Research Reach

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College of Home Science,
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Editorial

It is indeed with great pleasure we bring out the July issue of RESEARCH REACH that covers the proceedings of the Workshop organised by the Research Centre on "Writing Research Articles of International Standards" on 10th and 11th July 2015 at the College of Home Science. The workshop was attended by the academicians who are guides / mentors, Ph. D scholars, and postgraduate students from various colleges in India. In addition to the lectures by senior scientists and experts in research, there were post-lunch practice sessions for the participants on both the days. The workshop received great appreciation from the participants. We are grateful to Marico Ltd., Kamani Oils and Vista Foods as well as individual donors who supported this venture financially.

This issue has also introduced a new feature that will give the readers a self-check of their knowledge in their subject of specialisation under Home Science. Did you guess it? It is a QUIZ.

Further, this is a special issue with invited review articles from Dr B Sesikeran, Dr MS Bamji and Dr CN Sivaramakrishnan in the areas of Food Science, Nutrition and Dietetics and Textile Chemistry with stimulating ideas for further research in these subjects.

We are glad to bring out this issue during the Diamond Jubilee celebrations of our parent institute, Nirmala Niketan, which completes 60 years of service in the field of education.

Chief Editor,
Dr. G. Subbulakshmi

This issue is sent to every participant of the National Workshop on 'Writing Research Articles of International Standards'. You are requested to kindly send your subscriptions for future issues of the journal. You may also request your libraries to subscribe. Please do write your research articles as per the guidelines given in the workshop and the specifications given in this journal, for publication. The paper will be peer reviewed by the experts in the field as to its quality and published only after the suggestions are incorporated and the queries answered satisfactorily.

Regular subscribers are requested to renew your subscriptions for the year 2016.

INSTRUCTIONS TO THE AUTHORS

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

RESEARCH REACH – Journal of Home Science, is a peer-reviewed journal registered by the National Institute of Science Communication and Information Resources (ISSN 0974 – 917X). It is a bi-annual publication from the Research Centre, College of Home Science, Nirmala Niketan, 49, New Marine Lines, Mumbai – 400020.

The journal invites previously unpublished original articles and review articles from students, faculty, and researchers in the fields of Nutrition and Dietetics, Human Development, Home Science Extension Education, and Textile Sciences.

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

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

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

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

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9. Writing style

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

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

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

For Book References:

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

For Web references:

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

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

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REVIEW PAPER *Research Reach J.H. Sci. Vol. 14. No 2,1 - 4*

FOETAL ORIGINS OF ADULT ONSET DISEASES

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Some of the earliest changes in body composition take place between the first to the seventh day of embryogenesis (Fig. 1). These genetic programs take place both in the inner cell mass which will develop into the foetus as well as the single layer of trophoblasts which give rise to placenta and the foetal membranes. Both play a critical role in foetal development as well as in the determinants of long-term consequences for degenerative diseases.

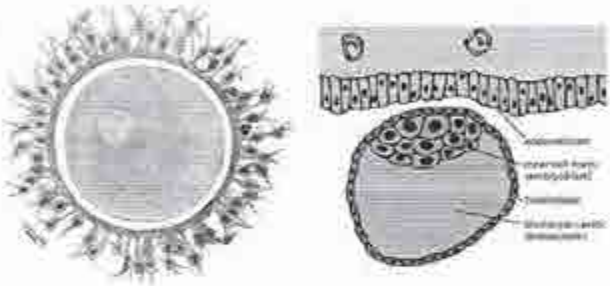

Fig. 1. Day 1 to day 7 of embryogenesis (Image source: https://commons.wikimedia.org/wiki/File:Blastocyst_English.svg).

Diagrammatic representation shows that the DNA chain is coiled around the histones like a thread on a spool and there are some histone projections/ tails to which methyl or acetyl groups bind (Fig. 2). Depending on this binding the spool of DNA could either be tightly coiled on the histone spool wherein those genes may not express themselves and remain inactive or the spool may loosen and that

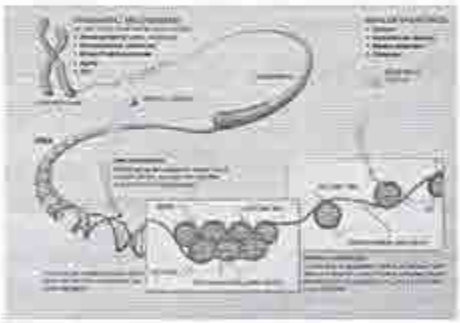

Fig. 2. Chromosomal DNA completely unfurled (Image source: https://en.wikipedia.org/wiki/Epigenetics).

segment of DNA may become externalised and then capable of expressing or transcribing. Thus, in every developing cell, genes can be switched on and off. It is now hypothesized that depending on the maternal microenvironment at the time of embryogenesis and the

presence or absence of certain macro and micronutrients several such gene expressions could be modified which is known as epigenesis or genetic programming. Since the DNA sequence remains unaltered, this is not a mutation. It is presumed that many of these changes happening so early in life are not only permanent but also inheritable through subsequent generations. These form the basis for foetal origins of degenerative diseases like diabetes, hypertension, obesity, heart disease, renal disease, etc. Essentially, they are epigenetic changes which alter metabolic processes as well as body composition and a number of endocrine pathways. Maternal Nutritional status can alter the epigenetic state of the foetal genome and imprint gene expression through (a) DNA methylation and (b) Histone acetylation and methylation. Both are affected by the availability of amino acids and micro nutrients like B12, folate and B6. The phenotypic changes in the foetus would be altered structure and function of placenta and other tissues like blood vessels, pancreas, kidneys, heart, etc.

Foetal growth is most vulnerable to maternal dietary deficiencies of nutrients (e.g. protein and micronutrients) during the peri-implantation period and the period of rapid placental development. Maternal obesity or over nutrition before or during pregnancy may result in foetal growth restriction and increased neonatal mortality and morbidity (Castro, Avina, 2002).

The various consequences of maternal malnutrition already known are:

1. Intra Uterine Growth Retardation (IUGR) leading to low birth weight (LBW).
2. Altered brain development if there is iodine deficiency.
3. Neural tube defects and still births due to folate deficiency.
4. Higher infant mortality rates.
5. Premature deliveries and pregnancy wastage.
6. Risk of metabolic syndrome.

Barkers Theory:

David Barker had observed that the prevalence of Type 2 Diabetes Mellitus (T2DM) in a given population is a function of past prevalence of low birth weight and present prevalence of adult obesity.

There have been several studies carried out in India which have thrown more light on this phenomenon.

In the Pune Children's Study (Bavdekar *et al.*, 1999), LBW children at four years of age had higher plasma glucose after a glucose load. When the same cohort were eight years of age, they had a higher LDL-Cholesterol, higher systolic blood pressure (BP) and greater insulin resistance. These risk factors were highest in children who were born small but became the biggest (heaviest, tallest and most adipose) at eight years of age.

In the New Delhi Birth Cohort study (Huffman *et al.*, 2011) and Hyderabad Nutrition Trial study (Kinra *et al.*, 2008),among adolescents whose mothers during their pregnancies had received food based energy and protein supplementation as a part of a package of public

health interventions (Integrated Child Development System or ICDS) showed a relatively lower cardiovascular risks in terms of insulin resistance and arterial stiffness when compared to those whose mothers did not receive the supplements during the pregnancy. In yet another study conducted in Nepal (Vaidya *et al.*, 2008), systolic blood pressure was lesser by 2.5 mm in two-year-old Nepal children, whose mothers received multiple micronutrients in pregnancy rather than iron-folic acid alone.

In the Gambia study (Hawksworth *et al.*, 2009), the incidence of LBW was lesser by 40% in mothers who had received high energy biscuits during pregnancy. There was a significant lower BP in children when the mothers got the supplements during pregnancy than during lactation.

Role of Placenta:

This is an aspect that is still poorly understood. Since the epigenetic change also affects the placenta it would certainly play a role in the foetal growth and development and the consequences. Trans-placental vascular perfusion and the capacity of the vascular bed and the role of arginine and nitric oxide is critical and needs further study (Belkacemi *et al.*, 2010). There are similar epidemiological evidences which suggest that the long chain n3 PUFA intakes (DHA) during pregnancy results in better brain development and cognitive performances (Obrien *et al.*, 2003; Helland *et al.*, 2003).

Summary of evidences so far:

- Energy and protein restrictions reduce birth weights, but minimally.
- Micronutrient deficiencies result in significant impact.
- Multiple micronutrient supplementation improve birth weights.
- Foetal growth is related to maternal height and birth weight.
- Under nutrition of the mother during her own foetal life and childhood growth limits the growth of her foetus.
- Effects of the mother's current nutritional status are influenced by her own past nutrition and that of earlier generations (Fall IJMR 2009).

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REVIEW PAPER *Research Reach J.H. Sci. Vol. 14. No 2. 5 - 22*

VEGETABLES FOR NUTRITION AND HEALTH

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Vegetables are nature's gift to humankind. Apart from being an important source of micronutrients (vitamins and minerals), vegetables also contain a variety of health-promoting phytochemicals which protect against degenerative diseases. For farmers who grow them, vegetables provide economic security. They are relatively easy to grow and need lesser water than cereal crops. According to Ezzati *et al.* (2002), inadequate intake of vegetables and fruits causes 2.7 million deaths globally, and is listed as top ten risk factors contributing to mortality.

CLASSIFICATION OF VEGETABLES

The classification of vegetables is based on the part of the plant which is edible. Some vegetables can fall in more than one category if more than one part is edible, for e.g. carrot, beetroot, and colocasia where root as well as leaves are edible. Table 1 gives few examples of vegetables derived from different parts of the plant. This list is not exhaustive.

Table 1. Classification of vegetables based on the part of the plant

Part of the plant	Examples
Bulbs: Usually grow just below the ground with a shoot above the ground.	Onion, garlic, spring onion, leek, fennel etc.
Flowers	Cauliflower, broccoli, artichoke etc.
Fruits	Brinjal (eggplant), capsicum, ladies fingers (okra), pumpkin, tomato, etc.
Fungi	Mushrooms
Leaves	Green leafy vegetables (GLV) like amaranth, lettuce spinach, etc.
Roots	Carrot, beetroot, radish, turnip, colocasia, etc.
Legumes- consumed as pods or seeds	French beans, broad beans, pea, etc.
Stems	Asparagus, celery, etc.
Tubers: vegetables which grow on the root of a plant	Potato, yam, artichoke, cassava

NUTRITIONAL IMPORTANCE OF VEGETABLES

As mentioned earlier, vegetables are important source of micronutrients as well as health promoting phytochemicals. However, within vegetables there is marked variation in the type and amount of nutrients present. In general, dark green leafy vegetables (DGLV) and yellow orange vegetables like carrots, and yellow pumpkin have higher content of provitamin A (β -carotene) besides vitamin C, and minerals. Vegetables are poor source of macronutrients exceptions being tubers which are rich in starch (carbohydrates) and leguminous vegetables like beans and peas which are rich in proteins.

NUTRITIVE VALUE OF COMMONLY CONSUMED VEGETABLES

Several reports suggest a decline in nutrient content of vegetables over the years (Worthington, 2001; Davis et al, 2004; McCance and Widdowson, 1940 and subsequent editors, 2002). Multiple factors influence the nutritive value of vegetables:

Moisture and macronutrients

The moisture content of vegetables varies from 59–96 g/100g. Protein varies from <1-7 g/100 g. Values for total lipids vary considerably with analytical method used. This can be a limitation for judging the energy and nutritional significance of vegetables. Vegetables are not an important source of fat. The crude fat content of vegetables varies between 0.08 - 0.40 g/100g. Nutritional importance of plant sterols like sitosterol, campesterol, brassicasterol etc. is now recognised. The most important sterol- cholesterol is not found in plants.

The available carbohydrate content of vegetables including mono, di and digestible polysaccharides varies between 1–32g/100g. Unavailable carbohydrates or fibre content of vegetables varies between 0.1g to 9.9 g/100g.

Micronutrients

While some generalisation in terms of association of some types of vegetables with some micronutrients is possible, the variation of micronutrients even within a species is very wide depending upon the season, soil, stage of ripening and other conditions. Considering the complexity of the task in terms of number of vegetables, nutrients, and regional, seasonal and other variations, a master table of micro-nutrients in vegetables is not practical.

Inorganic constituents

The ash content of vegetables which indicates the mineral content varies between 0.38 – 1.90 g/100g. The range of concentration of minerals and trace elements in vegetables is indicated in Table 2.

Table 2: Minerals and Trace elements in Vegetables

Name of the Mineral	Range (mg/100g)
Sodium (Na)	2 – 90
Potassium (K)	7 – 970
Calcium (Ca)	1 – 261
Phosphorus (P)	11 - 660
Magnesium (Mg)	9 – 447
Iron (Fe)	0.2 - 5.1
Manganese (Mn)	0.1 - 2.6
Zinc (Zn)	0.1 -5.0
Copper (Cu)	0.01 -1.55
Iodine (I)	2 - 3
Selenium (Se)	1 - 10
Chlorine (Cl)	9 - 490

Source: (Gopalan *et al*, 1989, reprinted in 2011).

Vitamins

Many vitamins occur in several active forms called vitamers.

Fat Soluble Vitamins

Vitamin A: As mentioned earlier, vitamin A precursors like β-carotene are present in high quantities in dark green leafy vegetables (DGLV) (discussed later) and yellow orange vegetables and fruits like carrots, yellow pumpkin, mangoes, and papaya. Table 3 lists the β-carotene content of some of the yellow orange vegetables and fruits from India which are rich in provitamin A. (Gopalan *et al* 1989, reprinted 2011).

Vitamin D: Plants from the Solanaceae family like brinjal, tomato leaves are rich sources of this vitamin.

Vitamin E: Vitamin E is present in high concentrations in vegetable oils and cereals.

Vitamin K: Vitamin K is widely distributed in plant foods.

Water Soluble Vitamins

Thiamine (B1): Though un-milled cereals and pulses are rich sources of thiamine, vegetables also contribute a small quantity of thiamine. The thiamine content of most vegetables is less than 0.1 mg/100g.

