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JOURNAL OF HOME SCIENCE

EDITORIAL

From the team of "Research Reach" it is our constant endeavor to provide the readers with a few, but well written papers covering different research areas in Home Science.

This January 2013 issue of the journal has a paper by Dr. Suman Pant and Susheela Gurjar that examines the effect of embroidery on the drape of a fabric. Hospital case studies provide the readers with a practical overview of how clinical conditions are managed in a hospital setting. We have, therefore, introduced this as a new addition and this issue has an interesting case study on "Onset of Type I diabetes in a child with hypothyroidism" by Ms. Swarupa K and Lalitha Reddy.

We have included 3 papers that focus on newer products – Products using lesser used greens such as drumstick and carrot greens (Swati Vyas et al), Gluten free flour using Chestnuts and rice (Navita Pareek and Akriti), a fermented beverage using apple, beetroot and carrot (Nandeeta Anna George and Dr Beatrice).

Nutrient bioavailability has been the focus in the paper by Ms. Priyanka Thapliyal et al on "Effect of processing on total mineral and HCl-extractable mineral content of chickpea varieties".

We wish all our readers a Happy and prosperous New Year.

Chief Editor,
Dr. Malathi Sivaramakrishnan

INSTRUCTIONS TO THE AUTHORS

Research Reach-Journal of Home Science (ISSN 0974 – 617X) is devoted to original Research and Development in all branches of Home Science. It is a bi-annual publication from the Research Centre, College of Home Science, Nirmala Niketan, 49, New Marine Lines, Mumbai – 400020.

The format of the journal includes (using **Font- Times New Roman 12):**

1. Review paper on specific topics of current trends pertaining to Home Science. It should be a mini review with around 15-18 typed pages.
2. Research papers with a maximum of 7-14 pages
3. Research notes limited to a maximum of 2-6 typed pages
4. Paper / Book Review of not more than 1 typed page each.

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The article should cover:
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Information / Views / Data published in the journal are of the authors only.

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RESEARCH PAPERS

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PREPARATION OF VALUE ADDED PRODUCTS FROM LESSER USED GREENS

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'Food based strategy' is used as a tool for combating micronutrient deficiencies. It is also referred as dietary modification, which encompasses a wide variety of intervention that aim at increasing the production, availability and consumption of food products, which are rich in micronutrients. One such food products are green leafy vegetables. There are many varieties of green leafy vegetables which are though rich in micronutrients, but are usually discarded or not used for human consumption. They are a rich source of micronutrients but are still under exploited some of the lesser used greens include drumstick leaves (Moringa Oleifira) and carrot leaves (Daucus Carota). The present study was done with the objective of comparing the nutritive value of the selected leaf with its fresh counterpart and preparing value added products from lesser used greens. Selection and procurement of leaves was done by local market, Dehydration was done by shade drying method as it has maximum nutrient retention and nutritional analysis was done by AOAC, 2004 methods. The sensory evaluation of the recipes was performed in comparison with control using 5 point hedonic scale. The results showed significant increase in all the nutrients in the dried samples of the leaves making them a concentrated source of nutrients. It was clear from the acceptability scores of all quality factors that all products (Idli, Cookies and Laddo) of drumstick and carrot leaf powder were well accepted at 3% level of incorporation and satisfactory accepted at 5% level of incorporation.

KEY WORDS: Moringa Oleifira, Daucus Carota, dehydration, biochemical estimation, sensory evaluation

Micronutrient malnutrition is a term used to refer to diseases caused by a dietary deficiency of vitamins or minerals. More than 2 billion people in the world today may be affected by micronutrient malnutrition. Vitamin A deficiency, iron deficiency anemia and iodine deficiency disorders are the most common forms of micronutrient malnutrition. People of all population groups in all regions of the world can be affected by micronutrient malnutrition. Although the most severe problems of micronutrient malnutrition are found in developing countries, people in developed countries also suffer from various forms of these nutritional problems. According to WHO, 1992 Anemia and iron deficiency affects more than 2 billion people in virtually all countries. Those most affected are women and pre-school age children. Anemia in infants and children is associated with retarded physical growth, reduced resistance to infections and slow development of learning abilities. In adults, it causes fatigue and reduced work capacity and may cause reproductive impairment. IDA affects about 43% of women and 34% of men in developing countries and usually is most serious in pregnant women and children, though non-pregnant women, the elderly, and men in hookworm-endemic areas also comprise groups at risk. According to WHO, 1992 the vitamin A deficiency (VAD) primarily affects children; worldwide, some 250 million children are at risk. It causes night blindness, and eventually, permanent

blindness (xeropthalmia). It also contributes to retarded physical growth and impaired resistance to infections, resulting in high rates of sickness and death among young children. Every year, a quarter to half a million children become permanent blind as a result of VAD; two-third of these are likely to die. Clinical VAD affects at least 2.80 million preschool children in over 60 countries, and subclinical VAD is considered a problem for at least 251 million, school age children and pregnant women are also affected. In case of Iodine deficiency a great step of Iodization of salt has been implemented by government and it is running successfully.

Four main strategies – dietary improvement, including increased production and consumption of micronutrient-rich foods; food fortification; supplementation; and global public health and other disease control measures – can be implemented to overcome micronutrient malnutrition. Food based strategies, which include food production, dietary diversification and food fortification, are the most sustainable approaches to increasing the micronutrient status of populations. World declaration on Nutrition has formulated a Plan of Action for Nutrition, and they recommended that governments should give priority to food-based strategies to control and prevent micronutrient deficiencies. Policy makers and planners have recognized that short term supplementation programmes implemented during the last two decades in developing countries have not succeeded in solving the problem. On the contrary the food based approaches promote consumption of foods that are rich in micronutrient or are enriched through fortification Green leafy vegetables are rich source of micronutrient. These greens are inexpensive and it is advisable to include at least 50g of it in daily diet. They are rich sources of iron, calcium and other micronutrients like ascorbic acid and phosphorus. According to available official figures leafy vegetables are grown in about 0.11 million hectors of land in India and the production is about 0.73 million tones. Although green leafy vegetables contain high amount of moisture and are not good source of calories and are highly perishable. Vegetables can be therefore processed and preserved by simple tradition methods like drying. Dehydrated vegetables are simple to use and to have a longer shelf life than fresh vegetables. The dried leafy powder can then be incorporated in various recipes in acceptable proportions. In this way we can ensure consumption of micronutrient rich green leafy vegetables on daily basis. Keeping in view, the importance of green leafy vegetables, the present study has been elucidated to develop various recipes by incorporating lesser used greens of drumstick and carrot.

MATERIALS AND METHODS:

The fresh green leaves were obtained from local market and the edible portion of the greens (leaves) of carrot and drumstick was separated and projected to below mentioned process.

Sorting

Fresh, green, un-damaged, non-insect infested, bruised, discolored, decayed and wilted leaves were discarded before washing the leaves, as decayed and wilted leaves give a bad flavor to the whole batch. Besides decayed and wilted leaves can lead to loss of nutrients too (Adeyeye and Otokiti, 1999).

