**-Staining on Linen, **W**-Staining on Wool.

All the samples showed fair colourfastness to sunlight. The colourfastness was lower for both silk and linen samples premordanted with alum compared to samples premordanted with tannic acid. In case of samples dyed without premordanting, silk showed better colourfastness compared to linen. (Table 1). It was noted that on washing all silk dyed fabrics changed colour to dark brown shade. In case of linen, it varied from good colourfastness to poor colourfastness. Samples dyed without premordanting showed poor colourfastness while, alum premordanted samples showed fair colourfastness. Of all the samples tannic acid premordanted samples showed better colourfastness. Only slight staining was noted on the adjacent fabrics. All the samples showed good colourfastness to both alkaline and acidic preparation. But alum premordanted silk samples colour darkened in both alkaline and acidic medium. Only slight staining was noted on the adjacent fabrics (Table 2).

TABLE 2 EVALUATION OF DYED FABRIC FOR WASH AND PERSPIRATION FASTNESS

	Colour fastness to Washing			Colourfastness to perspiration					
Medium				Acidic			Alkaline		
	I	II		I	II		I	II	
Silk		S	Co		S	Co		S	Co
A	Changed	4/5	4/5	5	4/5	4/5	5	4/5	4/5
B	Changed	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5
C	Changed	4/5	4/5	darkened	4/5	5	darken	4/5	5
D	Changed	4/5	4/5	darkened	4/5	4/5	darken	4/5	4/5
E	Changed	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5
F	Changed	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5
Linen		L	Co		L	W		L	W
A	2/3	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5
B	2/3	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5
C	3	5	4/5	4	4/5	4/5	4	4/5	4/5
D	3	5	4/5	4	4/5	4/5	4	4/5	4/5
E	3 / 4	4/5	4/5	4	4/5	4/5	4	4/5	4/5
F	3 / 4	5	4/5	4	4/5	4/5	4	4/5	4/5

TABLE 3. ANTI-BACTERIAL PROPERTY OF THE DYED FABRICS

Fabrics	Silk			
Observation	**Growth under the fabric**	**Growth on the edge of the fabric**	**Zone of inhibition**	**Conclusion**
A	Growth observed	Growth observed	Not observed	Anti-bacterial not observed
C	No growth	No growth	Not observed	Anti-bacterial property observed
E	No growth	No growth	Not observed	Anti-bacterial property observed
	Linen			
A	No growth	No growth	Not observed	Anti-bacterial property observed
C	Growth observed	Growth observed	Not observed	Anti-bacterial property not observed
E	No growth	No growth	Not observed	Anti-bacterial property observed

Key : **A** – Dyed in 15% with neem leaves extract, **B** – Dyed in 20% with neem leaves extract. **C** – Alum pre-mordanted dyed in 15% with neem leaves extract **D** – Alum pre-mordanted dyed in 20% with neem leaves extract, **E** – Tannic Acid pre-mordanted dyed in 15% with neem leaves extract, **F** – Tannic Acid pre-mordanted dyed in 20% with neem leaves extract, **I** - Fastness to colour change. **II** -Colourfastness to staining, **Co**-Staining on Cotton, **S**-Staining on Silk, **L**-Staining on Linen, **W**-Staining on Wool.

All the fabrics dyed in 15% shade were tested for their anti-bacterial property and it was found that out of the 6 samples 4 showed anti-bacterial properties. Silk sample dyed without premordanting and alum premordanted linen fabric were the 2 samples, which did not exhibit anti-bacterial property. In the above 2 samples growth of microbes were noticed under the fabric as well as on the edge of the fabric. Zone of inhibition was not observed in all the 6 samples (Table 3). The reason for such a mixed result is unknown.

Conclusions

Neem could be used as a natural dye to obtain yellowish green to brown shades having fair colourfastness to sunlight, washing and wet rubbing. It was noted that silk samples changed colour on washing. All the samples showed good colourfastness to both alkaline and acidic

perspiration. But alum premordanted silk sample's colour darkened in both alkaline and acidic medium. The natural anti-bacterial property of the herb was exhibited in most of the samples; therefore, it could be beneficial for people having skin problems.