Table 3. Commonly Consumed Vegetables and Fruits Other Than GLV that are rich in β Carotene

Sr. no.	Name of the Foodstuff	β Carotene µg/100 g
1	Carrot (*Daucuscarota*)	6,460
2	Sweet Potato (Yellow) *(Ipomoesbatatas)*	1,810
3	Yellow Pumpkin (*Cucurbita maxima*)	1,160
4	Chillies, green (*Capsicum annuum)*	1,007
5	Mango, ripe (*Magniferaindica*)	1,990

Source: (Gopalan et al 1989, reprinted 2011).

Riboflavin (B2): Riboflavin content of most vegetables except some GLV and mushrooms is also less than 0.1mg/100g

Niacin(B3): Niacin content of most vegetables except some GLV and mushrooms is less than 0.5mg/100g.

Pantothenic acid (B12): Pantothenic acid in vegetables is in the range of 0.05 – 2 mg/100g

Pyridoxine (B6): The total pyridoxine content in vegetables is in the range of 0.01-0.93mg/100g

Biotin: Biotin content in vegetables ranges from 0.1-65 mg/100g.

Folic acid: Folic acid in vegetables ranges from 5-370 mg/100g.

Ascorbic acid (Vitamin C: Vegetables, particularly GLV, are an important source of vitamin C. The richest sources of vitamin C are however fruits like Indian gooseberry (amla, *Emblica officinalis*) (600 mg/100g), guava (*Psidium guajava*) (200 mg/100g), and citrus fruits like lime (*Citrus orantifolia)* (63 mg/100g), etc. (Gopalan *et al.* 1989, reprinted, 2011).

Importance of Dark Green leafy vegetables (DGLV)

DGLV are an important source of micronutrients, particularly provitaminA, vitamin C, folic acid iron, calcium and zinc in Indian diets (Tables 4 and 5). (Gopalanet al, 1989, reprinted 2011). These values are approximate, and do not take into consideration regional differences due to climatic and soil conditions. Bioavailablity can also show marked variations between species and within species, depending upon handling, cooking, and presence of inhibitors and promoters.

Table 4. Vitamins in Commonly Consumed GLV in India (values per 100 g).

Name of the Foodstuff (Local / Botanical Name)	β carotene µg / 100 g	B1 mg	B2 mg	B6 mg	Folates µg	C mg
Agathi *(Sesbania grandiflora)*	15,440	0.21	0.09	1.2	-	169
Amaranth *(AmaranthusCaudatus)*	8,340	0.03	0.3	1.2	149	99
Ambat chukka *(Rumexvesicarius)*	2,800	0.03	0.06	0.2	125	12
Beet Greens *(Beta vulgaris)*	5,862	0.26	0.56	3.3	15	70
Cabbage *(Brassica oleraceavar.capitata)*	120	0.06	0.09	0.4	23	124
Celery leaves *(Apiumgraveolens var. dulce)*	3,990	0.02	0.11	1.2	36	62
Colocasia leaves *(Colocasia anti-quorum)*	5,920	0.06	0.45	1.9	126	63
Coriander leaves *(Coriandrumsativum)*	4,800	0.05	0.06	0.8	62	135
Drum Stick leaves *(Moringaoleifera)*	19,690	0.06	0.05	0.8	40	220
Fenugreek leaves *(Trigonellafoenumgraecum)*	9,100	0.04	0.31	0.8	-	52
Gogu *(Hibiscus cannabinus)*	6,970	0.07	0.39	1.1	-	20
Knol-Knol Greens *(brassica oleracea var. caulorapa)*	4,146	0.25	0.10	3	194	157
Lettuce *(Lactucasativa)*	1,100	0.09	0.13	0.5	38	10
Basella *(Basellarubra)*	2,840	0.03	0.16	0.5	-	87
Mint *(Menthaspicata)*	5,480	0.05	0.26	1	114	27
Mustard leaves *(Brassica campestris var. sarason)*	2,622	0.03	0.11	0.80	187	33
Ponnanganni *(Alternatherasessilis)*	1,926	0	0.14	1.2	-	17
Spinach *(Spinaciaoleracea)*	2,740	0.03	0.26	0.5	123	28

Source: Gopalan et al., 1989, reprinted, 2011.

Table 5. Minerals in Commonly Consumed Green Leafy Vegetables in India

Name of the Foodstuff (Local / Botanical Name)	Ca	P	Fe	Mg	Na	K	Cu	Mn	Mo	Zn	Cr
	(mg/100g)						(µg/100g)				
Agathi (*Sesbania grandiflora*)	1130	80	3.9	-	-	-	-	-	-	-	-
Amaranth (*AmaranthusCaudatus*)	200	40	2.32	122.1	230	341	78	365	130	178	6.9
Ambat chukka (*Rumexvesicarius*)	63	17	0.75	123.7	-	-	42	403		271	6.1
Beet Greens (*Beta vulgaris*)	380	30	16.2	70	226	762	75	321	-	380	-
Cabbage (*Brassica oleraceavar. capitata*)	39	44	0.8	31.7	18	170	22	183	78	298	4.7
Celery leaves (*Apiumgraveolens var. dulce*)	230	140	6.3	52	35.5	210	10	100	-	130	-
Colocasia leaves (*Colocasia anti-quorum*)	460	125	0.98	32.8	3	648	184	-	-	410	11.4
Coriander leaves (*Coriandrumsativum*)	184	71	1.42	31.4	58.3	256	141	497	1120	323	13.5
Drum Stick leaves (*Moringaoleifera*)	440	70	0.85	41.7	9	259	69	375	-	163	9.5
Fenugreek leaves (*Trigonellafoenumgraecum*)	395	51	1.93	33.8	76.1	31	96	229	400	358	5.8
Gogu	172	40	2.28	66.1	-	-	84	298	-	272	5.2
Knol-Knol Greens (*brassica oleracea var. caulorapa*)	740	50	13.3	31	40	296	10	100	ND	190	-
Lettuce (*Lactucasativa*)	50	28	2.4	30	58	33	80	300	1.3	180	6.7

Source: Gopalan *et al.*, 1989 (reprinted 2011).

NUTRITIVE VALUE OF LESS FAMILIAR VEGETABLES

Studies from India, China, and Africa show that indigenous wild growing vegetables are rich in micronutrients. They are better acclimatised to natural conditions and hence easier to grow; are pest resistant, and acceptable by the local populations.

Bhaskarachary *et al*, (1995) found that the carotenoid profile and content of GLV growing in the wild is similar or higher than the cultivated GLV (Table 6).

Table 6. β-Carotene Content of Some Less Familiar GLV

Foodstuff Local/Botanical name	*β-carotene (μg/100g)*
Botlabenda (*Abutilon indicum*)	12600
Chennangiaku (*Cassia sp*)	*11900*
Yerramolakakura (*Amaranthussp*)	11900
Mullathotakura (*Amaranthusspinosus*)	10900
Tulasi (*Ocimum sanctum*)	8150
Betel leaf (*Piper beetle*)	5900
Ponnagantikura (*Alternantherasesselis*)	5700
Tummikura (*Leucasaspera*)	4100
Uttareni (*Achyranthesaspera*)	4300
Chitramulam (*Plumbagozeylanica*)	3900

A remarkable inventory of local greens from Zahirabad district of Andhra Pradesh, (now Telangana State) was made by the Deccan Development Society, India, during a Netherlands-supported and FAO-coordinated project on the Andhra Pradesh Farmer Managed Ground Water Systems (APFMGWS) Project. While the local farmers had rich knowledge of the health benefits of these greens for specific ailments, their nutritional understanding was poor (APFMGWS, 2003). Several traditional vegetables grown by tribals of Rajasthan had exceptionally high values of iron and β-carotene , the highest iron being in Cassia tora (32 mg/100 g) and β-carotene in drumstick leaves (6700 μg/100 g) (Sankhala et al.,2005). High nutrient content in some locally grown and wild vegetables from Himachal Pradesh (Kalia *et al*, 2007) and Meghalaya (Seal, 2011) has been reported.

EFFECT OFPROCESSING ON NUTRIENTS IN VEGETABLES

Effects of Storage and Primary Processing

Processes like controlled atmosphere (CA) storage result in little loss of nutrients. Cutting, soaking, and peeling vegetables before washing can lead to loss of nutrients. Nutrients like vitamin C, folic acid, and other B-vitamins in vegetables are concentrated beneath the skin. Heating fruits or vegetables briefly with steam or water (blanching) helps to preserve colour, flavour, texture, and nutrient content during subsequent processing, by inactivating enzymes that could cause spoilage. Nutrient losses during freezing are minimal. Sometimes, fruits and vegetables frozen soon after harvesting have better quality than the so called market fresh produce.

Box 1. Nutritive values of vegetables harvested from AVRDC indigenous vegetable display garden, world vegetables centre

Vegetables with high Beta carotene content (> 8000 µg /100 g)
Leaves of penghu senna (*Cassia sophera*), jute mallow (*Corchorus olitorius*), Sickle senna (*Cassia tora*), mugwort (*Artemisia indica*), Chinese mallow (*Malva verticillata*), and butterfly pea (*Clitoria ternatea*).
Vegetables with high vitamin E content. (> 5.9 mg/100 g)
Penghu senna, rue (*Ruta graveolens*), star gooseberry (*Sauropus androgynus*), ivy gourd fruit (*Coccinia grandis*) and daylily (*Hemerocallis fulva*) are rich in vitamin E (>5.9 mg).
Vegetables with high vitamin C content (>220mg/100g)
Coffee senna (*Cassia occidentalis*), penghusenna, rocket salad (*Eruca spp.*) and rue.
Vegetables with high iron content, (>4mg/100g)
Young leaves of Chinese mallow (9.4 mg) and water dropwort stem (*Oenanthe javanica*) (4.2mg). These indigenous plant species like penghu senna, rue (*Ruta graveolens*), star gooseberry (*Sauropus androgynus*), ivy gourd fruit (*Coccinia grandis*) and daylily (*Hemerocallis fulva*) are rich in vitamin E (>5.9 mg).

Box 2. Vegetables with high anti-oxidant content, harvested from AVRDC indigenous vegetable display garden Species with highest antioxidant activities.

Scientific name	*Common name (part)*
Cedrela sinensis	Chinese cedar (leaf)
Rosmaninus officinalis	*Rosemary (leaf)*
Oroxylum indicum	Tree of Damocles (shoot)
Cassia tora	Sickle senna (leaf)
Cassia siamea	Cassod tree (shoot)
Amaranthus spp.	Amaranth (plant)

Some loss of vitamin C and provitamin A occurs during dehydration. Canning is done by heating food in a closed container to destroy the microorganisms in raw food. Water-soluble nutrients may dissolve in the water in the can, but are not lost unless the water is discarded. Cans should be stored in cool place.

Effect of Cooking

Gentlecooking (steaming, microwave cooking) improves palatability, adds flavours, destroys harmful micro-organisms, and increases digestibility, particularly of starchy foods. Cooking swells starch and bursts cell walls. This facilitates digestion by increasing access to digestive enzymes. Trypsin inhibitor in legumes is destroyed during cooking. Some loss of vitamins

particularly provitamin A, vitamin C and B- vitamins like thiamine and folic acid occurs during cooking, but this trades off with other health-promotive changes in food such as better digestibility and the conversion of nutrients into forms that are more easily digested. Bioavailability of β- carotene from vegetables increases with cooking with the addition of little oil (stir frying). If vegetables are boiled with excess water, that water should be used for making *dal*, dough etc to avoid loss of nutrients.. Addition of cooking soda (sodium bicarbonate) preserves the colour of vegetables, but causes loss of thiamine and vitamin C. Vitamin C is lost if cooked vegetables are exposed to air and light before serving. Loss of food folate during cooking can be substantial. Bioavailability of β- carotene from yellow –orange fruits and vegetables and DGLV increases with cooking/ heat treatment (Rock et al 1998,Veda et al, 2010.)13,14. Addition of food acidulants like tamarind (*Tamarindus indica*) and citric acid and antioxidant spices like turmeric (*Curcuma longa*) and onion (*Allium cepa*) protectsβ carotene during heat treatment (*Gayathri et al,* 2004).

BIOAVAILABILITY/BIOACCESSIBILITY OF NUTRIENTS FROM VEGETABLES

Bioavailability is the proportion of a nutrient that is absorbed from the diet and used for normal body functions (Agget, 2010). Bioavailablity is influenced by internal and external factors. The former include food matrix, chemical form of the nutrient, the method of processing/ cooking, presence of inhibitors of absorption like fibre, phytate, polyphenols, etc. and promoters such as the presence of other micronutrients that may produce competitive inhibition of absorption. Internal factors are gender, age, nutritional status (deficiency), and physiological status (pregnancy) (Agget, 2010). Bioavailability increases during conditions of increased demand like nutrient deficiency, (iron, zinc, vitamin A), and pregnancy. The issue of bioavailability is particularly relevant to fat-soluble vitamins like provitamin A (β-carotene, and other carotenes with provitaminA activity) and minerals like iron and zinc.

In vivo studies in animals and humans that may give better estimate of bioavailability are not easy to carry out. Hence, in vitro bio-accessibility using simulated conditions for intestinal digestion and absorption, (digestive enzymes and equilibrium dialysis or use of Caco-2 cells) are used to derive estimates.

Bioavailability of Provitamin A Carotenoids

Bioavailability of carotenoids is the fraction of ingested carotenoid utilised for normal physiological functions or storage. Bioconversion is the proportion of bioavailable carotenoid converted to retinol (vitamin A). The mnemonic SLAMENGHI describes the factors influencing carotenoid bioavailability and bioconversion. These are: Species of carotenoid; Molecular linkage; Amount of carotenoids consumed in a meal; Matrix in which the carotenoid is incorporated; Effectors of absorption and bioconversion; Nutrient status of the host; Genetic factors; Host-related factors; and Mathematical interactions (West *et al*, 1998). Among these, the matrix in which the carotenoids are incorporated plays an important role. Better bioavailablity of β-carotene from yellow orange fruits and vegetables than from DGLV may be due to this factor. The cell wall structure of fruits is weaker than that of GLV. Besides, the carotenoids in fruits are contained in the oil droplets of chromoplast and are hence, perhaps, more easily extractable during digestion.