Washing

The stalks of the leaves were cut from the main branches and the leaves were washed thoroughly three to four times with plenty of water to remove all the adhering dust, dirt particles. After washing, the leaves were tied together in small bunches and was hung in an airy space to drain away extra water and to air – dry the leaves. The residual moisture was evaporated at a room temperature, before the actual drying process on a clean paper with constant turning over to avert

fungal growth. After air drying, all the stems and branches of the leaves were removed and only the leaves were used for drying. The leaves were then weighed and used for drying.

Shadow drying

The technique used in the present study for dehydration was shadow drying. In shadow drying, the air – dried leaves were spread on cotton sheets but instead of keeping them on the roofs the leaves were kept in the room only. The room selected for shadow drying was well ventilated. Natural current of air was used for shadow drying the leaves. It took about six days for the leaves to dry completely and become crisp and brittle to touch.

Nutrient analysis

The nutrient analysis was done to analyze the dried sample for selected nutrients such as: Nutrition estimation: Iron (mg/100g), Beta Carotene (µg/100g), Vitamin C (mg/100 g), Moisture (%). Anti-nutritional compounds: Fiber (g/100g), oxalates (mg/100g) and phytates (g/100g). The nutritional analysis was done using the standard procedure of AOAC (2004)

Product Formulation and Sensory evaluation:

Value addition was done to the commonly consumed standardized recipes by incorporating dehydrated carrot and drumstick leaves in different proportions (5%, 10% and 15%). Sensory evaluation of the value added recipe was done against the control recipe prepared without incorporating green leaves. Evaluation of sensory attributes like appearance, color, flavor, taste, texture, after taste and overall acceptability using 5 point hedonic scale by semi trained panelist.

RESULT AND DISSCUSSION

Nutrient composition

The dried sample was analyzed for selected nutrients and the results are presented in Table 1.

Table 1: Nutritive value of processed leaf powder per 100 gram

Nutrients	Carrot		Drumstick	
	Fresh leaves	Dried leaves	Fresh leaves	Dried leaves
Iron	8.8 mg	35 mg	0.85 mg	24 mg
β-carotene	6460 µg	39280 µg	6780 µg	39600 µg
Vitamin C	79 mg		220 mg	
0 days		24 mg		37.5 mg
15 days		21 mg		30 mg
Moisture	76.6 g	9.5 g	75.9 g	9.2 g
Fiber	1.9 g	25 g	0.9 g	12.5 g
Oxalates	5 mg	365.5 mg	101 mg	337.5 g

The values for fresh leaves have been taken from the nutritive value of Indian food.

Iron content

Fresh drumstick leaves have an iron content of 0.085 mg per 100 gram of fresh leaves whereas the iron content of the leaf powder prepared by shadow drying was 24 mg per 100 gram which was 96% more than their fresh counterpart. Fresh carrot leaves have an iron content of 8.8 mg per 100 gram fresh leaves whereas iron content of carrot leaf powder was 35 mg per 100 gram which was 98% more than their fresh counterpart.

β carotene content

The retention of β carotene in shadow dried sample of drumstick and carrot leaves was 39600 μg and 39280 μg per 100 gram of sample respectively, which was 88% (drumstick leaves) and 85% (carrot leaves) more than their fresh counterpart.

Vitamin C content

Vitamin C content in fresh leaves of drumstick leaves was 220 mg and in carrot leaves was 79 mg per 100 gram. This was the only nutrient, which reduced after dehydration as it is oxidized rapidly on exposure to heat and air. The vitamin C content at 0 days was 24 mg and 37.5 mg, and at 15 days, it was 21 mg and 30 mg per 100 gram dried carrot and drumstick leaf powder respectively. This data shows that vitamin C content of leaf powder reduced with increasing days.

Moisture content

The moisture content in fresh leaves of drumstick and carrot was 75.9 gram and 76.6 gram respectively and in dehydrated leaves, the moisture content at 0 day was 9.2%.

Fiber content

The fiber content in the dehydrated powder of leaves was higher in comparison to the dried leaves as in fresh carrot leaves it was 1.9g however in dried sample it was 25g , the fresh drumstick leaves contained about 0.9g fiber but the dried leaves had 12.5g of fiber.

Oxalate content

Oxalate content in fresh leaves of drumstick leaves was 101 mg and in dehydrated leaf powder, it was 337.5 mg and carrot was 5 mg and it was 365.5 mg in dried sample of carrot leaves.

Sensory evaluation:

An overview of sensory evaluation (Table 2&3) highlights that the products prepared by incorporating green leaves were acceptable at 3 gram level. Comparison of various sensory attributes of products developed was done in relation to the control recipe. And it was realized that the products prepared by both the leaves were almost same with respect to color, texture, flavor, appearance and overall acceptability.

Table 2: Mean Hedonic Score of Foods Cooked by incorporating Carrot Leaves

Item	Sensory Characteristics	Percent incorporation			
		0%(control)	3%	5%	10%
Ladoo	Appearance	4.8	4.0	3.2	2.0
	Color	4.8	4.2	3.5	2.5
	Flavor	4.6	4.2	3.8	2.6
	Taste	4.4	4.0	3.2	2.4
	Texture	5.0	5.0	5.0	5.0
	After taste	4.8	4.4	3.4	2.6
	Overall acceptability	4.8	4.6	3.8	2.6
Idli	Appearance	4.6	4.2	3.4	2.6
	Color	4.8	4.0	3.6	2.6
	Flavor	4.8	4.6	3.6	2.8
	Taste	4.8	4.4	3.2	2.6
	Texture	5.0	5.0	5.0	5.0
	After taste	4.8	4.6	3.2	2.6
	Overall acceptability	5.0	4.6	3.6	2.8
Cookies	Appearance	4.8	4.4	3.2	2.5
	Color	4.8	4.0	3.3	2.2
	Flavor	4.4	4.2	3.5	2.2
	Taste	4.6	4.0	3.4	2.2
	Texture	5.0	5.0	5.0	5.0
	After taste	4.6	4.2	3.6	2.2
	Overall acceptability	4.6	4.2	3.6	2.4

Ladoo: Ladoos prepared by both carrot and drumstick leaves were light green in color at three gram level of incorporation as the amount of incorporation increase it resulted in darker color which affected its appearance as well as color, the flavor become more bitter and the judges disliked the taste. It even left a grassy flavor in mouth after consumption, although the texture remains unaffected. But in case of drumstick leaves the texture started deteriorating at 5 grams and particularly in 10 grams of incorporation. All the sensory attributes contributed in reducing overall acceptability above 3% level. Hence the overall acceptability reduced on increasing the incorporation from 5 to 10%.

Idli: Idli prepared by both carrot and drumstick leaves were light green in color at three gram level of incorporation as the amount of incorporation increase it gave a peculiar dark green color to the Idli resulting into unacceptable color and appearance, high amounts also resulted in bitter flavor which resulted grassy after taste in the mouth and also caused regurgitation after consumption. Idli prepared by incorporating carrot leaves had appropriate texture but

incorporation of drumstick leaves in higher amounts resulted in deterioration of texture. The overall acceptability reduced on increasing the incorporation from 5 to 10%.