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CONSTRUCTION OF KNITTED FABRIC AND GARMENTS USING LYOCELL-COTTON BLEND

Sharma V and Dedhia E
College of Home Science, 49,New Marine Lines, Mumbai 400.020

In today's world of pollution it has become necessary for use of eco-friendly products. Lyocell is one such fiber, which is eco-friendly in nature. Blending with cotton enhances its properties, making it a perfect fabric for apparel wear. Constructing garments through knitting process is becoming very popular, as people prefer 'wash n wear' fabrics. In the present study, lyocell-cotton blended yarn in the proportion of 60:40 of 20 count has been used for the construction of knitted garments. Single jersey and double jersey fabrics were made using circular weft knitting, which were then constructed into T-shirts. The tests conducted at yarn stage showed that the yarn has good tensile strength and elongation. No problems in knitting of the yarns and the fabrics were made without any yarn breakage. The fabric tests results showed slight and moderate amount of pilling in single jersey and double jersey respectively. Also the fabrics tested especially single jersey fabrics were prone to shrinkage.

The growing concern for environmental problems has led the fiber industry to manufacture products, which are eco-friendly in nature. Keeping in mind the environmental concerns, Courtaulds has developed a new plant in Alabama, U.S.A. and after 14 years of research and development it has launched its new fiber 'Tencel'. Tencel is the brand name for the fiber and 'Lyocell' is the generic name. (Agarwal 2001).

Lyocell fibers are regenerated fibers developed in an eco-friendly process as an alternative to viscose. It can be defined as "cellulose fiber obtained by an organic solvent spinning process" (Taylor 2002). Lyocell can also be defined as a man-made cellulosic fiber, which is produced by regenerating the fiber form out of a cellulose solution in an organic solvent. (Sayed et al. 2002). Lyocell has the properties of both natural and synthetic fibers, which excludes the limitations of other cellulosic fibers. The manufacturing process is a natural one, safety-tested, non-toxic chemicals are used and there is no chemical alteration of the natural cellulose. This fiber is both biodegradable and recyclable fiber. (Taylor 2002)

Lyocell is a versatile fiber as it is a perfect partner for blending. It can be blended with both natural and synthetic fibers. Blending improves the performance of most of the fibers. It can be blended with cotton, linen, polyester, nylon, silk and most other fibers. Blend of lyocell and cotton adds softness, increases strength and shows increase in the performance of the fiber. Lyocell shows no loss in blending process. (Sayed et al. 2002)

Cotton fabrics do not have good drapability; they lack the body and suppleness required for a good drape. They lack elasticity and are easily wrinkled. Cotton fabrics show great amount of shrinkage and are turned yellow when exposed to sunlight for a prolonged time. (Teli et al. 2000). Thus by blending with lyocell, cotton will overcome all these drawbacks and a fabric fit for apparel wear can be created.

In today's world of 'wash n wear' garments. knitted fabrics with qualities such as wrinkle free, shape retention etc are take the top of the list.. Thus the present study aims atconstruction of knitted fabric and garments using Lyocell-Cotton blend.

Materials and Methods

Lyocell-Cotton blend yarn was provided by Rajasthan Spinning and Weaving Mills. Banswara, Rajasthan.All the tests were carried out at CIRCOT, Adenala road, Matunga, Mumbai.

The twist was adjusted to Z twist and a tension of 13gms was given. The distance between the two clamps was adjusted to 10". The specimen was clamped at both the ends, with one end stationary and the other rotating till the yarn was untwisted. The readings were taken automatically as it was a digital twist tester.

Yarn strength was carried out through a single yarn strength tester, which was attached to a computer. The yarn was made to pass through many yarn guides and then it was passed through the strength tester where the load was applied. The computer recorded the strength and the results were obtained.

The hairiness of the yarn was tested by Shirley hairiness tester. The yarn was placed at one end and was made to pass through yarn guides and lastly was wounded on a drum at the other end. The speed of the drummer was 60y/min and the machine was run for one minute with the help of stopwatch. 10 samples were tested and the results were recorded each time.