In human subjects, carotenoid bioavailability can be measured by monitoring the increase in plasma vitamin A after feeding a test meal containing carotenoid. A more accurate method involves feeding plant foods intrinsically labelled with stable isotopes (Burri and Clifford, 2004). However, due to practical constraints and expenditure, *in vitro* methods for assessing bioaccessibility are more commonly used.

In vitro bio-accesibility shows wide variation between different carotenoids in a food, and between different foods for a given carotenoid. Even though in vitro bio-accesibility may not reflect the true *in vivo* bioavailability, it provides relevant information for food industries and for food-based dietary guidelines.

Commonly used ingredients in Indian cooking (food acidulants) like 'amchur' (dry mango powder), lime (citrus juice), tamarind (*Tamarindus indica*), and kokum (*Garcinia indica*) and spices like turmeric (*Curcuma indica*), onion (*Allium cepa*), improve bio-accesibility of β-carotene from vegetables (Veda *et al*, 2008). However, tamarind with high tannin content inhibits iron absorption.

Conversion ratio for Bioconversion of β-carotene to Vitamin A

Most of the dietaryβ-caroteneis converted to vitaminA in the intestine by the enzyme carotene oxygenase. While in rodents this conversion is almost complete in the intestine, in other species including humans some unconverted precursor does get absorbed and is either stored in the liver or converted to vitamin A in the liver. Structurally speaking, one molecule of β-carotene should yield two molecules of vitamin A. But during conversion, there is 50% or more loss of vitamin A. Some more and variable loss occurs during digestion and absorption. This has resulted in controversy regarding the factor to be used for vitamin A equivalent of β-carotene.

Some studies have shown very low conversion, particularly from vegetables, raising doubts regarding vegetables as source of β- carotene. However, many studies from India and other countries have shown that a conversion ratio of 6-8 is reasonable, and vegetables are a good source of vitamin A (Thurnham, 2007). The most recent recommendation of the Indian Council of Medical Research (ICMR) is conversion efficiency ratio of 8:1 (ICMR, 2010). *In vivo* (rat and children) and *in vitro* studies show that the bioconversion efficiency improves in vitamin A deficiency but is affected in protein deficiency (Parvin *et al.*, 2000, Parvin and Sivakumar 2000).

Bioavailability of Water Soluble Vitamins

Riboflavin in milk and eggs occurs mostly as free riboflavin, bound to specific proteins, whereas in plants it is mostly in the form of its coenzymes FMN and FAD. The two forms are absorbed equally well.

Bioavailability of Vitamin B6 from plant foods is reduced by fibre (5-10%) and pyridoxine glucoside (75–80%). This glucoside is found in many plant foods, with highest content present in crucifers (Reynolds, 1988).

Bioavailability of oxidised synthetic folic acid is better than the reduced forms of folate polyglutamate present in plant foods (Ohrvik and Witthoft, 2011).

Estimates of bioavailability of folate from composite diets based on human studies have varied from 10% to 98%. Several factors influence bioavailability of food folate (Mcnutty and Pentieva, 2004). Almost two thirds of dietary folate, mostly derived from vegetables is in polyglutamyl form. Folate polyglutamates have to be hydrolysed to monoglutamates for absorption in the intestine by the enzyme glutamate carboxypeptidase II (GCPII) whose optimum pH is 6–7. Acidic foods that reduce the pH of the intestine can reduce the activity of this enzyme and hence bioavailability of food folate. Folate binding proteins and antioxidants like ascorbic acid improve the stability of folic acid during processing and digestion.

Ascorbic acid (vitamin C) is absorbed both by active transport and passive diffusion. The former is the major mechanism at low levels of dietary intake, and later at high intake since active transport gets saturated. Bioavailability of natural and synthetic ascorbic acid are similar.

Bioavailability of Minerals and Trace Elements.

High content of inhibitors like phytate and polyphenols affect the bioavailability of minerals, particularly iron, from plant foods.The haeme form of iron present in animal foods is better absorbed. Presence of inhibitors like oxalate, phytate, and fibre affect the bioavailability of calcium from plant foods. In general, vegetables that are rich in calcium are also rich in oxalate.

The nutritive value of a vegetable has to be judged not just on the basis of the content of specific nutrient, but also inhibitors, promoters and other factors that determine the bioavailability. Agronomic and biotechnological approaches should be tried to reduce the content of inhibitors and increase promoters, besides increasing the content of nutrients.

Promotive Effect of Vegetables on Bioaccessibility of Iron and Zinc from Food Grains.

Vitamin C and other organic acids are known to promote iron absorption from diet (*Hemalatha et al* 2005). Vitamin A and β-carotene have also been reported to enhance iron absorption (Garcia - *Casal et al* 1998). Studies from India and China show promotive effect of vegetables rich in vitamin C and β-carotene on bioaccessibility of iron and zinc from food grains using the simulated gastrointestinal digestion procedure involving equilibrium dialysis. (*Gautam et al* 2011; Luo andXie 2012).

Uptake of ferrous fumarate by Caco-2 cells was enhanced with β-carotene, which also overcame the inhibitory effects of phytate and tannic acid – known inhibitors of iron uptake. β carotene facilitates the absorption of non-haeme iron, by forming a soluble complex in the intestinal lumen and preventing the inhibitory effect of phytates and polyphenols.(Garcia-Casal *et al*, 2000). These observations show that in developing countries where deficiencies of iron and zinc

are rampant, such culinary strategies, coupled with homestead production of promotive vegetables, can be nutritionally helpful.

EFFECT OF ORGANIC FARMING ON NUTRIENT CONTENT OF VEGETABLES.

Organic farming systems rely on crop rotation, organic manure and fertilisers, weeding, and biological pest control. There is a general belief that plants grown organically are more nutritious and healthy. However, the health claim of the label 'organic' is not proven. At best it's a process claim. Nutritional quality of foods is determined by healthful and harmful substances contained in the foods. Organic label may have a psychological effect of goodness. To examine the effects of substances present in plant foods grown organically versus those grown conventionally, some animal studies have been done, but long-term nutritional experiments in humans are lacking.

Opinion regarding nutritional quality of organically versus conventionally grown vegetables as determined by chemical analysis of nutrients, other health promoting phyto-chemicals and undesirable substances, is divided. Organically grown vegetables may have lower content of undesirable constituents like nitrates, and pesticide residues, and slightly higher content of vitamin C. The differences in the contents of other nutrients if any are small and unlikely to be of nutritional significance at least in developed countries where the diets are wholesome and micronutrient deficiencies rare (Kopke, 2003; Bourne and Prescott, 2002,). Organic farming tends to give lower yields and that would offset the little advantage, if any. In a recent publication, Singh and Ryan have brought out the advantages of judicious use of fertilisers for soil health. Saving on chemical fertilisers and pesticides may have some environmental and economic advantage. For sustainable farming there has to be judicious use of organic and chemical fertilisers and integrated pest management.

BIOTECHNOLOGY FOR ENHANCING NUTRIENT CONTENT AND REDUCING ANTI-NUTRITIONAL FACTORS.

Nutritional value of vegetables can be enhanced by increasing the nutrient content (biofortification) as well as reducing anti-nutrients.

Strategies for increasing access to micronutrients include: pharmaceutical supplementation, food fortification, biofortification and dietary diversification through production and consumption of micronutrient-rich foods. Each of these has a place and it's not the case of either/or but all strategies to be used appropriately to ensure best results.

Biofortification

Crops can be enriched with specific nutrients (biofortified) using biotechnology-conventional breeding, marker driven molecular breeding or genetic engineering. The first two approaches are possible where there is natural resource of micronutrient-rich varieties – high iron, zinc, β carotene, etc. Such well-endowed varieties are crossed with cultivated varieties, preferably high-yielding varieties. Since such selective breeding does not involve transferring genes across species, it is less controversial. However, where

such biodiversity within a species is not available, genetic engineering of transferring genes has to be resorted to.

One of the biggest international programmes for biofortification is the Harvest Plus programme launched in 2004 with funding from Bill and Melinda Gates Foundation, and other donors. The current focus of this programme is enhancing the levels of iron, zinc, and β-carotene in seven staple crops grown in areas of subsistence farming. These are sweet potato, bean, pearl millet, cassava, maize, rice, and wheat. Research on biofortification is going on in Brazil, China, India and other countries. In India, the Harvest Plus programme includes, rice, wheat, maize, and pearl millet, using conventional breeding methods. Orange fleshed sweet potato varieties are currently available in African and Indian subcontinent.

In genetic engineering, genes are transferred within or across species, preferably edible plants, using gene splicing technology. Genetically Modified (GM) crops have faced opposition from activist groups, particularly if gene transfer occurs across species.

AsisDatta and his colleagues in India have developed a high protein potato by transferring the AmA1(Amaranth Albumin1) gene from Grain Amaranthus, an edible plant, to potato – a carbohydrate-rich, protein-deficient food crop. Apart from 60% higher protein, the protein quality in terms of content of the essential amino acids like lysine, tryptophan, and sulphur-containing amino acids was also improved (Datta 2012). The bio-safety assessment of transgenic potatoes suggested that they are safe for human consumption. The transgenic potatoes with more than one attribute await commercial cultivation.

Folate-rich tomatoes (Diaz de la Garza *et al.*, 2007) and lettuce, iron-rich lettuce (Goto *et al.*, 2000) have also been developed through genetic engineering but not commercialised. The subject of transgenic vegetable breeding for nutritional quality and health benefits has been reviewed (Dias, 2012).

Reducing Anti- Nutritional Factors and Enhancing Tolerance to Biotic Stress

Genetic engineering can be used to reduce anti-nutritional factors like oxalic acid in vegetables like tomatoes and spinach. Oxalic acid promotes kidney stones by chelating with calcium to form calcium oxalate.

Datta and colleagues have reduced the oxalic acid content of tomato by cloning the gene for the *oxalate-degrading* enzyme oxalate decarboxylase (OXDC), from *Flammulina velutipes* and expressing it in tomato and tobacco. This genetic manipulation also conferred improved resistance to infection by S. sclerotiorum (Datta, 2012).

Genetic engineering has been tried to reduce post-harvest losses of fruits and vegetables which can be as high as 50% in countries like India.

HEALTH PROMOTIVE PHYTOCHEMICALS IN VEGETABLES.

Phytochemicals are chemicals in plants, which have health promoting properties. They are distinct from nutrients, though some nutrients like vitamin C, E, β-carotene, and zinc also function as health promoting phytochemicals besides their known functions as nutrients. Numerous studies have suggested that these health-promoting phytochemicals protect against degenerative diseases like cardiovascular diseases, cancer, and even other degenerative diseases like cataract. Many of them function as antioxidants. Oxidant stress is etio-pathologically related to degenerative diseases. The importance of dietary antioxidants and their health benefits have been briefly reviewed (Khan and Giridhar, 2011). Phytochemicals can also function as immune stimulants and detoxifying agents. High concentrations of some of these chemicals may behave as drugs and may be even toxic (Bamji and Bhaskarachari, 2015).Some of the important phytochemicals, their source and functions are described in Table 7.

Table 7. Some health promotive phytochemicals, their sources and functions

Phytochemical	Source	Functions
Polyphenols. Flavonoids Important members- resveratrol, quercetin, catechin	Celery, cranberries, onions, broccoli, apples, cherries, berries, tea, red wine, purple grape juice, parsley, soybeans, egg plant (brinjal), tomato and thyme.	Animal studies: Suppress tumour growth, prevent blood clots, interfere with sexual hormones, anti-inflammatory properties. Powerful antioxidants.
Phytoestrogens Isoflavones Lignan	Soya, soy products Fibre layers of whole grains, berries, some seeds and some vegetables & fruits	Act like female hormone oestrogen Estrogenic properties. Anti-cancer activity shown in animals
Isothiocyanates and related substances, indoles	Cruciferous vegetables. Responsible for the sharp taste of vegetables and mustard oil.	Stimulate enzymes that convert estrogens to a more benign form. May block steroid hormones that promote breast and prostate cancer. Cruciferous vegetables are also high in vitamin C, selenium, and fibre.
Monoterpenes Perillyl alcohol Limonene	Peels of citrus fruits	Block proteins that stimulate cell growth and reproduction. Being tested for actions against cancer
Organosulfur compounds, Allicin	Allium family of vegetables	May benefit immune system, detoxification of carcinogens in liver, reduces cholesterol production in the liver.
Capsaicin	Red peppers	Reduce substance P, a compound that contributes to inflammation and delivery of pain impulses from the central nervous system. May be anti-carcinogenic
Carotenoids Beta-carotene, lutein,Lycopene	Green leafy veg, yellow, orange fruits & vegetables. Tomatoes	Free radical scavengers. Reduces risk of certain types of cancers

Source: Health guide, 2012, NY Times.

CONCLUSION

Vegetables, particularly dark green leafy vegetables, are an important part of the human diet. They are rich in micronutrients, fibre, and health promoting phytochemicals which protect against chronic diseases. Nutritionists recommend five servings of vegetables and fruits daily for health and nutritional wellbeing. Homestead production of vegetables and fruits can improve access to vegetables and fruits at affordable cost, and ensure household nutrition security. Nutrition communication for bringing about behavioural change, and promoting consumption of nutrient-dense vegetables is an important responsibility of nutritionists.

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REVIEW PAPER *Research Reach J.H. Sci. Vol. 14. No 1, 23 - 34*

NEW FRONTIERS IN CHEMICAL PROCESSING OF TEXTILES

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Research in the field of textiles has emerged with greater benefits to the society apart from the traditional use of clothing. Lot of innovative textiles are coming up with variety of uses in the development of newer products such as face masks, building materials and so on (https://www.ic.gc.ca/eic/site/textiles-textiles.nsf/eng/tx03247.html).