Cookies: Cookies prepared by both carrot and drumstick leaves were light green in color at three gram level of incorporation as the amount of incorporation increase it resulted in darker color, the flavor became bitterer and the judges disliked the taste. It even left the grassy flavor in mouth after consumption, although the texture remains unaffected. But in case of drumstick leaves the texture stared deteriorating at 5 grams and particularly in 10 gram of incorporation.

Table 3: Mean Hedonic Score of Foods Cooked by incorporating Drumstick Leaves

Item	Sensory Characteristics	Percent incorporation			
		0%(control)	3%	5%	10%
Ladoo	Appearance	4.8	4.4	3.8	2.0
	Color	4.8	4.6	3.8	2.2
	Flavor	4.6	4.0	3.4	2.2
	Taste	4.8	4.4	3.4	2.0
	Texture	5.0	4.6	3.8	2.4
	After taste	4.8	4.6	3.4	2.0
	Overall acceptability	5.0	4.8	3.8	2.4
Idli	Appearance	5.0	4.6	3.4	2.0
	Color	4.8	4.6	3.5	2.0
	Flavor	4.4	4.2	3.2	2.3
	Taste	4.8	4.6	3.2	2.3
	Texture	5.0	4.8	3.6	2.6
	After taste	5.0	4.8	3.6	2.2
	Overall acceptability	5.0	4.8	3.6	2.2
Cookies	Appearance	4.8	4.4	3.4	2.2
	Color	4.6	4.2	3.6	2.2
	Flavor	4.6	4.2	3.0	2.0
	Taste	4.6	4.2	3.2	2.0
	Texture	5.0	4.6	3.2	2.4
	After taste	4.6	4.2	3.0	2.0
	Overall acceptability	4.8	4.6	3.4	2.2

The result of biochemical analysis showed that the leaf samples after dehydration become a concentrated source of all nutrients. The results are in good agreement with the studies done by Lakshmi and Vimla (2000) which showed that the leaves retained good amounts of protein, fiber and calcium in various samples of the leaves dried by sun drying and cabinet drying. Similar findings were reported by Joshi and Mehta (2010) in dehydrated green leaves of drumstick. After

dehydration the leaf powder became concentrated source of almost all macro as well as micronutrient. In this study dehydration was done by sun, shadow and oven drying methods and shadow drying method proved to be the best in nutrient retention. Studies have shown that the carotene losses are directly dependent on the method of drying. Loss of beta carotene from green leafy vegetables such as mint, curry, gogu and amaranth, after drying was found to range from 24 to 40% in sun dried leaves and 6 to 25% in oven dried leaves (Aletor and Adeogun, 1995). Study done by Nambier and Seshadri (2001) reported the significance of drumstick leaves as a source of vitamin A, these leaves could retain 50% of their beta carotene on shade dehydration and the dehydrated leaves could be easily incorporated into traditional, western and Indian recipes without altering their acceptability characteristics. In a study done by Kowsalya et al, 2010 dried and processed amaranth leaf powder was incorporated at a level of 2.5 to 10% and termed as amaranthus incorporated nutritious mix (noodles, vermicelli and pasta). The findings revealed that the developed products were highly acceptable from organoleptic evaluation and nutrient content was highly satisfactory. Begum et al, 2000 incorporated cauliflower leaf powder at 10% level in masala biscuits, masala buns, gingelly chikki, wheat soy halwa and nippattun had mean acceptability scores of 3.4, 3.6, 3.4 and 3.9 respectively on a 5 point hedonic scale. Products were found to be rich in iron, beta carotene and calcium and were highly acceptable. Vasundhara et al, 2009 explored the possibility of utilizing fresh colocasia leaves in common dishes to increase the intake of greens as a source of micronutrients. In food products were developed and standardized six were green, dhals and vegetable combinations and four were snack items. Nutrient content of prepared recipes especially dietary fiber, beta carotene, calcium and iron were higher than the control.

CONCLUSION

Green leafy vegetables are a rich source of iron, beta carotene, vitamin C, fiber and other important nutrients. In comparison to other food products, these are a cheap and easily available source of micronutrients. Dehydration is one of the simplest strategies for preservation of green leafy vegetables particularly at household level. Dehydration technique makes the leaves a concentrated source of nutrients as well as improves their shelf life. Hence addition of small amounts of these foods in different dietary preparation is of immense value in meeting the daily micronutrient requirements. Results revealed that Drumstick and carrot leaves were accepted at 3% level of incorporation. Incorporation of 3 grams carrot or drumstick powder in ladoo, idli and cookies had an overall acceptability in range of 4.2-4.8 which proves that the product is well accepted. On consumption of 3 grams dried carrot or drumstick powder we get approximately 1178.4 µg and 1188 µg of β carotene respectively. The half to one third RDA of β carotene is 1200-800 µg for pregnant women, preschool and school going children and it can be fulfilled by consuming 6 ladoo, 4 idli and 8 cookies daily.

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EFFECT OF EMBROIDERY ON DRAPE OF FABRIC

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Effect of embroidery on drape characteristics of fabric has been assessed. Embroidered samples were prepared using six types of embroidery stitches with cotton thread. Commercially available two types of fabric were selected for embroidery. Placement of motifs was also varied. Drape characteristics such as % drape coefficient, number of nodes, shape of nodes and their regularity were determined. It was found that % drape coefficient increased after embroidery along with change in number of nodes and shape of nodes. Parameters like type of embroidery stitches, placement of motifs and fabric type affected drapability of fabric.

KEYWORDS: % drape coefficients, nodes, drape profile

Drape is the ability of fabric to fall under its own weight in to wavy folds. This unique behaviour provides graceful aesthetic effect in garment. It has been a device of special adornments in costumes. The drape relieves monotony of shape and enhances beauty of garment as well as its appreciation.

Drape of fabric depends upon type of weave, weight, thickness, stiffness and flexural rigidity (Hu and Chan, 1997; Stylois, 1998). It can also be modified by finishing (Pant, 2004).Effect of seam and seam allowance on drape of fabric has been studied by a number of researchers (Hu and Chuny, 1998; Sharrouf, 2007). Present study explores the effect of embroidery on drape of fabric.

Embroidery is one of the methods of applying decoration. It is the art of working ornamental design on cloth with decorative stitches. Embroidery can be done on different fabrics varying in thickness, weight, compactness, and fiber content. Whether the finished piece of embroidery is to be a delicate or coarse piece of work depends on the combination of threads, material and stitches. The embroidery is done on article of personal wear like kurta, dupatta, veil, sari, and skirt and dress material of all kinds. It can be done with hand or machine.

Many types of hand embroideries are used. Approximately 76 hand stitches (basic stitches and their variation) are used and today hand embroidery has reached its highest point of perfection. To the simplest garment, hand embroidery imparts a certain note of distinction.

As embroidery is a kind of surface enrichment technique, it may alter surface characteristic of the fabric. Embroidery incorporates extra threads in fabric which adds weight to the material. Weight of embroidered fabric will depend upon number of embroidery threads used (two or more than two), density of embroidery stitches (type of embroidery stitch) as well as placement of motif (whether all over the fabric or scattered).All these factors may influence drape of embroidered garment.