Knitted fabrics are made by drawing one loop through another loop with the help of one or more then one set of needles. Weft knitted fabrics was developed. In this type of knits loops are formed one after the other in successive order. Single jersey knits and double jersey knits were made. Single jersey knits were produced on single needle bed machine with one set of needles and double jersey knits were produced on double needle bed machine with two sets of needles. Circular knitting machines developed both the type of fabrics.

Pilling test – The fabric to be tested was cut according to the standard plate provided. The cut samples were then marked and stitched tightly over rubber tubes. The rubber tubes were then placed in pilliometer for about 5 hours. After 5 hours the samples were removed and the pilling was assessed visually with the help of standard plates 4 samples were tested.

Shrinkage test – The fabric was cut according to the template provided and necessary markings were done. The sample was measured before the test. Then the fabric was soaked in water for one hour and then was flat dried in shade 24 hours. Again the samples were measured and then were compared with the measurements recorded earlier at the beginning of the test.

Dyeing – First samples were dyed using different dyes, namely, direct dyes, vat dyes, natural dyes and reactive dyes. Amongst the all types of dyes reactive dyes came out to be the best. Therefore the whole cloth was dyed using reactive dyes. The dye was pasted with a little cold water and added to the dye bath and after 10 minute of stirring 0.75gm/ml of Na_2So_4 was added. After 20

minutes 1.5gm/100ml of NaCl was added. The dyeing was continued for 30 minutes and then the material was rinsed and dried.

The dyed fabrics were evaluated for its wash fastness property through the grey scale.

Wash fastness was evaluated using laundrometer. The test method used was 2 IS: 3361 – 1979 as given in I.S.I. Handbook of Textile Testing.

The method used to conduct this test was IS: 2454 and grey scale was used for evaluating colourfastness to light. IS: 971-1983 method was used to test the colour fastness to perspiration. Grey scale was used for evaluating colourfastness to perspiration. Colour fastness to rubbing was done using the IS: 766-1988 method. Grey scale was used for evaluating colourfastness to rubbing.

A survey was conducted through a questionnaire to know about the awareness regarding lyocell fibres and also to know people's views and comments regarding the fabric developed.

Results and Discussion

Twist tester was used for calculating twist per inch in the Lyocell-cotton-blended yarn. The blended yarn had 'Z' twist and it showed slight variation in the twist. The twist per inch calculated was 28.2TPI. Lyocell-cotton showed good tensile strength. Tensile strength tester was used. Strength results of the lyocell-cotton yarn are shown in Table 1. Lyocell-cotton blended yarn showed average elongation (Table 2).

TABLE 1. TENSILE STRENGTH OF LYOCELL/COTTON YARN

	B-Force	Tenacity
Mean Values	631.8	21.40
CV%	5.46	5.46
S+/-	34.5	1.17
Q95%+/-	6.9	0.23

TABLE 2 . ELONGATION OF LYOCELL-COTTON YARN

	B-Force	Elongation %
Mean Values	631.8	6.94
CV (%)	5.46 ± 34.5	6.12 ± 0.42
Q 95%+	6.9	0.08

The blended yarn showed hairiness. This was mainly because Lyocell yarn has the property to fibrillate that is, protruding of hairs on the fibre surface. The results showed 34 yds / min of hairiness. Hairiness also results due to twist factor higher the twist greater the hairiness. Pilling was observed in both the types, though more in double jersey fabric. This may be due to the construction of the fabric. Pilling is observed in lyocell-cotton-blended fabric because lyocell has the tendency to fibrillate which causes pilling on the fabric surface.

Both the type of fabric showed shrinkage (Table3). Single jersey fabric showed elongation in course direction and slight shrinkage in Wales's direction. Double jersey fabric was more resistant to shrinkage then single jersey fabric. It showed less shrinkage in both the direction.

TABLE 3: SHRINKAGE RESULTS OF LYOCELL/COTTON FABRIC

Sample	Wales direction %	Course direction %
Single jersey	12.6	-6.6
Double jersey	4.0	5.0

It was observed that –

- Direct dyes showed uneven dyeing and appeared quite dull.
- Vat dyeing results were not at all satisfactory.
- Natural dyes showed dull effect.
- Hot reactive dyes showed positive results. Even Dyeing was observed n both types of fabrics

Reactive dyes have affinity for cellulosic fabrics and lyocell and cotton both being cellulosic fabric the dyeing results were good. There was moderate colour change and noticeable staining taken place in lyocell-cotton fabric. Cotton fabric showed considerable staining on washing (Table 4). Colour fastness to light was moderate (4-5) in both the case.