Over the past five decades, the textile industry has witnessed unexpected growth in newer fibres (particularly synthetic fibres), spectacular developments in machine engineering, coupled with large scale applications of electronics and information technology. Fibre and textile processing facilities have also undergone enormous improvements in automation and simplification. Micro fibres and nano fibres have become the order of the day. The benefits of nano technology are made use of in up gradation of chemical finishes.

Chemical processing of textiles is unique and presents its own set of challenges and opportunities. Currently, textile wet processing adopts aqueous eco-friendly routes, following the principles of green chemistry. Awareness and monitoring of carbon footprint is of paramount importance in today's context. Further, newer tools which are slowly creeping into these textile technologies and which are also being successfully used are manipulation with laser, radio waves drying tools, plasma bonding techniques, Ionic liquids for solvent effects, ultrasonic treatments, supercritical fluids and enzymatic treatments. All these technologies are making inroads to achieve more sustainable processing.

Specialty chemicals play a significant role in the production of fibres and textiles. Awareness of chemical reactions, polymer sciences and understanding complex biochemical reactions have resulted in what we see a dramatic shift in the minds of a processor. "Specialty chemicals can be defined as a group of relatively high value low volume chemicals known for their end use applications and/ or performance enhancing properties" (Kadakia, Nigam and Singhai, 2008).

SUSTAINABLE FIBRES

Naturally available fibres can be classified into two types, namely animal fibres (protein) and plant fibres (cellulose). The animal fibres are those obtained from the fur of animals and includes wool, cashmere, and alpaca. Silk, although it is a fibre produced by the larvae of the silkworm, is also considered a protein fibre. Plant fibres may be sourced from the seed (cotton), husk, leaves, or stems (flax, hemp) of various plants. The addition of chemicals to these natural fibres in order to produce a new range of fibres with improved properties results in what is termed as 'regenerated fibres', the filaments of which are then used to spin a fibre.

Regenerated fibres that use cellulose as its base include Viscose and Rayon. Newer fibres such as Tencel were developed using processes and chemicals that were less harmful to the

environment as compared to Viscose and Rayon. Its production involves the use of a wet method where the cellulose is dissolved in a suitable solvent. This maintains the integrity of the cellulosic fibre in as close as possible to its natural form. The technique uses a closed-loop system that allows only small quantities of toxic waste material into the environment and the raw material (fibre) is obtained from forests certified by the Forest Stewardship Council (FSC).

Regenerated fibres using proteins as their base such as soya, corn, peanuts and even milk, are termed as Azlons. In the past, these were made using chemicals that were obtained from petroleum. In modern years, raw materials may originate from agricultural produce. Commonly used synthetic fibres include nylon, polyester, acrylic, acetate, olefin, and spandex (www.organicexchange.org).

ENVIRONMENTAL CONCERNS

In order to be considered an environment-friendly, the production of textiles must reduce the amount of water used and released and the amount of chemicals in it. As air pollution caused by these industries has been a concern for long, there is sufficient data on emissions in the atmosphere from each stage of production and processing of textiles. However, water released from various processing techniques often get mixed together resulting in a slush that consists of chemical wastes that differ according to the kind of base material, processing technique, and chemicals used for various finishes (Resitex Project, 2007)

Chemicals give textiles colour and the performance that a consumer demands. Chemicals are not bad, but it depends on how they are used. A safe chemical used incorrectly can be many times polluting than a classified chemical used correctly. "Both natural and man-made fibres contain impurities such as metals, lubricants, and other residues that contribute to pollution in mill effluent" (US-Asia Environmental Partnership). Chemical releases from the textile processing sector is not well quantified. Data on releases, particularly air emissions, are not readily available. Most estimates are based on mass-balance calculations rather than direct measurement. The industry is coming together to develop ways to identify and quantify releases.

COMPARISON OF FIBRES

It is very difficult to evaluate the overall environmental impact of one fibre over another; the information is very difficult to access or applies only to a specific region. Judgments have to be made on how to weigh the different impacts of the source, production and use of the product. The life cycle of a fibre may be assessed by calculating the use of energy in its production, release of CO2 and other gases, use and disposal of water waste, the use of land, creation of a toxic environment and the life of the textile product made as a result and its disposal. (www.organicexchange.org).

Gaseous emissions are usually treated or collected before they are released. However, things are different in the case of liquid emissions as water is used and released from multiple

processes and the wastes are mixed into a common pipe before being released. This results in a complex mixture of chemicals, auxiliaries depending on the stage and type of processing that the water was used for. (Integrated Pollution Prevention and Control, 2003).

The Scottish Environment Protection Agency suggests the use of Best Available Techniques (BAT) to reduce the effect of textile processing on the environment.
"Best available techniques is the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of a particular technique for providing in principle the basis of emission limit values" (Scottish Environment Protection Agency). Techniques include both the technology used and the way in which the installation is designed, maintained, and operated. Thus, BAT technology means in achieving a high general level of environmental protection of the environment as a whole.Best Available Technology can thus support textile processing, policy makers, and the regulators in addressing environmental concerns with the application of abatement strategy, thereby limiting pollutant discharges and improving the environment.

FACTORS TO BE CONSIDERED FOR BEST AVAILABLE TECHNOLOGY

A: General Management Practices

The European IPCC Bureau suggests that efficient training of staff and the creation of standard operating procedures for the maintenance of equipment, storage, handling and dosing of chemicals are effective management practices. It is vital for good management to update knowledge about the inputs and outputs of the process which can involve the use of chemicals, energy, water, wastes (solid, liquid, and gaseous). (The European IPPC Bureau, 2003).

The inputs and outputs in the processing unit must be supervised in order to gauge and enhance an environment-friendly and economic performance. (EcoSMEs.net).
The recipe of the chemical mixes used in the processing, production schedule, quality of material, etc. must be regularly updated. Automation in the control of temperature, input of chemicals, concentration of liquor, etc., helps in better control and reduces the need for wasting chemicals on trials of processes. Automation and improving operations to increase efficiency also helps to reduce the use of water in textile processing. The reduction in the liquor ratio, improvement in washing efficiency, combining of procedures (e.g. scouring and desizing) and the reuse of treated water can all help reduce water and energy (for heating) utlisation in the industry. Improved technology in heat-insulation pipes, valves, tanks and machines, recovery of heat from used water can improve energy efficiency of the process (EcoSMEs.net).

B: Quality Management of Incoming Fibre

Detailed information from suppliers regarding the raw material procured will also help in the reduction of pollution. Information regarding not only the characteristics of the raw material but also the type and amount of chemicals, sizing agents, metals, residual monomers and

biocides (such as ectoparasiticides in wool) must be available. With this information, one can choose processing techniques that can reduce the negative impact of the processing on the environment at the beginning of the processing (The European IPPC Bureau, 2003).

C: Dosing and dispensing of chemicals (excluding dyes)

BAT includes automated systems in the production and mixing of chemicals and auxiliaries in the processing without the need for human involvement (Portela, 2011).

D: Selection and use of chemicals

While using BAT, processing units need to follow standard principals in the choice and utlisation of chemicals. If possible, the avoidance of chemical use is preferable. However, if the use of chemicals is unavoidable, methods that reduce the risk of the chemical use on the environment must be preferred. Chemicals are normally classified into different lists, and this may be used to select the most efficient and least harmful one (Portela, 2011).

E: Selection of incoming fibre raw material

As mentioned earlier, detailed information on the quality and quantity of chemicals used in the treatment of raw materials is essential to help industries choose the least-harmful treatment and processing technique. The European IPPC Bureau suggests that production units must co-ordinate and collaborate with other companies in the chain of production to encourage environmental responsibility in other partners in the chain. The BAT can vary according to the material used. Production units must choose methods that have the least emission and biodegradable/bio eliminable agents. According to the IPPC, "All measures assume that the fibre raw materials for textile processing are produced with some sort of quality assurance scheme, so that the finisher can get the appropriate information about the types and amounts of contaminants." (The European IPPC Bureau).

Water and Energy Management

Water and energy savings are often related in the textile industry because the main use of energy is to heat up the process baths. BAT starts from the monitoring of water and energy consumption in the various processes along with improved control of process parameters. "BAT includes the use of machinery with reduced liquor ratio in batch processing and low add-on techniques in continuous processing, applying the latest techniques to improve washing efficiency.BAT is also to investigate possibilities for water re-use and recycling by a systematic characterisation of quality and volume of the various process streams." (Ecolabel training guidelines, 2004). While using BAT, processing units need to follow standard principals in the choice and utlisation of chemicals. If possible, the avoidance of chemical use is preferable. However, if the use of chemicals is unavoidable, methods that reduce the risk of the chemical use on the environment must be preferred. Chemicals are normally classified into different lists, and this may be used to select the most efficient and least harmful one (Portela, 2011).

CLEAN TECHNOLOGIES

The term "clean technologies" is defined as "a manufacturing processes or product technologies that reduce pollution or waste, energy use, or material use in comparison to the technologies that they replace" (cited by Proctor, 2011). Some of the clean technologies include:

- Pad-batch dyeing
- Low bath ratio dyeing
- Low salt/high fixation dyeing
- Dye bath reuse
- Continuous dyeing for knits
- Automated color mix kitchen
- Automated chemical dosing
- Transfer printing
- Laser engraving of printing screens
- Surfactant substitution
- Recovery of synthetic sizes
- Countercurrent washing
- Low add-on finishing

MECHANICAL FINISHING

Water foot print

A cotton T-shirt weighing 250 grams before it reaches the hands of a consumer passes through a number of intermediate processes and products and consumes approximately 2700 liters of water. Cotton is processed into lint and normally 350 kgs of lint is obtained out of 1000 kgs of seed cotton. 1000 Kgs of lint fabric produces 900 kgs of grey fabric which under goes wet processing. Cotton being hydrophilic consumes 30 m3 per ton for bleaching, 140 m3 per ton for dyeing and 190 m3 per ton for printing. The average water footprint of printed cotton (for example a pair of jeans weighing 1 kilogram) is 11000 liters per kilogram.

Carbon Foot Print

Carbon credits are generated by enterprises in the developing world that shift to cleaner technologies and thereby save on energy consumption, consequently reducing their greenhouse gas emissions. For each ton of carbon dioxide (the major GHG) emission avoided, the entity can get a carbon emission certificate which they can sell either immediately or through a futures market, just like any other commodity. The certificates are sold to entities in rich countries, like power utilities, which have emission reduction targets to achieve and find it cheaper to buy 'offsetting' certificates rather than do a clean-up in their own backyard. This trade is carried out under an UN-mandated international convention on climate change to help rich countries reduce their emissions as are required to meet certain norms. **Other greenhouse gases that originate from industrial and agricultural processes are** Methane, Nitrous oxide, Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) Sulphur hexafluoride (SF6). As these gases accumulate, they absorb infrared radiation in the atmosphere, thus

changing the dynamic balance between the energy received from the sun and the energy escaping. The net result of these changes is a rise in temperature. Human activity impacts the environment in two ways - directly through processes that burn fossil fuels and indirectly through the products that we use. The carbon footprint is therefore, made up of the sum of two parts, the primary footprint and the secondary footprint. The primary footprint is a measure of the direct emissions of carbon dioxide from fossil fuels which includes domestic energy consumption and transportation (e.g. car and plane). The secondary footprint is a measure of the indirect carbon dioxide emissions over the entire lifecycle of the products and emissions associated with their manufacture and eventual breakdown.

Life cycle analysis (LCA)

Environmental issues are playing an increasingly important role in the textile industry, both from the point of view of government regulation and consumer expectations. Textile sector is one of the biggest consumer intensive sectors, but recycling and reclamation practices are not satisfactory. Sustainable processing of textiles means different ways of achieving more technologies as well as improving recycling in the industry. LCA neatly underlines the environmental profile of cotton and synthetic fibre based textiles and how it could be improved. Sustainability can be integrated not only up to processing but till textile designing, ensuring better sustainable production improving processes such as dyeing as well as more environmental friendly processes including enzyme and plasma technologies. LCA is a systematic approach of evaluating the environmental consequences of a textile fabric, its process from cradle to grave by taking snap shots of the entire sequence of operations from cultivation of cotton or manufacture of synthetic fibres to the final product including the waste generated during processing there by estimating the impact of each process. The main objectives include multi disciplinary life cycle assessments covering the entire fibre production and textile product chain, as well as to develop eco efficiency indicators for the different phases in the textile product chain which includes waste minimisation, energy usage and environmental effects of each stage.

The approach to the principle of life cycle analysis in textiles is fast catching up during the past one decade to ensure that time, data processing departments are set up inside the companies.

Energy profile and resource utilisation

Textile industry is one of the most energy consuming industries. Each textile manufacturing process has its own energy requirements according to process. Different types of energy are required in each stage; some processes may require more electricity while others may require more heat. "The thermal energy required per meter of cloth is 4,500-5,500 Kcal and electrical energy required per meter of cloth is 0.45-0.55 kwh. This translates into huge quantities of fossil fuels - both to create energy directly needed to power the mills, produce heat and steam, and power air conditioners, as well as indirectly to create the many chemicals used in production" (O Ecotextiles, 2009).

State-of-the-art dyeing machines and dryers can be insulated for energy-efficiency. Older heated machines can be covered with low-thermal-conductivity coatings, foam, or board materials. Many varieties of materials are available from the chemical industry and have been adapted to textile machines. Many of these materials and coatings also provide corrosion resistance, for longer machine life. Technological advances have enabled efficient and effective application of sprayed on insulating materials to almost any processing equipment or piping system.

This technology has been used for decades in chemical industries of all types and can be applied in many mill applications and with many types of textile-processing equipment. Operating costs typically are decreased by 5% to 10%. Insulation is especially effective with jet and other batch wet-processing machines that operate for long periods at high temperatures.

In addition, textile industry has one of the lowest efficiencies in energy utilisation because it is largely antiquated and researchers are concerned with the development and implementation of new techniques to conserve energy. The minimisation of leaks in the compressed air system, regulation of pressure at the right level, use of alternatives to compressed air, switching off lights when not necessary, use of energy efficient lamps, proper servicing of boilers, operating at correct temperature are some of the general measures which can cut energy cost.