Based on the above aspects a study was planned to find out effect of hand embroidery on drape of fabric. Parameters like embroidery stitches, placement of motifs and fabric were varied.

METHODOLOGY

Material

Fabric: Two types of commercially available fabrics of plain weave were used – Mulmul and Georgette.

Embroidery thread: Cotton thread of anchor was used for embroidery on georgette and mulmul fabrics.

The preliminary data of weight / unit area, fabric count and thickness of fabrics have been given in Table 1.

Table 1: Preliminary data of fabric

Name of fabric	Weight (ounce/sq. yard)	Thickness(mm)	Fabric count	
			Warps/inch	Weft/inch
Mulmul	0.583	0.20	66	60
Georgette	1.30	0.35	64	60

Preparation of embroidery samples

Six types of stitches were selected to prepare embroidery samples. These were-running stitch, chain stitch, satin stitch, stem stitch, herringbone stitch and feather stitch. Stitches were selected keeping in view their characteristics such as flexibility, elasticity, tightness, looseness, firmness, compactness. Embroidery was done with two threads.

Suitable motifs were selected keeping in mind the types of embroidery. Placements of motifs were varied– scattered and all over.

Determination of drape characteristics of embroidered fabric

This was determined by IS: 8357-1977 method. Circular drape meter was used to measure fabric drapability. Percent drape coefficient, draped area, number, shape and regularity of nodes/folds were assessed.

RESULT AND DISCUSSION

Effect of embroidery stitches on drape characteristic of fabrics

Table 2 shows drape characteristic of georgette fabric which was embroidered with different stitches in random placement of motifs.

Table 2: Drape characteristics of embroidered georgette fabric with scattered placement of motifs

Name of embroidery stitch	Draped area (sq. inch)	No. of Nodes	% drape Coefficient
Control (unembroidered)	33.76	8	28.90
Running Stitch	37.23	7	37.10
Satin Stitch	37.46	7	33.65
Stem Stitch	39.61	6	42.37
Herringbone Stitch	37.69	7	38.19
Chain Stitch	36.69	8	35.83
Feather Stitch	36.46	7	35.28

It is clear that draped area increased after embroidery. This resulted in increase in percent drape coefficient in all the samples embroidered with different stitches. Georgette is soft and flexible. Binding of yarns by embroidery stitches imparted stiffness to the fabric as it affected free movement of yarns adversely. Thus change in flexibility of the fabric modified drape of the embroidered fabric. Results of earlier studies on effect of seam on drape show that seam distinctively affects stiffness and drape of the fabric. In this work embroidery stitches were used which had similar effect on drape of fabric.

Maximum increase was found in fabric embroidered with stem stitch. Lowest increase was found in fabric embroidered with satin stitch. Satin stitch incorporated highest (maximum) number of threads in the fabric which increased weight of the fabric significantly. Increase in weight decreased draped area as fabric tries to come closer. Stem stitch is quite firm. It firmly bounded yarns of georgette fabric. This may be the reason of highest increase in % drape coefficient of fabric embroidered with this stitch.

Table 2 shows that number of nodes decreased in embroidered georgette fabric. Increase in draped area resulted in mutual cancellation of bends causing decrease in number of nodes. Data given in Table 3 shows effect of scattered placement of embroidered motifs on drape ability of mulmul fabric.

Table 3: Drape characteristics of embroidered mulmul fabric with scattered placement of motifs

Name of embroidery stitch	Draped area (sq. inch)	No. of Nodes	% drape Coefficient
Control (unembroidered)	43.92	6	52.91
Running Stitch	48.46	7	53.64
Satin Stitch	42.07	8	48.52
Stem Stitch	44.84	5	55.09
Herringbone Stitch	46.15	8	58.18
Chain Stitch	44.69	7	54.73
Feather Stitch	44.69	7	59.46

Draped area and percent drape coefficient of mulmul fabric also increased after embroidery. Lowest increase in drape coefficient was found in fabric embroidered with satin stitch. This trend is similar to georgette fabric. Mulmul fabric embroidered with herringbone and feather stitch also showed more increase as compared to other stitches. Number of nodes decreased after doing embroidery. This trend is also similar to georgette fabric.

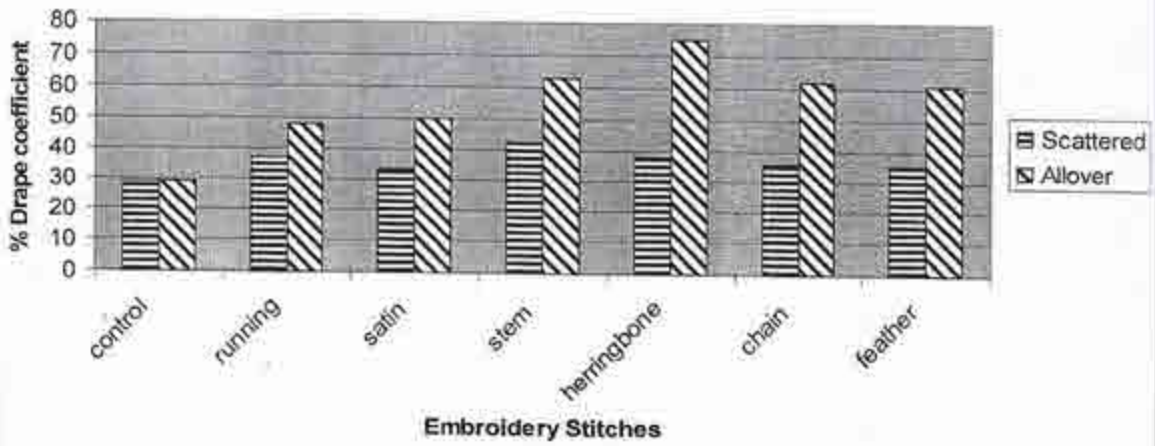
Table 4 shows effect of all over placement of embroidery motifs on drapability of georgette fabric. Increase in percent drape coefficient is lowest in fabric embroidered with running stitch. This stitch is loose and open, so did not bring about much change in softness of georgette. Satin stitch caused less increase in drape coefficient than other stitches. Highest increase in percent drape coefficient of georgette fabric embroidered with herringbone stitch was seen. Number of nodes decreased in the embroidered georgette fabric.