TABLE 4 WASH FASTNESS OF LYOCELL-COTTON FABRIC

Particulars	Grey Scale Assessment		
	Colour Change	Extent of Staining	
		Lyocell-cotton	Cotton
Single Jersey	3	3	2
Double Jersey	3	3	2

TABLE 5 COLOUR FASTNESS TO PERSPIRATION OF LYOCELL-COTTON

	Single Jersey	Double Jersey
Acidic		
Change in shade	3-4	2-3
Staining on cotton	2-3	3
Staining on wool	3-4	2-3
Alkaline		
Change in shade	4	2-3
Staining on cotton	3	3
Staining on wool	4	2-3

Colour fastness to perspiration (Table 5) in case of single jersey fabric was found to be fair to good. In case of double jersey fabric fair change was observed in shade and even in this type of fabric noticeable staining was observed.

Dry rubbing showed not much change in colour, but in case of wet rubbing both the fabrics showed fair colour change.

As per the survey, 49.33% respondents found the single jersey fabric as moderate of which 15 were students (42.85%) and 22 textile experts (55%). 61.33% respondents found the double jersey fabric as moderate of which 19 were students (54.28%) and 27 textile experts (67.5%). Figures 1 and 2 show the rating of single jersey and double jersey lyocell-cotton fabrics.

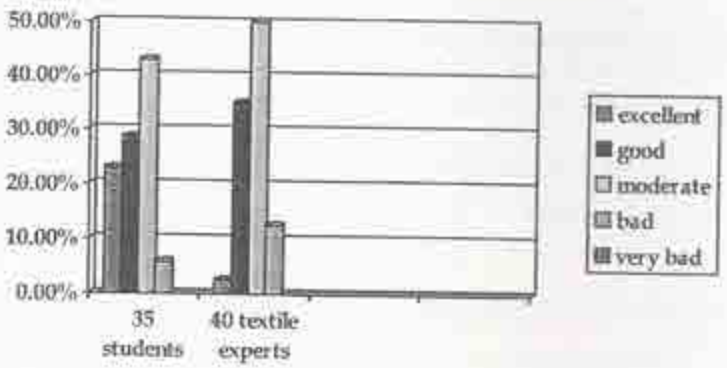

Fig. 1 Ratings of lyocell/cotton single jersey fabric

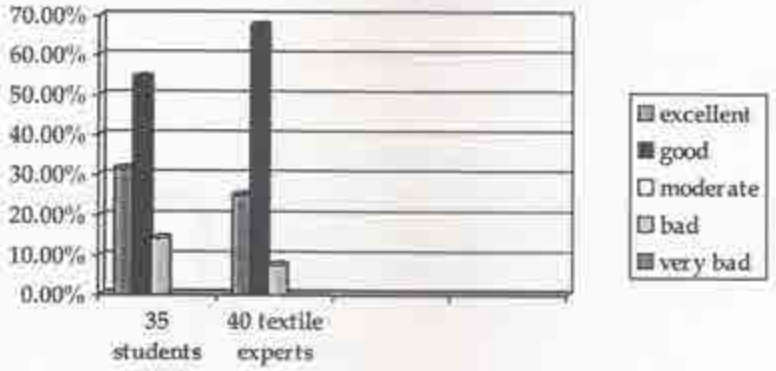

Fig. 2 Ratings of lyocell/cotton double jersey fabric

Conclusion:

The results from the test confirm that lyocell/cotton- blended fabrics can be used for making garments as it has all the desirable characteristics for a perfect fabric, like good strength, smoothness and softness, does not shrink much especially in the case of double jersey fabric. The survey also confirmed that these fabrics can be used for apparel wear especially single jersey fabrics in sports wear, socks and lingerie and double jersey fabrics in sports wear and shirts.

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