There is hardly any operation in textile processing that can be operated by the use of dyes and water alone. Practically, every colorant system requires the use of auxiliaries / specialty chemicals to ensure its reliable functioning and control. Specialty chemicals for textile processing differentiates between auxiliaries promoted for commercial reasons than that serve a technical need. Specialty chemicals play an important role by improving reproducibility and minimising re processing, there by offering cost savings.

Emerging technologies in textile processing focus on the following:
1. Minimum use of resources (water and energy) by using Best Available Technologies
2. Reducing chemical consumption
3. No or low pollution load
4. Elimination of harmful and toxic chemicals.

Man-made celluloses deserve a special treatment, as the regenerated cellulosics are here to stay. The xanthate process yields the viscose rayon, both in the staple and the filament form; this sector is undergoing lot of transformation with fresh capital being injected and a totally global approach to all the environment issues. Here, technologies are constantly being upgraded to give desirable features in the various fibres produced. A brand new technology which has made inroads in this area of regenerated cellulosics is the dissolution of cellulose ionic liquids and subsequent regeneration, a fabulous claim on the properties of solvents.

Role of specialty chemicals

Specialty chemicals play a very important role in textile processing. New chemical technologies have played a pivotal role in maintaining the growth of textile chemicals in accordance with legislation on health, safety and environment which is fast emerging. A

niche in this segment is the textile wet processing chemicals that can help lower the cost of textile chemical production effectively. An approach to lower chemical costs is to provide the chemicals in bulk or semi-bulk containers. In this way, the costs for drums and drum disposal are eliminated. Rising quality specifications accompanied by increasing cost pressure makes for a very challenging situation for textile processors and the textile industry as a whole.

There is tremendous pressure to deliver textile auxiliaries at low cost. Continuing the decade old trend of having the strongest growth in the textile industry, the textile chemicals manufacturers have now come up with unique ideas for making the textile chemicals available in the concentrated form there by reducing cost.

Low temperature bleaching

Pretreatment of fabrics in any form whether, yarn, woven fabric or knitted hosiery, is the basic requirement for further textile processing, for whites or dyeing or printing. This pretreatment makes the fabric uniformly absorbent and white and is the basic requirement for successful dyeing and finishing. Special bleach activators have been developed to carry out bleaching at low temperature.

Salt free /high fixation dyeing of reactive dyes

This technology will catch up in the foreseeable future as the pollution norms will only get stricter by the day. Techniques have evolved wherein pigment dyeable substrates are made available for routine processing by these techniques. The charging type – cationiser creates positive charge sites along the polymer body which helps in the virtual "sucking" of the reactive dye species so as to bring them in the close proximity of the fibre without the aid of electrolytes like salt, only to get reacted by the alkaline treatment and subsequent fixation. The cationiser treated textile material, essentially for the cellulosics, does not require salt to push the dye molecules on to the fibres, helping in offering a system wherein salt-free or low salt reactive dye-dyeable systems get activated. The products that are acceptable for this type of treatment are desired to give such effects without any heat-treatments or curing before dyeing.

Ionic liquids

Non-aqueous systems can either reduce or completely eliminate the amount of water used in textile processing. Reducing the amount of water in a textile process provides environmental benefits as well as cost savings. Recent research has shown that ionic liquids have the potential to be used in place of water in some textile processes.

Textile processing is a water intensive sector. On average, an estimated 200 liters of water is needed to process 1kg of textile material. The development of ionic liquids that exhibit useful and unique properties can create huge untapped potential for commercial applications to increase operating efficiencies of many chemical production operation - including the processing of textiles.

Process modifications : Cationic and anionic dyeable fibres

Almost all types of polymers including cellulosics are made cationic-dye dyeable by injecting anionic species in the dopes, this is similar to the acrylic fibre technology wherein some anionically charged co-monomer forms an integral part of the fibre back-bone. Anionic dye dyeable fibres can be obtained by binding certain cationic molecules on the fibre's polymeric. The processing parameters and workability dictates the selection of chemical molecules, some typical type for regenerated cellulosics whereas some other types for hydrophobic synthetic fibres. Nitrogen and quaternary ammonium compounds chemistry play a pivotal role here and success has dawned on quaternary polymeric molecules that do not affect the spinnability characteristics of these polymers. Naturally occurring Chitosan has emerged a forerunner, wherein dosages and stability are being studied and perfected.

Low add-on equipments in dyeing

These types of processing equipments operate with a mechanism to uniformly apply the fabric with a minimum amount of liquid necessary in semi continuous and continuous processing systems are known to be typical examples of energy conservation techniques. Foam finishing is a novel application technique for treating porous substrates with foamed chemicals at low wet pick-ups. It involves the use of a rapidly-breaking low-density foam or froth as the delivery medium for finishing chemicals, precise metering and flow control for delivery of foam to the substrate, pressure-driven impregnation of the foam into the substrate, and an applicator system designed to allow uniform high-speed application and collapse of the foam in a single step. The semi-stable foam is necessary to get spontaneous foam collapse and spreading though the substrate, and is in contrast to stable foams specified in various foam coating processes normally requiring a separate step to break and distribute the foam through the textile material. Foam finishing reduces energy savings anywhere in the range between 30 to 50%.

Low liquor ratio dyeing machines

It is easy to understand that areduction in water use will contribute to significant energy savings in the dyeing processwhich consists of various wet treatment and drying unit operations. It is especially desirable to curb the water consumption because it is linked to the overall water supply cost including that of drainage. For the reduction of the processing bath ratio, it is necessary to investigate the following measures.In general, dyeing and finishing methods are classified into the batch and continuous processing methods and it is recommended to use the latter method where a low bath ratio is desired. However, depending on the details of processing requirements, there are often instances in which the batch method has to be employed. In such cases, batch processing machines which allow lower bath ratios such as the jigger, wince, beam, pad roll and jet flow types should be selected as far as the circumstances permit. It is easy to see that the bath ratio has a direct influence on the production cost. Recently, low bath ratio processing machines which are built in with the above mechanisms have been developed and put on the market.

Automated chemical dosing and color kitchen

Special mention has to be made of the dye bath monitoring system which enables dyers to monitor dye concentration in the dye bath while measuring the temperature, pH, and conductivity of the dye bath simultaneously. Automation of color kitchen can result in a better control of the processes. A good color kitchen considerably reduces the number of dye additions and the levels of reprocessing. The right first time ratio shows a good percentage anywhere from 40 to 80%. This effectively translates into average savings of 5 to 10% in energy and water use, also a reduction on the consumption of dyestuffs and chemicals to around 10 to 20% with efficient color kitchen. (http://dyes-pigments.standardcon.com/colour-kitchen-manager.html)

Other new trends in dyeing and printing technologies

The quality of dyeing can be improved by use of computer product design, measured by computer color matching and other computer graphic arts technologies and methods. Dyes with short processes, pollution, etc., are widely used in waterless printing technology has been processing technology, non-plate printing technology, low temperature plasma processing technology, complex systems through efficient and advanced printing techniques and dyeing and finishing process allows process shorter and higher efficiency, better product performance. Digital printing is a growing segment which is replacing flat screen printing machines due to similar costs and production speeds.

Other emerging trends in the areas of processing include Dye bath reuse, recovery of synthetic sizes and counter current washing.

One of the next frontiers in material sciences is "Nanotechnology" with many specialty chemical companies exploring this space to benefit from its potential for innovations. Nanotechnology can be employed to improve the functionality of textiles through specialty chemicals that help provide 'easy release, quick wick finishes that enhance water/ oil repellence, hygiene and odor free properties. This enables textiles to command higher premium through differentiation in an otherwise highly competitive market.

Emerging technologies have demonstrated on a pilot scale with and some have been implemented on a full scale include the following:

- Direct dyebath monitoring and control systems : Control strategy that adjusts the dyeing process in real time to account and correct for uncontrollable parameters.
- Real-time adaptive control systems : Control strategy to adjust dyeing or other processing steps in real time to account and correct for uncontrollable parameters.
- Ink-jet printing : Droplets of dye solution are directed onto fabric to form a pattern, eliminating photographic screen making and color mix kitchen activities.
- Supercritical fluid dyeing : Uses carbon dioxide (CO2) as the fluid medium on disperse-dyed synthetics, eliminating aqueous effluent.
- Ultrasound dyeing : Uses ultrasound waves to impart dyes to fabric, eliminating aqueous effluent.
- Radio frequency drying : Uses radio waves rather than ovens to dry yarn or fabric.

However, there are many more challenges in the field of processing where active research should be pursued; some of them are listed below:

1. Room temperature bleaching of cotton
2. Caustic soda replacement in the scouring of cotton
3. Reactive dyeing of cellulose using Plasma
4. Single bath dyeing of polyester and cotton blends
5. Dyeing of polyester at 90c (without organic carrier)
6. Multi fibre dyeing (more than two)
7. Sugar surfactants in processing
8. Replacement of sodium hydrosulphite in vat dyeing
9. Solar energy in textile processing
10. Super critical dyeing of cellulose

CONCLUSION

Functional demands for specialty chemicals will continue to grow with each dye – fibre system and dyeing and printing processes having specific needs. The primary functions are to prepare the substrate ready for colouration, by desizing - scouring bleaching, the more complex ones are protect against atmospheric influences as in the case of UV absorbers or inhibitors of gas fume fading or to enhance the fastness properties such as chlorine – light besides wash and rubbing fastness.

The tools available to a researcher today are plenty and technological positioning of ideas from other streams of sciences converts a modern day scientist into a virtual magician, especially when it comes to polymers, fibre forming long chain molecules for textiles.

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New Feature: QUIZ – 01
(FOOD SCIENCE AND NUTRITION)

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In order to make learning fun, we have a new feature in the RESEARCH REACH - the Quiz. In every edition, our team will try to put together clever questions to pick at your grey cells. Each edition will focus on a different field in Home Science. We look forward to your feedback regarding this new section. Learn and enjoy! (The Editor).

I. RECENT EVENTS

1. Which is the first country in the world to receive validation recently from WHO that it has eliminated mother-to-child transmission of HIV?

2. This rare type of MDR tuberculosis that is resistant to isoniazid and rifampin, plus any fluoroquinolone and at least one of three injectable second-line drugs (i.e., amikacin, kanamycin, or capreomycin).

3. In 2007, I won a Nobel Prize for nutrition for investigating people's appetite for mindless eating by secretly feeding them a self-refilling bowl of Soup. Who am I?

4. If a food is labelled as 'No Added MSG' it must fulfil the following norms:
   - No Added MSG
   - No naturally occurring ingredient with MSG
   - Both A and B
   - 2.5ppm.

5. I received a Nobel Prize for Nutrition for photographing and retrospectively analysing every meal I consumed during a period of 34 years (and counting). Who am I?

II. MULTIPLE CHOICE QUESTIONS

1. Vitamin which serves as a coenzyme for many carboxylases is:
   a) Pyridoxilphosphate
   b) Niacin
   c) Biotin
   d) Cyanocobalamine

2. To which of the following does bariatric surgery not apply?
   a) Gastric bypass
   b) Gastric banding
   c) Duodenal bypass
   d) Liposuction

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3. Which of the following is the best source of Eicosapentaenoic acids?
   a)Salmon
   b) Linseed
   c) Mustard oil
   d) Walnuts

4. A toxic glycoalkaloid found in the green portion of potatoes is known as _____.
   a) Courgette
   b) Solanin
   c) Saponin
   d) Amygdalin

5. The active principle flavouring constituent present in coriander seeds is
   a) Trigonellin
   b) Gereniol
   c) Eugenol
   d) Allicin

6. The best bioavailable source of iron is _____
   a) Jaggery
   b) Palakbhaji
   c) Chicken curry
   d) Gardencress seeds

7. Passing electric current through an electricity conducting product with high resistance is called_____
   a) Electric Heating
   b) Voltic Heating
   c) Ohmic Heating
   d) Resistance Heating

8. A series of manufacturing and administrative procedures for consistent and specific product quality is
   a) Quality Control
   b) Protocol Quality
   c) Assurance Protocol
   d) Good Manufacturing Practices
   e) Good Monitoring Practices

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III. BIOCHEMISTRY AND NUTRITION

1. A sugar with a five-member ring is called_____.
2. Glutamate is a precursor for an inhibitory neurotransmitter called _____.
3. Caproic acid has ____ carbon atoms.
4. A hydroxyl of sugar reversibly condenses with alcohol to form _____.
5. A disease occurring due to a deficiency of the enzyme Homogentisate oxidase _____.
6. Process of conversion of acetyl CoA to acetoacetate in the liver is _____.
7. A polysaccharide that is present in synovial fluid is_____.
8. Starting product of the urea cycle in addition to ornithine is _____.
9. _____ helps in transfer of fat across the mitochondrial membrane.
10. The other name for 1, 25 Dihydroxycholecalciferol is D3 and _____
11. Selenium deficiency disease in humans characterized by cardiomyopathy & congestive heart failure _____.
12. Phytochemical from Rice Bran which inhibits platelet aggregation is called_____.
13. A niacin equivalent = Total mgs of niacin + _____.
14. The consumption of the artificial sweetener _____ is contraindicated for those suffering from a rare genetic disorder phenylketonuria.
15. One retinol activity equivalent = _____ IU of retinol.
16. The mineral which is a cofactor for the enzyme carbonic anhydrase _____.
17. The ratio of the content of each Essential Amino Acid in food prot (mg/g prot) to the content of same amino acid in reference protein (mg/g prot) _____.
18. When all people, at all times have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preference for active and healthy life; we are talking about achieving _____.
19. Heating at 85 degree Celsius for a fraction of second is called _____.
20. Watermelon (*Citrullus vulgaris*) is a natural and rich source of which non-essential amino acid? _____.
21. This test requires the preparation of three samples among which two are exactly the same and the evaluator is asked to indicate the odd sample. _____
22. A chopping technique in which herbs or leafy green vegetables (such as spinach and basil) are cut into long, thin strips is called_____.
23. I coat my fish in rice powder and semolina before frying. The technique I use is? _____.
24. The power source of a microwave oven is called a _____.

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IV. VISUAL ROUND

1. Executive Director of Protein Foods and Nutrition Development Association of India and is recipient of distinguished Teaching Associate Award 1973 by an American University. Who am I?