Table 4: Drape Characteristics of embroidered georgette fabric with all over placement of motifs

Name of embroidery stitch	Draped area (sq. inch)	No. of Nodes	% drape Coefficient
Control (unembroidered)	33.76	8	28.90
Running Stitch	41.84	7	48.00
Satin Stitch	46.07	7	50.00
Stem Stitch	48.15	6	62.91
Herringbone Stitch	59.84	3	90.54
Chain Stitch	47.84	6	62.18
Feather Stitch	47.38	8	61.09

Effect of placement of motifs on drape of fabric

Fig 1: Effect of placement of motifs on % drapecoefficient of embroidered fabric

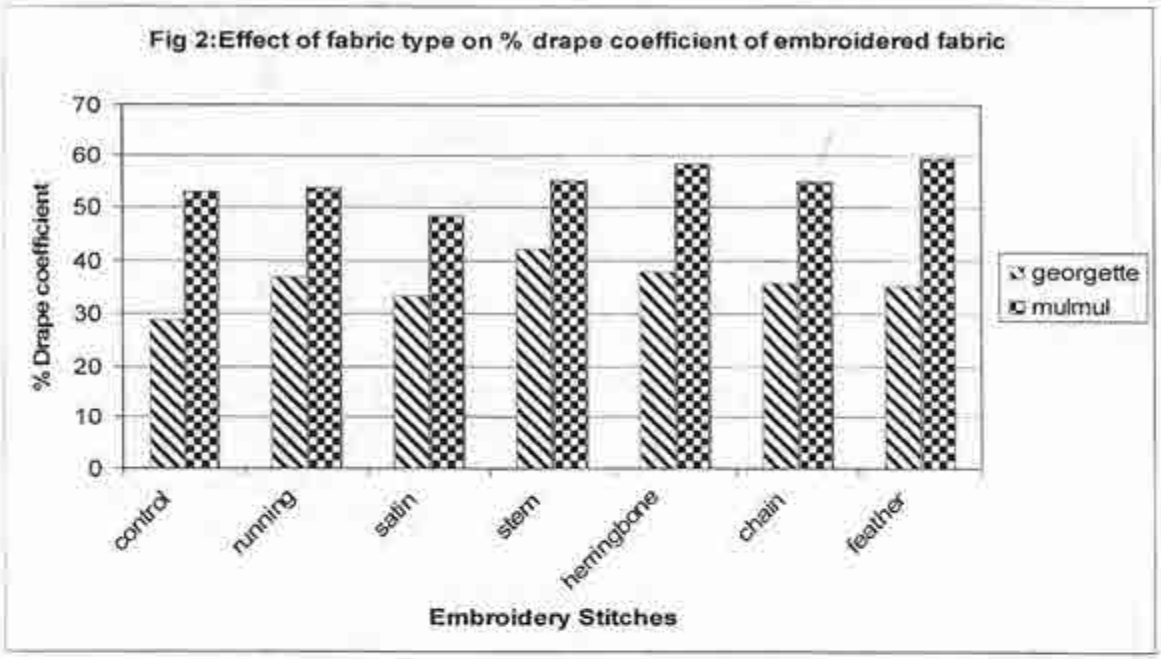


It is evident from figure 1 that placement of motif affected drape of the fabric. Increase in percent drape coefficient is significantly higher in fabric in which motifs were placed all over in comparison to the fabric with scattered placement of motifs.

There are greater numbers of stitches in all over placement. The increase in density of stitches made fabric all the more stiff which increased draped area. Binding of yarns is higher in all over placement of embroidery motifs. This affected softness of the fabric badly.

Effect of fabric on drape

Comparison of drape characteristic of georgette and mulmul with scattered placement of motifs (Table 2 and 3; and figure2) show that percent drape coefficient of control (unembroidered plain) georgette fabric is less than that of mulmul fabric.



Thus drapability of georgette is better than mulmul fabric. This is because of combined effect of flexibility as well as weight of georgette so it drapes closer. Drape profiles of embroidered georgette and mulmul fabrics with scattered placement of motifs and all over placement showed that numbers of nodes were more in georgette than in mulmul fabric. Arrangement of nodes was also more even/regular in georgette fabric. On the other hand embroidered mulmul gave irregular folds. Folds were deep in georgette (wave like) whereas they were shallow in mulmul fabric (ripple like).

CONCLUSION

Thus it can be said that drapability of fabric changed after embroidery. Factors like type of embroidery stitches, placement of motifs as well as type of fabric affected drape characteristic. Embroidery and its parameters can be utilized by garment designers to change drape characteristics of embroidered garments to provide new look to garment.

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EFFECT OF PROCESSING ON TOTAL MINERAL AND HCL-EXTRACTABLE MINERAL CONTENT OF CHICKPEA VARIETIES

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Legumes are rich and less expensive sources of dietary protein and contribute substantial amount of protein in diets of large part of world's population. Chickpea (*Cicerarietinum*) is a good source of carbohydrate, protein, minerals and trace elements and its protein quality is similar to or better than other legumes such as pigeon pea, black gram and green gram. In the present investigation the affect of processing methods on total mineral and HCl-extractable minerals like calcium, iron and phosphorus was determined. Minerals are generally present in association with the phytic acid in plant foods which may be responsible for their lower extractability. HCl-extractable minerals are those minerals which are soluble in 0.03N HCl, the concentration of HCl found in human stomach. The amount of HCl-extractable minerals in food indicated an index of their bioavailability from the food. The total calcium, iron and phosphorus content of raw chickpea varieties ranged from 137.00 to 159.50, 5.33 to 6.67 and 229.47 to 270.17mg/100g respectively. The HCl-extractable calcium, iron and phosphorus content of raw chickpea varieties ranged from 46.33 to 64.43, 43.29 to 46.50 and 53.53 to 58.41 mg/100g respectively. Five varieties of chickpea were subjected to various processing methods viz. soaking, dehulling and germination. Processing decreased mineral content whereas a remarkable increase in the HCl-extractability of mono, divalent and trivalent ions like calcium, iron and phosphorus was observed. The total mineral content decreased after all processing and minimum loss was observed in soaking followed by dehulling and germination. Increase in the HCl-extractability of minerals was maximum in germination of chickpea followed by dehulling and soaking.

KEY WORDS: Legumes; Chickpea; Total minerals; HCl-extractability; Processing

Food legumes are crops of the family *Leguminosae* also called *Fabaceae*. Worldwide these are mainly grown on large area for their edible seeds and thus are called grain legumes. These are produced and widely consumed throughout the world particularly in tropical and sub-tropical areas of Africa, Asia and Latin America (Gupta *et al*., 2005).

Chickpea is the 3rd most important pulse crop in the world. Chickpea (*Cicerarietinum*) is a legume and a native of Mediterranean region. The name '*Cicer*' is derived from Greek word 'kikus' that means force or strength. Chickpea is a *rabi* crop sown from November to December and harvested from February to March. The seeds of chickpea contain high level of carbohydrates i.e., 41.10 to 47.42 per cent and protein i.e., 21.70 to 23.40 per cent. Chickpea seed has high protein digestibility, contains high level of complex carbohydrates, is rich in vitamins and minerals and has relatively less anti nutritional factors (Muzquiz and Wood, 2007; Wood and Grusak, 2007).

Plant based diets are often associated with micronutrient deficits, exacerbated in part by poor micronutrient bioavailability. In India, the most common domestic methods used for processing of legumes include soaking, for different periods, dehulling and germination etc. These processing treatments have been reported to be beneficial for enhancing the nutritive value of

various food legumes, as they reduce the content of anti nutritional factors and improve the digestibility of carbohydrate and protein (Kataria, 1986; Bishnoi *et al.*, 1993). The present study was undertaken to assess the effects of various processing techniques on the mineral composition of chickpea varieties.

MATERIALS AND METHODS

Materials: Five varieties of chickpea, namely HC-1, HC-5, H07-3, H-208 and C-235, were procured in a single lot from the Pulse section, Department of Plant Breeding, College of Agriculture, CCS Haryana Agricultural University, Hisar. The seeds were cleaned and made free of dust, dirt and foreign materials prior to processing and product development. All the processing and estimations were done in triplicate.

Moisture in the samples was estimated by employing the standard methods of analysis (AOAC, 2000).

Procedure : Five gram sample was weighed in a petri dish and dried in an oven at 60°C temperature for six hours or till a constant weight was obtained. The sample was weighed after cooling it in a desiccator.

$$\text{Moisture (\%)} = \frac{\text{Loss in weight}}{\text{Weight (g) of sample}} \times 100$$

Soaking

The cleaned chickpea seeds were soaked in distilled water (1:4 w/v) for 12 hours at room temperature, and then washed and rinsed with distilled water.

Dehulling

After soaking the seeds overnight (12 hours), hulls were removed manually.

Germination

Soaked seeds (12 hrs) were kept in petri dishes lined with wet filter paper for germination in an incubator at 37°C for 24 hours. Seeds were kept moist by sprinkling distilled water frequently.

Total Minerals: Calcium and iron in acid digested samples were determined according to the method of Lindsey and Norwell (1969). Phosphorus was determined colorimetrically by using the method of Chen *et al.* (1956).

Extraction: To one gram sample 25-30 ml of diacid mixture (HNO_3: $HClO_4$: 5:1, v/v) was added and kept overnight. The contents were digested by heating until clear white precipitates settled down at the bottom. The volume made to 50 ml with double distilled water. The crystals were filtered (Whatman No. 42) and used for the determination of total calcium, iron and phosphorus.

HCl-extractable mineral were assessed by employing the method of Peterson *et al.* (1943). Minerals including calcium, iron and phosphorus were extracted in 0.03 HCl to assess availability of these minerals in the samples.

Extraction: To one gram sample 50ml, 0.03N HCl was added and incubated at 37° in a water bath for 3 hours with constant stirring to stimulate condition of human stomach. At the end of incubation period, the mixture was filtered through an ashless filter paper (Whatman No. 42) and the filtrate was analyzed for minerals including calcium, phosphorus and iron.
Availability of minerals: Calcium and iron were determined by Atomic Absorption Spectrophotometer AABQ-20 and phosphorus was estimated colorimetrically.
Statistical analysis: Suitable standard statistical methods were used for analysis of data.

RESULTS AND DISCUSSION

Total minerals

Calcium: The calcium content of chickpea varieties is presented in Table 1. The total calcium of chickpea varieties ranged from 137.00 to 159.50 mg/100g. Calcium content in soaked chickpea varieties ranged from 120.67 to 141.33 mg/100gand per cent decrease ranged from 10.04 to 14.31. Significant ($P \leq 0.05$) reduction in calcium content was observed after soaking. The decrease in calcium content in soaking can be corroborated with the findings of other workers (Duhan *et al.*, 2001; Duhan *et al.*, 2004; El-maki *et al.*, 2007). Calcium content in dehulled chickpea ranged from 103.83 to 123.00 mg/100g.Highest (25.39%) and lowest (20.01%) decrease in calcium content was observed in HC-1 and H-208, respectively. The observed pattern of reduction in calcium content are in consistence with results reported by workers (Negi and Boora, 2003; Wang *et al.*, 2008). In germinated chickpea calcium content varied from 104.67 to 120.33 mg/100g. Germination decreased calcium content significantly ($P \leq 0.05$) in all chickpea varieties. Per cent reduction ranged from 24.32 to 31.07 in germinated chickpea varieties. After germination calcium content was observed to decrease significantly ($P \leq 0.05$). Similar results have been reported by Akinyele and Akinlosotu (1991) and Duhan *et al.* (2004) in other legumes.

Table 1: Effect of processing on calcium content of chickpea varieties (mg/100 g, on dry weight basis)

Treatment	Variety					Mean
	HC-I	HC-5	H-208	C-235	H07-3	
Raw	147.00±1.53	137.00±1.04	152.10±1.49	143.77±1.12	159.50±0.76	147.87±2.08
Soaked (12h)	128.83±0.88 (-12.36)	120.67±1.88 (-11.91)	130.33±2.91 (-14.31)	129.33±0.93 (-10.04)	141.33±0.73 (-11.39)	130.09±1.87
Dehulled	109.67±0.72 (-25.39)	103.83±0.88 (-24.21)	121.67±0.93 (-20.01)	111.67±0.19 (-22.33)	123.00±0.29 (-22.89)	113.97±0.47
Germinated (24 h)	108.67±1.36 (-26.07))	104.67±1.59 (-24.32)	104.83±0.88 (-31.07)	114.08±1.32 (-26.02)	120.33±1.20 (-24.56)	110.32±2.88
CD($P \leq 0.05$)	Variety : 1.54		Treatment : 1.83		Interaction : 4.09	

Values are mean ± SE of three observation

Iron: The iron content of chickpea varieties is presented in Table 2. The iron content in raw chickpea varied from 5.33 to 6.67 mg/100g. Iron content ranged from 4.98 to 6.27 mg/100g in soaked chickpea varieties. Soaking reduced iron content significantly ($P \leq 0.05$) in chickpea varieties. Per cent reduction in iron content varied from 4.50 to 11.09 in soaked chickpea

varieties. Reduction of 12-16 per cent (Negi and Boora, 2003) and 3 per cent (Kaushik *et al.*, 2010) iron content has been reported after soaking. In dehulled chickpea iron content varied from 4.58 to 5.87 mg/100g. Iron content decreased significantly ($P \leq 0.05$) after dehulling in all chickpea varieties. Per cent reduction in iron content ranged from 11.46 to 14.56 in dehulled chickpea varieties. Highest (14.56%) reduction was observed in H-208 and lowest (11.46%) in H07-3. The results are in close agreement with those earlier workers (Duhan *et al.*, 2001; Negi and Boora, 2003). Iron content in germinated chickpea varieties ranged from 3.77 to 5.10 mg/100g. A significant ($P \leq 0.05$) reduction in iron content was observed in germinated chickpea varieties. Per cent reduction in iron content in germinated chickpea varieties varied from 18.83 to 29.27. A slight decrease in iron content after germination has been reported in chickpea by Saharan *et al.* (2002). Similar results have also been reported by Akinyele and Akinlosotu (1991) and Duhan *et al.* (2004) in some other pulses.