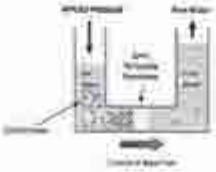
2. This is a crop of dry and warm climate crop consumed in North-western parts of India. It is a rich source of iron and protein. Identify the seeds.

3. Can you identify this plant used to prepare a well-known herbal sweetener?

4. This herb has an assertively pine-like fragrance and pungent flavor used to stuff meat and meat products.

5. This machine is used to make ready to eat breakfast cereals.

6. This process is extensively used in the dairy industry for the production of wheyprotein powders.



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7. You are on an industrial tour. You see vats containing water, barley, and hops. What kind of factory are you likely to be in?

8. I am the cafeteria germ. Who am I?

9. I am the fried rice bacillus. Who am I?

10. This research centre has developed numerous disease resistant and high-yielding crop varieties, particularly groundnuts and irradiated potatoes.

11. I am the father of Green Revolution and I won the World Food Prize in Washington in 1987. Who am I?

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V. RAPID FIRE

Set 1:

1. What does FSSAI stand for?
2. RDA of an adult male for iron is?
3. If anaar is pomegranate then ananasis?
4. Waist circumference is a better indicator of abdominal obesity than waist hip ratio – True or False?
5. Cow's milk has _____ mgs of calcium in 100 ml.
6. Name the food which contains the phytochemical Genestein.
7. Name the micro-organism that is used in the preparation of Beer.
8. The temperature of liquid Nitrogen use in cryogenic Freezing is - 187 degrees C. True or False?
9. What is broiling food with flames, smoke and radiant heat? Roasting or Charbroiling?
10. Number of maternal deaths /1000 of the population is called?

Set 2:

1. What does NDDB stand for?
2. RDA of calcium for a 13 year old boy is?
3. If Pudina is Mint then Tulsi is?
4. Fasting blood sugar levels is the best indicator of long term blood glucose control. True or False?
5. Gardencress seeds contain _____ mgs of iron/100 g.
6. Name the food which contains the phytochemical EGCG.
7. Name the microorganism responsible for the disease of typhoid?
8. The temperature for hardening of icecream is -30 to -35 °C. True or False?
9. To separate raw meat from the bone what is used– paring knife or boning knife?
10. Grey coloured spots on the conjunctiva due to vitamin A deficiency is called?

Set 3:

1. What does MUAC stand for?
2. RDA of Vitamin C for an adult woman is _____?
3. If Melon seeds are Magaz,then onion seeds are?
4. Haemoglobin assessment is the best indicator of early iron deficiency. True or False?
5. Ragi has _____ mgs of calcium /100 g?
6. Name the food which is the rich source of the phytochemical lycopene?
7. Name the microorganism used in the preparation of yogurt?
8. The temperature for beer fermentation is 40-45 degrees C. True or False?
9. The part of the refrigerator that pumps the vapourised gas is called compressor/ condensor?
10. Name the trace mineral that protects against cancer?

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VI. IDENTIFY THE NUTRIENTS

1. The mineral (not electrolyte) pair optimally needed to prevent hypertension.
2. The mineral pair which is a cofactor for cytochromes.
3. The vitamin pair involved in DNA synthesis.

VII. QUESTIONS BASED ON A SITUATION

1. Laloo Prasad Yadav was admitted in the hospital with intense upper right quadrant abdominal pain. Pining away for Rabri Devi, he complained in Bhojpuri, which loosely translated to "Why should I suffer whenever I have my favorite bhajias and rabripuri?"
What is the condition poor Mr. Laloo Prasad suffering from?

2. Maharashtra CM Devendra Fadnavis decided to improve his muscle mass to further impress Mrs. CM. His intense gym exercise routine was ineffective in terms of muscle mass increase.
Which B vitamin may have been at suboptimal levels resulting in his condition?

3. George Clooney was feeling anxious and had bouts of insomnia on his world tour with his beloved Amal. Amal suggested that he have milk following which he felt better.
Which neurotransmitter would have been released after milk consumption for him to feel rested?

4. A news report states that whenever Deepika Padukone met Ranvir Singh her heart beats faster!
What is the pressure in the bloodstream associated with pumping blood from the heart called?

5. When Viraat Kohli lost the match, Anushka Sharma consoled him with chocolates, after which his spirits lifted.
Which hormones would have been secreted to improve Viraat Kohli's mood?

RESEARCH CENTRE
COLLEGE OF HOME SCIENCE, NIRMALA NIKETAN
49, New Marine Lines, Mumbai 400020

'Writing Scientific Research Articles of International Standards'

PROGRAMME: July 10-11, 2015

Time	Session	Speaker
9.00 – 10.00 am	**Registration + Breakfast**	
10.00 – 10.05 am	Welcome	Dr Geeta Ibrahim, Principal
10.05 – 10.15 am	Introduction to the Workshop	Dr G Subbulakshmi, Director, Research Centre
10.15 – 11.00 am	Keynote Address	Dr B Sesikeran, Former Director, NIN, Hyderabad.
11.00 – 11.15 am	**Tea**	
11.15 – 12.45 pm	Excellence in Scientific Research Writing: A Contextual View	Dr RajalakshmiSriram, Former Professor, Dept. of Human Development, M.S. University, Vadodara
12.45 – 1.45 pm	Writing Excellent Scientific Research Articles	Dr RekhaSinghal, HOD, Food Engineering and Technology, ICT, Mumbai
1.45 – 2.15 pm	**Lunch**	
2.15 – 4.30 pm Participants to prepare abstracts of given full research paper in 150 and 300 words. Evaluation of above exercise by the other experts Discussion on abstract writing in groups by the experts		**Human Development:** Dr AnuradhaBakshi **Textiles and Fashion Technology:** Dr Ela Dedhia **Foods, Nutrition, and Dietetics:** Dr M Subhadra
Announcement in all the three groups	Assignment: Prepare a Research Proposal for a study to be presented tomorrow in 5 minutes.	
4.30 pm	**Tea and closing for the day**	

Participants from Community Resource Management and Social work may join whichever parallel session they desire depending on their area of research.

RESEARCH CENTRE
COLLEGE OF HOME SCIENCE, NIRMALA NIKETAN
49, New Marine Lines, Mumbai 400020

'Writing Scientific Research Articles of International Standards'

PROGRAMME: July 11, 2015

Time	Session	Speaker
9.30 - 10.30 am	**Ethical Writing and Plagiarism**	Dr YaminiSuvarna, Founder Director, ASPIRE, Mumbai
10.45 - 11.45 am	The Effective Presentation of Figures, Tables and Photographs in Writing Research Papers	Dr SreenivasanSankar, Former Director CIRCOT, Presently Consultant to Textile Industries
11.45 - 12.00 am	**Tea break**	
12.00 noon -1.00 pm	Statistics and Interpretation of Data	Dr PragyaKhandeparkar, HOD (Statistics), SIES College, Mumbai
1.00 - 2.00 pm	**Lunch**	
2.00 - 4.00 pm	Presentation and evaluation of research proposals prepared by the participants.	**Human Development:** Dr Nirmala Almeida **Textiles and Fashion Technology:** Dr Ela Dedhia **Foods, Nutrition, and Dietetics:** Dr G Subbulakshmi
4.00 - 4.30 pm	Closing programme: Vote of thanks, Distribution of Certificates	

Participants from Community Resource Management and Social work joined whichever parallel session they desired depending on their area of research.

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PROCEEDINGS OF THE NATIONAL WORKSHOP 'WRITING SCIENTIFIC RESEARCH ARTICLES OF INTERNATIONAL STANDARDS'

ORGANISED BY THE RESEARCH CENTRE, COLLEGE OF HOME SCIENCE NIRMALA NIKETAN, MUMBAI

10th and 11th July, 2015

Conducting scientific research is only the beginning in the scholarship of discovery. The ability to write well is critical for research scholars publishing their research work in reputed journals, as it enables them to clearly and precisely convey their ideas and research results.

As editors of the RESEARCH REACH – Journal of Home Science, over a period of time we have realised that the Indian standards of writing scientific research papers especially in Home Science needs to be upgraded to meet the standards of international journals, and thereby help Indian research get noticed around the world.

Thus, we planned a two-day workshop in **July (10th and 11th) 2015** for Ph.D scholars, post graduate students and the faculty of Home Science all over India, with a view to encourage more researchers to write effectively and get their papers published in reputed journals. The session consisted of details on scientific language, the importance of ethics in scientific writing, interpretation of statistics, avoiding plagiarism, writing project proposals, etc. In the workshop, we also encouraged the participants to write suitable abstracts from an original paper under the guidance of the experts in the field. This helped them understand how writing correctly is as essential as achieving technical accuracy and gaining career advancement by having their research published.

The program began with welcome speech by **Dr Geeta Ibrahim,** Principal, College of Home Science, followed by the traditional inauguration with the lighting of the lamp. The Director of the Research Centre, Dr G Subbulakshmi gave the background of the workshop. The keynote address was delivered by **Dr B Sesikeran,** Former Director, NIN, Hyderabad, on **'Research Methodology – Proposal to Publication'**. He introduced the topic by explaining the reasons for communicating research work. Enumerating the purpose of conducting research, he stated that research is conducted in order to fulfil the following:

- The need to meet the academic requirements, where a thesis is mandatory for students.
- An individual or group's keenness to observe / investigate a particular phenomenon.
- Fill up the gaps in existing knowledge.
- Repeat existing studies (evidence based research).
- Develop new methods and their validation.
- Find out the incidence, prevalence, frequency of a disease.
- Study the association between two entities.

The components of a research proposal are: The title, summary, background (rational / introduction), hypothesis, objectives, methods/design/ timeline, expected outcome, budget and references while a research publication, apart from the title, abstract, background

(rationale / introduction), hypothesis, objectives, methods/design, include results, discussion, conclusion, references and acknowledgement. In fact a research proposal well written is half the work done for publication.

Steps in conducting research:

1. Development of a hypothesis (Null / alternate): A hypothesis is more than a wild guess but less than a fact. A study ends with the acceptance of either the null or alternate hypothesis. Results must be reported irrespective of whether they support the hypothesis or not.
2. Title: A title is a one-line summary of the work.
3. Introduction: An introduction provides logic for objectives. An important feature of a good proposal is a crisp introduction. Its length should be less than 50% in comparison to discussion. One must give appropriate references for statements made in the introduction. Mention the name of the author and the year of publication in parentheses. In case of multiple authors, the first two authors must be mentioned in the text, followed by the term 'et al'. However, the names of all the authors must be mentioned in the references list. Personal comments could be also included with appropriate references.
4. Objectives: The objectives of the study must be clear and specific..
5. Background: The background must tell the reviewer why a person is conducting the study.
6. Methodology: This includes the design, participant characteristics, materials, methods and type of statistical analysis. It provides information on the selection criteria, controls used, ethical considerations, sampling, etc. It also includes details of the test, standards used, source of equipment, chemicals, calibration, and standardisation.

Ethical issues in research

The principles of ethical conduct of research on humans include:Principle of essentiality, voluntariness, informed consent and community agreement, non-exploitation, privacy and confidentiality, precaution and risk minimisation, professional competence, accountability and transparency, maximisation of the public interest and distributive justice, institutional arrangements, public domain (ctri.nic.in) and totality of responsibility, compliance (www.icmr.nic.in/ethical_guidelines).

Categories of research proposals are:

- Exemption from review
- Expedited review
- Full review

Writing the references

1. Vancouver style: Developed by the International Committee of Medical Journal Editors. (www.lib.murdoch.edu.au/find/citation/vancouver.html). This citation style involves the use of numerals near the cited text which corresponds to the author details in the list of references. The numerals are commonly in superscript. The numbers are given in the chronological order of the citation, and this order is maintained in the list of references/bibliography. E.g. Schol[2,3,5];Schol[1,2,3-8,9]; Schol[1,2,3-5].

2. Harvard Style: Commonly endorsed by the American Psychological Association (APA) style. The names of the author and the year of the publication is written in parentheses at the end of the statement.

References must be included in alphabetical order (Harvard style) or in the order in which they appear in text (Vancouver style).

Personal communication must be included in text but not in reference list. This can include personal conversations, contents from a letter or an email.

DOI: A digital object identifier (DOI) is the number assigned to an online document by the International DOI Foundation that makes document easily retrievable over the internet.

Journal articles

The following are some guidelines for writing the references in journal articles:

- List first six authors in the references followed by *et al.*
- The MEDLINE journals database helps in the abbreviation of the titles of the journal.
- The year comes after the name/s of the author/s. Volume number, issue and page number must be given.
- If the cited text does not show the name of an author but is the property of an organisation, then write the name of the organisation.
- If there is no author and organisation then just write the title of the book.
- If same person is author or editor then write 'Ed' after the name of the author.
- If the book has been published for the first time then there is no need to write the edition number.
- If the book has more than one volume then mention the volume.
- Thesis or dissertation can also be referred and must be included in the references.
- E-book: Check when it was published online and when it was actually published offline.
- The entire URL must be given when you are citing an online reference.

Plagiarism:

Up to 20% of text in an article can include quoted text from the referred source. These must appear within quotation marks followed by the reference. For the rest of the text, one cannot totally copy and paste text and then add the reference, one needs to paraphrase the text and state the reference.

Online plagiarism checkers are designed to accept up to 20% similarity, as they assume the direct quotes are within quotation marks. With these guidelines, Dr Sesikeran ended his address while encouraging students and guides to write and publish their work, keeping in mind the 'rules of the game'.

The second speaker **Dr Rajalakshmi Sriram**, Former Professor, Dept. of Human Development, M.S. University, focussed on Excellence in Scientific Research Writing which according to her was adapted from:

- Angelo L Patti, Colleen A Wilkinson', ABC's of APA', Fall 2009.
- Patricia M Shield Ph.D,'Writing Excellent Research Papers.'
- HsgiungTzeng,'How to Promote the Research Ability and Publications for Successfully Publishing in High Level SSCI / SCI Journals?', October 2013.