Table 2: Effect of processing on iron content of chickpea varieties (mg/100 g, on dry weight basis)

Treatment	Variety					Mean
	HC-I	HC-5	H-208	C-235	H07-3	
Raw	5.33±0.44	6.67±0.44	5.42±0.36	6.0±0.29	6.63±0.33	6.01±0.21
Soaked (12 h)	4.98±0.27 (-6.56)	5.93±0.49 (-11.09)	5.13±0.46 (-5.35)	5.73±0.37 (-4.50)	6.27±0.27 (-5.42)	5.70±0.21
Dehulled	4.58±0.07 (-14.07)	5.79±0.37 (-13.19)	4.63±0.36 (-14.56)	5.17±0.20 (-13.83)	5.87±0.59 (-11.46)	5.21±0.21
Germinated (24 h)	3.77±0.04 (-29.27)	5.10±0.07 (-23.54)	3.92±0.73 (-27.67)	4.87±0.10 (18.83)	4.82±0.06 (-27.30)	4.48±0.14
CD($P \leq 0.05$) Variety : 0.29 Treatment : 0.34 Interaction : 0.77						

Values are mean ± SE of three observation

Phosphorus: Data on phosphorus content in chickpea varieties is presented in Table 3. The phosphorus content in raw chickpea varieties ranged from 229.47 to 270.17 mg/100g. Urga *et al.* (2005) reported phosphorus content in the range of 233.92 to 432.65 mg/100g in grass pea. In mung bean, the phosphorus content was reported as 391.00 mg/100g by Mubarak (2005). Phosphorus content in soaked chickpea varieties ranged from 223.03 to 259.03 mg/100g. Significant ($P \leq 0.05$) reduction in phosphorus content was observed after soaking. Per cent reduction in phosphorus content ranged from 2.81 to 4.93 in soaked chickpea varieties. Phosphorus content in dehulled chickpea ranged from 207.46 to 243.53 mg/100g. Dehulling reduced phosphorus content significantly ($P \leq 0.05$) in chickpea varieties. Per cent reduction in phosphorus content ranged from 6.79 to 12.86 in dehulled chickpea varieties. In germinated chickpea phosphorus content varied from 192.97 to 223.13 mg/100g. Germination decreased phosphorus content significantly ($P \leq 0.05$) in all chickpea varieties and per cent reduction ranged from 11.76 to 19.80. Phosphorus content decreased significantly ($P \leq 0.05$) upon soaking and dehulling (Duhan *et al.*, 2001).

Table 3: Effect of processing on phosphorus content of chickpea varieties (mg/100 g, on dry weight basis)

Treatment	Variety					Mean
	HC-I	HC-5	H-208	C-235	H07-3	
Raw	250.50±1.72	270.17±1.36	229.47±3.91	255.43±1.37	245.33±1.34	250.18±3.
Soaked (12h)	242.40±3.35 (-3.23)	259.03±3.53 (-4.12)	223.03±3.41 (-2.81)	242.93±0.97 (-4.89)	233.23±2.41 (-4.93)	239.32±5.38
Dehulled	230.63±0.90 (-7.93)	243.53±4.63 (-9.86)	207.46±0.84 (-9.59)	222.57±1.74 (-12.86)	231.13±1.41 (-6.79)	223.86±3.63
Germinated (24 h)	216.62±0.31 (-13.52)	223.13±0.88 (-17.41)	192.97±0.30 (-15.90)	204.57±0.34 (-19.80)	216.47±1.68 (-11.76)	208.75±2.68
CD(P≤0.05)	Variety : 1.95		Treatment : 2.31		Interaction : 5.17	

Values are mean ± SE of three observation

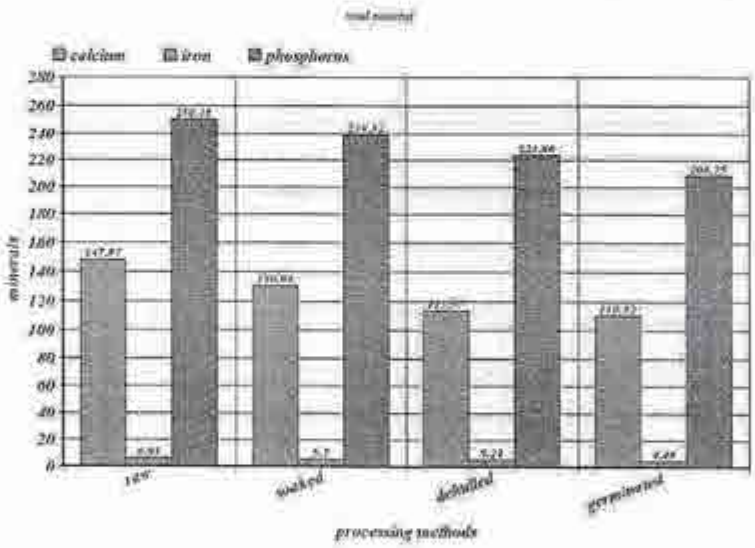

Fig 1: Total mineral content in raw, soaked, dehulled and germinated chick peas

HCl-extractable Calcium: The HCl-extractability of calcium in raw chickpea seeds ranged from 46.33 to 64.43 mg/100g and is presented in Table 4. Soaking increased extractability of calcium significantly and it ranged from 66.01 to 80.79 mg/100g. Per cent increase in HCl-extractable calcium ranged from 20.25 to 37.22. Highest (37.22%) increase was observed in H07-3. During Dehulling HCl-extractable calcium ranged from 76.32 to 86.01 mg/100g. Significant (P≤0.05) improvement in extractability of calcium was observed after dehulling. Per cent increase ranged from 25.09 to 42.41 in dehulled chickpea. HCl-extractable calcium of germinated chickpea ranged from 95.12 to 103.02 mg/100g. Significant (P≤0.05) increase in calcium extractability were observed after germination in all chickpea varieties except in H-208 and H07-3 which have almost similar value of extractable calcium and showed non-significant differences. Per cent increase in extractable calcium of germinated chickpea ranged from 37.46 to 53.10. Significant (P≤0.05) increase in extractable calcium was observed in HC-1, HC-5 and C-235.

Table 4: Effect of processing on HCl-extractability of calcium in chickpea varieties (mg/100g, on dry weight basis)

Treatment	Variety					Mean
	HC-I	HC-5	H-208	C-235	H07-3	
Raw	56.12±0.12	64.43±0.12	47.96±0.36	49.26±0.17	46.33±0.17	52.82±1.79
Soaked (12h)	78.84±0.26 (+28.80)	80.79±0.32 (+20.25)	66.01±0.28 (+27.34)	69.75±0.35 (+29.38)	73.80±0.22 (37.22)	73.84±1.47
Dehulled	80.90±0.24 (+30.63)	86.01±0.24 (+25.09)	76.32±0.18 (+37.16)	79.47±0.19 (+38.01)	80.45±0.25 (+42.41)	80.63±0.84
Germinated (24 h)	99.81±0.22 (+43.77)	103.02±0.39 (37.46)	98.63±0.10 (+51.37)	95.12±0.13 (+48.21)	98.79±0.42 (+53.10)	99.07±0.68
CD(P≤0.05) Variety : 0.26 Treatment :0.31 Interaction : 0.70						

Values are mean ± SE of three observation

HCl-extractable iron: The HCl-extractability of iron in raw chickpea seeds ranged from 43.29 to 46.50 mg/100g. Results are presented in Table 5. Extractable iron in soaked chickpea ranged from 53.50 to 56.41 mg/100g. Soaking improved extractability of iron significantly (P≤0.05).Per cent increase in soaked chickpea ranged from 15.79 to 21.17. Highest (21.17%) and lowest (15.79%) increase in HCl-extractable iron was observed in H07-3 and H-208, respectively. Duhan *et al.* (2001) observed 12.5 per cent increment in HCl-extractable iron after soaking in chickpea. The extractability of iron ranged from 56.13 to 59.91 mg/100g in dehulled chickpea. Significant (P≤0.05) increase in extractability of iron was observed after dehulling. Per cent increase in dehulled chickpea ranged from 18.88 to 26.34. Duhan *et al.* (2004) reported increase in HCl-extractable iron after dehulling in chickpea. Extractable iron of germinated chickpea ranged from 73.16 to 76.93 mg/100g. Significant (P≤0.05) increase in extractable iron was observed after germination. Per cent increase ranged from 37.64 to 43.73 in germinated chickpea.