Scientific writing is different from informal writing as it follows science, logic, and principles whereas non-scientific writing does not. Science is a method and therefore scientific writing has to be presented in a systematic way. One needs to follow professional codes for writing.

Different ways of writing are followed for different types of studies. E.g. Ethnography (the study of culture), articles from media, biology, and psychology all follow different styles of writing.

Why publish articles?

Papers are published for Academic Performance Index (API), academic enhancement, and knowledge sharing. Even small work can be published. Many of the Master's theses remain unpublished. Success itself is the motivator for greater success and rejection is the key to improvement.

What do publishers expect from authors?

Publishers expect consistency in writing, originality of work, significant advances in the field which contribute to new knowledge, reliability, appropriate methods and conclusions, meeting ethical standards. Weak articles are not accepted. Duplication and repetition must be avoided. The work should be published as soon as possible before it gets outdated.

What makes a good paper?

- Good motivation / application
- Solid model / analysis
- Great results and contributions
- Managerial / social insight

Good topic vs. hot topic

A paper should contain good topic rather than a "hot" topic. It should contribute to significant knowledge in a specific area.

Most of the studies are conducted based on the supervisor's interest. However, supervisors / guides should understand the interests of their students and should involve them in the topics of the students' choice.

A good research publication should have a better theory, method, quality data, references from scholarly manuscripts, and critical thinking (rigorous analysis, logically argument, well written discussion and able to stimulate one's thinking).

Feedback is very important. It should always be taken positively. Research is a process and there are no shortcuts in achieving the best results. Discuss about one's research with different experts. This helps in strengthening the research.

Clarity is very important. Discuss points clearly to avoid confusion; otherwise it may lead to rejection. Clarity in thoughts is important which makes it easy to write. Lack of effort can also result in the lack of clarity.
A person's writing ability and understanding of the concept improves with regular reading.

Purpose of writing a research paper:
- Communicate new information/ new perspective
- Reporting path-breaking research
- Add to previous knowledge
- Share findings in different context
- Influence practice and policy
- Helps create a difference to society.

Few goals studied in depth leads to good research. The main or broad aim should be focused and highlighted. The main information should be passed on.
Each journal has its own style so it needs to be followed.

As you prepare to write a paper, begin by writing a methodology (although this is the later part in a research paper) and then write the objectives as it is difficult to write them. Writing methods first helps in boosting confidence.

Keep ideas in a miscellaneous sheet and then organise it. This will ensure you donotlose any idea. A conceptual framework is very important.
Literature review: This should be complete but precise, be considerate towards others' work. Acknowledge the work of other authors.

References: There are different styles of writing the references. One can refer to the APA manual, or the Chicago Manual of Style. There are tutorials available on the internet. Avoid writing interpretations from secondary sources as you have not read the original article. Download the original article and then cite it.

The next speaker, **Dr Rekha Singhal**, HOD of Food Engineering and Technology Division of ICT, Mumbai, spoke on Scientific Writing.
Since many researchers working all over the world towards a common objective, the information requires to be communicated skilfully. Editors and reviewers look for good quality papers.

The journal chosen for the publication of one's research depends on the impact factor, the ease of publishing and the scope and relevance of the work to the objectives of the journal. Before writing the manuscript, it is vital that an author reads the journal's guidelines for publication in that journal and write the paper accordingly. Ensure the manuscript has been proofread by a third person. Be self-critical and develop insightful thinking. The authors should give importance to scientific language, ensuring proper interpretation. The guides and mentors should certify the authenticity of the data. As journal space is precious, it is

important to make the article as relevant and as informative as possible. All the sections must be clear, balanced, and focused on the topic discussed and easy for indexing and searching. Avoid the use of informal or literary language.

The title should be concise, detailed and should tell the reader about the paper. The structure of the abstract is important as it allows the editors to decide the suitability of the article for the specific journal. The size of the abstract should be between 150 – 300 words, as per the requirements of the particular journal. The format varies for different journals. It may be in a single paragraph, or split under different subheadings. It should be written in such a manner that makes the reader want to read further. It should be written after you have completed writing the rest of the paper.

The introduction should include the scope and importance of the study. It should justify the need for the study in the context of previously conducted research in the related subject. The introduction should be crisp and relevant to the aspect being studied.

Any materials used for the study must be mentioned. The information on the brands and the principles of the working of the instruments/materials must be included. Every minute details of the methods must be clearly mentioned so as to confirm the results by the same methods, if necessary.

The results must be separated into subsections. The tables and figures must follow a chronological order. Compare the results with previous work will help in interpreting the data. Before presenting the table, the text portion should explain the results. The data obtained should be analysed and discussed, interpreting the cause and effects of the results obtained, taking in consideration the limitations of the study. The findings of the study should relate to the aims and objectives as well as the hypotheses. Unscientific words, tall unproven claims, must be avoided. In the discussion, the data presented should be interpreted and the findings should be related to the aims and the hyopothesis of the study. Statements not supported by concrete data should be avoided. If the results of the study contradicts the results of the previous studies this should be mentioned honestly and convincingly.

The conclusion should be within half page, but should not be a copy of the abstract and should explicitly bring out the salient features of the study.

Finally, everyone who contributed to the study in some way or the other (other than the researcher/s) such as funding, technical help, free samples, etc. with the permission of the person concerned, must be acknowledged.

The references should be complete with all the names of the authors, year of publication, and the name of the journal, volume number and issue number. Only scientific, authentic research must be referred to.

Referring to one's own studies should not occur too often. The format that is suggested by the journal should be used. The initials of all the authors must be included in the references list but not in the text.

Post submission responses

There are four possible responses that an author can expect –

- A scientific paper presented well is 'accepted without change'.
- Some papers are accepted with minor changes suggested by the reviewers.
- Some papers are advised to be revised and may be accepted after major revisions. Some papers may be rejected outright.

Although one may get disappointed at the first sight of corrections or revisions suggested, it is possible to resubmit the papers with major or minor corrections if the suggestions are strictly followed. However, a rejected manuscript cannot be resubmitted to the journal. When returning a revised manuscript, highlight the corrections/answers to the queries from the reviewers.

Covering letter

The covering letter is the author's chance to communicate with the editor directly. It must be submitted with the manuscript. Mention what would make your manuscript special to the journal. Approval of all authors for submission of the article should be indicated.

Ethical issues

- Lack of ethics can earn rejection and ban from publication
- Unethical behaviour includes scientific misconduct, falsification of results
- Publishing misconduct
- Conflict of interest

On the second day, the session began with a talk by **Dr Yamini Suvarna,** Founder Director of ASPIRE, on Ethical Writing and Plagiarism. She described the usage of the words 'Ethics' and 'Plagiarism' in the following manner:

- Ethics: Moral principles and values that govern behaviour; both professional and personal.
- Plagiarism: Taking someone else's writing and using it as one's own work without providing citations.
- Self Plagiarism: not providing citations to one's own work done previously.

Importance of ethics in research

Based on Ethical Guidelines for Social Science Research in Health, there are four moral principles:

- Non-Maleficence: Cause no harm to anyone.
- Beneficence: Make positive contribution to the society.
- Autonomy: Respect and protect the rights and dignity of participants.
- Justice: Benefits should be greater than the risks and should benefit all people.

Ten General Principles:

1. The Need for Research: Research should be beneficial to all. It should not be conducted just because one wants to do it.
2. It should maximise social justice and should be in public interest.
3. The researcher must have the required knowledge, ability and commitment towards research.
4. It should not infringe upon the rights of the respondents, their dignity and autonomy.
5. Privacy/ confidentiality and anonymity must be maintained.
6. Risks must be minimised.
7. Participants and the team members conducting the research should not be exploited.
8. The research should be communicated to all.
9. The researcher must be accountable to the guides and the research board. Transparency should be maintained at all times.
10. Total responsibility should be shared by all team members involved in the research study.

Ethical writing should be clear, accurate, fair and honest and must be a reflection of ethical practice.

According to Miguel Roig, (2015) the following points need to be kept in mind for ethical writing:

- When one writes, there's a contract between the author and the reader. It is important to maintain accurate and clear references, and correct interpretation of the original work.
- Results, facts and numbers should be presented without modifying them.
- The use of persuasive language to convince the reader about one's view point must be avoided.
- One must present all the sides of the argument in the literature review.
- Plagiarism in any form must be avoided.
- Every source of information must be acknowledged.
- While paraphrasing, one must understand the terminologies well to avoid change in the meaning.
- One must provide the citation when in doubt about a concept or fact.
- Complex studies should be presented as a cohesive unit and not as separate sections.
- The references in the text as well as in bibliography must be double checked by the authors. .
- The list of references must include only the studies that have been quoted in the text. A bibliography is a list of books and other reading materials that contain all the information on a particular topic. A research paper can have a list of references, but not a bibliography.
- The researcher's own ideas must be clearly differentiated from those of the studies referred.
- Evidences contrary to one's view point must also be reported.
- A 'No Objection Certificate' from the original publishers is required for the same study to be published in another journal.

Plagiarism must be strictly avoided.

A video on 10 types of plagiarism (Source: Write Check Videos, https://www.youtube.com/watch?v=EF5eFeJMplA) was shown to the audience during the talk.

The 10 Types of Plagiarism (as mentioned in the video) includes cloning(word-for-word copy),CTRL C (copy -paste and adding few original words), Find-replace (replacing words

in the text), Remix (taking information from various sources and fitting them together), Recycle(the use of one's own work done previously without citation), Hybrid: (a combination of cited and non-cited text), Mashup (a combination of text from multiple sources), 404 error (citing sources inaccurately), Aggregator (use of only cited text and no original writing in the paper), Re-tweet (use of proper citation, but poorly paraphrased).

In order to avoid plagiarism, one must quote original words, cite the author and mention the year of publication. While paraphrasing any referred material, the author and year of publication should still be mentioned. A video on 'Understanding and Developing Paraphrasing Skills' was shown to the participants. (Source: www.helps.uts.edu.au).

The next expert, **Dr Sreenivasan Sankar**, Former Director CIRCOT, gave a talk on 'Effective Depiction of Tables and Figures in Scientific Presentations'.
Richard Threlfall stated, 'Great science always speaks for itself and does not need to be dressed up…'

Scientific writing is essentially a medium for dissemination of scientific information and not a platform for self-portrayal emphasising both motivation and outcome of work. The graphics used in the writing must support the information in the text and must be clear, simple, accurate & and concise. A picture is worth a thousand words.

Tables and figures enhance the quality of manuscripts. Graphs and figures help in communicating complex ideas with clarity, precision and efficiency. They act as visual elements, help to present detailed results and complex ideas, clearly and concisely, and help reduce the length of manuscript enhancing the readers' understanding of results. At the screening stage, they offer reviewers and journal editors a quick overview of study findings. Once the paper is published, they do the same for readers. Good graphics should be clear, precise, present the true results efficiently and must not create confusion.

Use of tables and figures in a research paper:

Table
Shows many and precise numerical values in a small space
Compares and contrasts data
Shows the presence or absence of specific characteristics

Figure
Shows trends, patterns, relationships across and between data sets
Summarises research results
Displays visual explanation of sequence of events or characteristics

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Guidelines for Tables and Figures

- Display items must be made self-explanatory.
- The same data from tables must not be presented in both table and figures. Any one form of presentation must be chosen.
- There must be consistency.
- The table titles must be clear and informative.
- Adherence to the journal guidelines is essential.

Guidelines for tables

- Repetitive tables may be combined.
- Tables may commonly have not more than 4 columns and 3 lines.
- In case of a large quantity of data, it can be divided into categories.
  The table title must appear just above the table with table number.
  Sufficient spacing between rows and columns, clean layout and legible fonts are needed
- Superscript letters and notes are used to offer additional, clarifying information
  Writing 0.2, 0.4, etc. is preferred over .2 and .4.

Figures

- Bar graph: Compares 2–3 variables.
- Stacked bar graph: Depicts the proportions to the whole.
- Line graph: Represents two or more sets of data.
- Pie chart: Displays the percent contributions of various elements.
- Scatter chart: Shows the correlations.

The use of bold and clear contrasting colours for different sets of results, rather than different symbols with same colour gives better clarity. However, one must avoid too many data sets in too many colours in a single graph. A brief but descriptive title must appear below the figure with figure number. The font size of the words use in the key, on the axes and within the figures must be large enough for easy reading. Statistical markers like standard error-bars can be displayed in the figure. Statistically significant findings may be marked with asterisks, or "P-values" may be written on the graphs.

Photographs

- High quality photographs can enhance the value of the publication.
- Sharp, good colour and images having good contrast are preferred.
- Relevant portions that add visual value to text must be included.
- In micrographs, appropriate magnifications that help in revealing the phenomenon must be used.
  Important parts of the image may be labelled with standard fonts.

The talk on Statistics and Interpretation of Data was given by **Dr Pragya Khandeparkar,** HOD (Statistics), SIES College. At the first instance, she described the terms used in research statistics. **Statistics is** the collection, presentation, analysis and interpretation of data. The data collected can be analysed and presented in the form of a table.

Analysis

- The data collected can be condensed as an average (mean). Average is denoted by 'x'.
- Standard deviation is the measure that is used to quantify the amount of variation or dispersion of set of data values.
- Co-efficient of variation is given as ($s \sqrt{x} * 100$)

Testing of hypothesis: Hypothesis testing is needed for generalising the data.

	H0 is true	**H1 is true**
Reject H0	Type 1 error	√
Accept H1	√	Type 2 error

- A sample is representation of whole population
- Level of significance= max P (type 1 error), 5% error is accepted.
- The data collected can be analysed by various tests. Some tests are given below.

T-Test for Single Population Means.

e.g., haemoglobin levels of men and women.

H0: $\mu = 12$ (average of haemoglobin of men in Mumbai)

H1: $\mu > 12$

Sample size: 30

Test statistic

$$t = \frac{(\bar{x} - 12)}{(s \div \sqrt{N})}$$

If t score is small, H0 is correct and if t score is big, H0 is not correct.

If t cal is greater than t tab, reject the null hypothesis and accept alternate hypothesis at 5% level of significance.

T-Test for Equality of 2 Population Means

H0: $\mu 1 = \mu 2$; H1: $\mu 1 \neq \mu 2$

Test statistics

$$t = \frac{(\bar{x} - \bar{y})}{\sqrt{(s\,(1/n1 + 1/n2)}}$$

Larger the value, $\mu 1$ and $\mu 2$ are not equal.

Smaller the value, $\mu 1$ and $\mu 2$ are equal.

If t is greater than t = reject the null hypothesis and accept alternate hypothesis at 5% level of significance.

P value determines the chances of rejecting H0

Paired T-Test for Equality of 2 Population Means

- It is used to compare time 1 and time 2 i.e., before and after the intervention.
- Null hypothesis: $\mu 1 = \mu 2$
- Alternative hypothesis: $\mu 1 > \mu 2$

- The test statistic is, Paired $t = \bar{d}/Sd\sqrt{n}$
- Result must be stated in simple English.
- It is very important to mention whether the statement of research purpose is one-tailed or two-tailed.

Analysis of Variance (ANOVA)

- Test for equality of several population means.
- ANOVA table for F statistics plays a crucial role in estimating the p value.

Chi-Square Test

Two values of importance are the following:

Observed frequency

Expected frequency

- Small value of chi-square indicates that the value is independent and vice-versa.
- Chi-square=(Observed frequency-Expected frequency)^2/Expected frequency

Regression Analysis (R^2)

- It deals with association of values.
- Example: There is a positive relationship between body mass index and cholesterol level.
- i.e., if Body Mass Index is high it results in high cholesterol level.
- Hence, BMI is an independent variable and Cholesterol level is a dependent variable.
- R^2 value lies between 0 to 1.

Multiple Regression

Test for association of multiple values.

PRACTICE SESSIONS

In the post-lunch sessions on both days, the participants were grouped based on their fields of specialisations. The chairpersons for these sessions were as follows:

1. Foods, Nutrition, and Dietetics – Dr M Subhadra, Dr G Subbulakshmi
2. Human Development/ Psychology/ Social Work – Dr A Bakshi, Dr N Almeida
3. Textiles and Fashion Textiles – Dr E Dedhia

On the first day, the participants were asked to prepare abstracts in 150 words as well as 300 words of the research papers given to them. On the second day, they were asked to present a research proposal prepared by them, taking into consideration the guidelines given during the various sessions at the workshop. The participants enthusiastically completed the assignments, designed for their applicability.

The two day workshop was indeed well attended and appreciated by the participants as a very useful programme.

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LIST OF THESES / DISSERTATION TITLES (2014–2015)

Nirmala Niketan College of Home Science
49, New Marine Lines, Mumbai 400020

MSc Foods, Nutrition and Dietetics

1. Gala Shikha (Guide: Dr. Geeta Ibrahim): Development of vitamin D enriched mushroom spread. (N-321GAL)
2. Savla Hiral (Guide: Dr. Veena Yardi): Development of gluten-free extruded pasta using grape pomace and assessing its quality and acceptability. (N-322SAV)
3. Henriques Flavia (Guide: Mrs. Nina Dias): Development of low fat shortcrust pastry. (N-323HEN)
4. Abraham Sheba Ann (Guide: Mrs. Nina Dias): Development of omega-3 rich sandwich spread using chia seeds. (N-324ABR)
5. Navagharwala Tasneem (Guide: Dr. Veena Yardi): Development of probiotic drink powder containing whey protein and betel leaves extract. (N-325NAV)
6. Kelaskar Shrutika (Guide: Mrs. Vibha Hasija): Development of a mixed spice decoction for use in general health benefits. (N-326KEL)
7. Neethi Kumar (Guide: Dr. Subhadra M.): Effect of cooking on flavonoids and saponins in selected non-conventional anti-diabetic agents. (N-327NEE)
8. Meer Ifrah (Guide: Mrs. Vibha Hasija): Efficacy of online games and traditional nutrition education method among children aged 9–10 years. (N-328MEE)
9. Rodrigues Prioshka (Guide: Dr .Geeta Ibrahim): Development of chocolate substituting kokum butter for cocoa butter. (N-329ROD)
10. Netto Lourdes (Guide: Mrs Anuradha Mitra): Knowledge, attitudes & practices of working & non-working women from Mumbai with respect to cooking a healthy meal. (N-330NET)

MSc Sports Nutrition

1. Dhargave Vijayata (Guide: Dr. Geetanjali Bhide): Assessment of nutritional status,body composition and physical fitness of Indian hockey players. (SN-31DHA)
2. Vaidya Kalyani (Guide: Dr. Meena Mehta): Assessment of dietary nutrient intake and fitness levels between elite and amateur hockey players. (SN-32VAI)
3. Shaikh Hera (Guide: Dr. Meena Mehta): Assessment of nutritional knowledge and fitness levels of hockey players in Mumbai. (SN-33SHA)
4. Savant Tanvi (Guide: Dr. Meena Godhia): Assessment of nutrition status, physical fitness profile and nutrition knowledge among football players and sedentary individuals. (SN-34SAV)
5. Ubharay Nadia (Guide: Dr. Meena Godhia): Assessment of nutritional status,physical fitness profile and nutrition knowledge among football players and regular exercising individuals.(SN-35UBH)
6. Fernandes Jewel (Guide: Dr. Geetanjali Bhide): Assessment of nutritional status, body composition and physical fitness of Indian hockey players. (SN-36FER)
7. Ajgarni Abigail (Guide: Mrs. Sukhada Bhatte): To assess dietary habits, fitness level and incidence of injuries in amateur female cricketers aged 18–24 years in Mumbai. (SN-37AJG)
8. Fariiqui Nusrat (Guide: Dr. Subhadra M.): Assessment of body composition, nutritional status and physical fitness level of adolescent male cricket players. (SN-38FAR)

9. Khan Nishat (Guide: Mrs. Sukhada Bhatte): To correlate the incidence of injuries with nutritional nd fitness status amongst 18–23 year old amateur male cricketers in Mumbai. (SN-39KHA)
10. Beddingwala Salima (Guide: Dr. Subhadra M.): Assessment of nutritional status, body composition and physical fitness of adult male cricketers. (SN-40BED)

MSc Food Processing and Preservation

1. Kokitkar Pranjal (Guide: Dr. Subhadra M.): Factors influencing adolescent buying behaviour selected food products. (FP-55KOK)
2. Talekar Neha (Guide: Dr. Veena Yardi): Analysis of anti-nutritional parameters of *syzygium cumini* seeds and development of mouthfreshener. (FP-37TAL)
3. Kazi Fatima Y (Guide: Mrs. Sukhada Bhatte): Study of the effect of aloe vera and *foeniculum vulgare* on the shelf-life and characteristics of *achras sapota* and *musa acuminata*. (FP-38KAZ)
4. *Kadam Siddhita (Guide: Mrs. Sheetal Joshi): Processing and acceptability of wheat bread* fortified with soy okara. (FP-39KAD)
5. Cerejo Rishika R (Guide: Mrs. Veena Yardi): Development of vegetable jams. (FP-40CER)
6. Malkar Prajakta L (Guide: Dr. Jyoti Vora): Biochemical, nutritional and organoleptic studies on *Jasminum auriculam vahl* (Indian Jasmin). (FP-41MAL)
7. Dewoolkar Poojashree: Development of ragi based cake with added orange fruit peel powder. (FP-42DEW)
8. Shukla Poonam (Guide: Mrs. Geeta Ibrahim): Estimation of chlorogenic acid from coffee. (FP-43SHU)
9. Pawar Manali M. (Guide: Mrs. Nina Dias): Development of omega-3 rich sandwich spread using oil blends. (FP-44PAW)
10. Bhatkal Nita K (Guide: Mrs. Nina Dias): Waste utilization of banana peel as a functional ingredient in enrichment of baked product. (FP-45BHA)
11. Sumra Yogesh Jivraj (Guide: Mrs. Vibha Hasija): Evaluation of consistency in nutritive qualities customer satisfactionof preferred fast food products of two brands from different outlets in South Mumbai. (FP-46SUM)
12. Guhathakurta Monalisa (Guide: Mrs. Soni Tihara): Comparative assessment of traditional v/s modern drying methods on nutritional, total polyphenolic and anthocyanin content of *Garcin iaindica rinds*. (FP-47GUH)
13. Salunke Saloni (Guide: Ms. Unnati Shah): Analysis of sciioed and packed ice creams of same brand. (FP-48SAL)
14. Kahare Gauri (Guide: Ms .Unnati Shah): Analysis of fresh and large scale processed orange fruit juices of south Mumbai. (FP-49KAH)
15. Ursekar Anila (Guide: not given in Dis.): Development of ready-to-eat kheer for diabetics & its packaging. (FP-50URS)
16. HasijaShalu C. (Guide: Dr. Mrs. Geeta Ibrahim): Antimicrobial activity of orange, sweet lime and lemon peel oil on selected food borne pathogens. (FP-51HAS)
17. Iyer Chandra S. (Guide: Mrs. Soni Tilara): Micro-encapsulation of anthocyanin extracts from *Musa acuminata* bracts and its application as a potent biocolour. (FP-52IYE)

18. Salian Jayashree S. (Guide: Mrs. Sukhada Bhatte): Development of low cost weaning products using *Colocasises culenta.* (FP-53SAL)
19. Ganguly Trisha (Guide: Mrs. Anuradha Mitra): Development of a synbiotic fruit beverage (2015). (FP-54GAN)

MSc Human Development

1. Shapurkar Maayan (Guide: Ms. Payal Maheshwari): Awareness and attitudes of female teachers towards inclusive education and the relationship between their emotional intelligence and attitudes. (HD - 287SHA)
2. Joseph Jonelle C. (Guide: Ms. Payal Maheshwari): Awareness & attitudes of mothers & fathers towards inclusive education and the relationship between their emotional intelligence and attitude. (HD-288JOS)
3. Fernandes AlannahC.(Guide: Mrs. Rhonda Divecha): Perspectives of children (7 to 12 years old), parents and music teachers towards Western classical and English popular music education in Mumbai. (HD-289FER)
4. John Sneha Sophy (Guide: Dr. Anuradha Bakshi): Ways in which youth spend their time, related satisfaction and life goals: comparison of youth (13–18 year old) in Mumbai and Kottayam. (HD-290JOH)
5. Gaggar Foram (Guide: Dr. Mrs. Nirmala Almeida): Quality of life, coping strategies and coping effectiveness of college students in Mumbai. (HD-291GAG)
6. Rai Supriya T. (Guide: Dr. KaminiRege): Awareness and attitudes of middle aged adults (40-50 years) regarding euthanasia. (HD-292RAI)

MSc Textiles and Fashion Technology

1. Dehghani Mohaddesa (Guide: Dr Pratima Goyal): Design and development of 3 in 1 multi convertible gowns: wedding gowns, party gowns and saree gowns. (T-241DEH)
2. Vanu Siddiqa (Guide: Dr. Vishaka Karnad): Analysis of designer abaya from consumer and retailer perspectives. (T-242VAN)
3. Maru Unnati G. (Guide: Dr. Ela Dedhia): Study on ozone treated denim. (T-243MAR)
4. D'souza Eleesha (Guide: Dr. Ritu Madhan): Upscaling fabric scrap to develop convertible jewelry. (T-244D'S)
5. Shintre Nikita G. (Guide: Dr. ElaDedhia): Reducing environmental hazards by partly replacing potassium permanganate with eco-friendly natural product during denim washing. (T-245SHI)
6. Zuvenkar Dipika D. (Guide: Dr. Ela Dedhia): Reactive printing on towels. (T-246ZUV)
7. Sancheti Laveena(Guide: Dr. Ritu Madhan): Study on value additional to polypropylene non-woven fabric by applying various finishes using pad dry cure technique. (T-247SAN)

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ANSWERS TO THE QUIZ (No. 1)

Round 1 - Recent Events

1. Cuba
2. Extensively Drug Resistant TB
3. Brian Wansink
4. Both A and B
5. Dr. Yoshiro Nakamatsu of Tokyo, Japan

Round 2 - Multiple choice questions

1. Biotin
2. Liposuction
3. Salmon
4. Solanin
5. Gereniol
6. Chicken curry
7. Ohmic Heating
8. Good Manufacturing Practices

Round 3 - Biochemistry and Nutrition

1. Furanose
2. GABA
3. 6
4. Glycosides
5. Alkaptonuria
6. Ketogenesis
7. Hyaluronic acid
8. Carbomyl phosphate
9. Carnitine
10. Calcitriol
11. Keshan's Disease
12. Oryzanol
13. 1/60th of Tryptophan content
14. Aspartame
15. 3.33
16. Zinc
17. Chemical score/ Amino acid score
18. Nutrition Security
19. Flash Process
20. Citrulline
21. Triangle Test
22. Chiffonade
23. Dredging
24. Magnetron

Round 4 - Visual Round

1. Dr J S Pai
2. Bajra
3. Stevia
4. Rosemary
5. Air flow Puffing Machine
6. Reverse Osmosis
7. Beer Brewing Factory
8. Clostridium perfringes
9. Bacillus cereus
10. BARC
11. Dr. M S Swaminathan

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Round 5 - Rapid Fire

Set 1:

1. Food Safety and Standards Authority of India
2. 17 mg/day
3. Pineapple
4. True
5. 120 mg
6. Soya
7. *Saccharomyces cerevisiae*
8. False
9. Charboiling
10. Maternal Mortality Rate

Set 2:

1. National Dairy Development Board
2. 800 mg
3. Basil
4. False
5. 100 mg
6. Green tea
7. Salmonella typhi
8. True
9. Boning Knife
10. Bitot's Spots

Set 3:

1. Mid Upper Arm Circumference
2. 40 mg/day
3. Kalonji
4. False
5. 344 mg
6. Tomato
7. *Lactobacillus bulgaricus*
8. False
9. Compressor
10. Selenium

Round 6 - Identify the nutrients

1. Calcium and Magnesium
2. Copper and Iron
3. Folic acid and B12

Round 7 - Questions based on a situation

1. Gall Stones
2. B6
3. Serotonin
4. Systolic Pressure
5. Endorphins

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