Table 5: Effect of processing on HCl-extractability of iron in chickpea varieties (mg/100g, on dry weight basis)

Treatment	Variety					Mean
	HC-I	HC-5	H-208	C-235	H07-3	
Raw	43.29±0.17	44.59±0.05	45.53±0.39	46.50±0.27	44.47±0.25	44.88±0.30
Soaked (12 h)	53.50±0.17 (+19.08)	54.25±0.19 (+17.81)	54.07±0.38 (+15.79)	55.40±0.50 (+16.06)	56.41±0.06 (+21.17)	54.73±0.79
Dehulled	58.77±0.31 (+26.34)	56.43±0.19 (+20.98)	56.13±0.12 (+18.88)	57.83±0.18 (+19.59)	59.91±0.19 (+25.77)	57.82±0.39
Germinated (24 h)	76.93±0.07 (+43.73)	73.16±0.18 (+39.05)	74.82±0.15 (+39.45)	74.57±0.19 (+37.64)	75.84±0.21 (+41.36)	75.06±0.34
CD(P≤0.05) Variety :0.22 Treatment : 0.26 Interaction : 0.59						

Values are mean ± SE of three observation

HCl-extractable phosphorus: The HCl-extractability of phosphorus in raw chickpea ranged from 53.53 to 58.41 mg/100g as presented in Table 6. In soaked chickpea HCl-extractable phosphorus ranged from 58.39 to 62.77 mg/100g. Soaking of chickpea increased HCl-

extractability of phosphorus and per cent increase in soaked chickpea ranged from 3.85 to 8.72. HCl-extractable phosphorus in dehulled chickpea ranged from 62.73 to 65.47 mg/100g. Significantly ($P \leq 0.05$) higher HCl-extractable phosphorus was observed in C-235. Per cent increase ranged from 7.38 to 18.24 in dehulled chickpea varieties. Duhan *et al.* (2004) reported increment of 24.4 per cent HCl-extractable phosphorus in pigeon pea after dehulling. Extractable phosphorus in germinated chickpea ranged from 69.36 to 72.58 mg/100g. Germination significantly ($P \leq 0.05$) improved HCl-extractable phosphorus in chickpea. Per cent increase ranged from 17.45 to 26.25 in germinated chickpea varieties. Highest (26.25%) increase in HCl-extractable phosphorus was observed in C-235 and lowest (17.50 %) in HC-5.

Minerals are generally presented in association with the phytic acid in plant foods which may be responsible for their lower extractability. Decrease in the level of phytic acid by processing methods may possibly release these ions in free form and may account for their increased HCl-extractability.

Table 6: Effect of processing on HCl-extractability of phosphorus in chickpea varieties (mg/100g, on dry weight basis)

Treatment	Variety					Mean
	HC-I	HC-5	H-208	C-235	H07-3	
Raw	58.41±0.09	58.23±0.11	57.39±0.09	53.53±0.11	56.39±0.14	55.99±0.49
Soaked (12 h)	61.63±0.23 (+5.23)	62.77±0.24 (+7.23)	59.69±0.06 (+3.85)	58.39±0.19 (+8.72)	58.66±0.12 (+3.87)	58.23±0.42
Dehulled	63.53±0.29 (+8.06)	62.87±0.05 (+7.38)	62.73±0.08 (+8.51)	65.47±0.21 (+18.24)	63.59±0.15 (+11.32)	63.64±0.27
Germinated (24h)	72.56±0.18 (+19.50)	70.54±0.11 (+17.50)	71.26±0.15 (+19.46)	72.58±0.12 (+26.25)	69.36±0.11 (+18.69)	71.26±0.33
CD($P<0.05$)	Variety :0.18		Treatment : 0.21		Interaction : 0.48	

Values are mean ± SE of three observations.

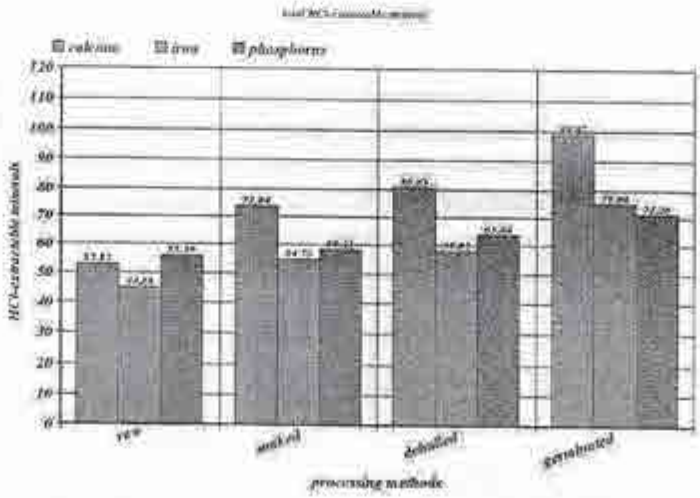

Fig 2: Total HCl extractable mineral content in raw, soaked, dehulled and germinated chick peas

CONCLUSION: It can therefore be concluded that all the processing methods significantly affected total mineral and HCl-extractable mineral content in chickpea. Total mineral content decreased slightly by all processing techniques, soaking showed minimum losses. Germination showed higher improvement in HCl-extractable minerals, followed by dehulling and soaking.

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PREPARATIONS OF GLUTEN FREE FLOUR FOR CELIAC DISEASE PATIENT AT HOUSE HOLD LEVEL

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Celiac disease (CD) or gluten-sensitive enteropathy (GSE) is a genetically based autoimmune disease. The only acceptable treatment for celiac disease is strict adherence to a 100% gluten-free diet for life. The broad objective of the study was to nutritional evaluation of the prepared gluten free flour through the chestnut and rice. The nutrient analysis included moisture, ash, protein, fiber, fat and carbohydrates. The result revealed that the chestnut flour was rich in fat and fiber whereas the rice flour was rich in the protein ash and carbohydrate so nutrient content of combination flour was better than chestnut and rice flour. Therefore these prepared nutrient rich gluten free flour can be utilized as a basic ingredient for food recipes in future to provide an alternate to the patient of celiac disease to fulfill their nutrient requirements.

KEY WORDS: CD- Celiac disease, GSE- Gluten-sensitive enteropathy

While celiac disease is estimated to affect about 1% of the world's population, it is thought to be uncommon not only in India but in Asia also. There is a lack of studies on the prevalence of celiac disease from Asian nations. The prevalence of celiac disease in this north Indian community is 1 in 96. Celiac disease is more common than is recognized in India (Makharia et al, 2011). The Indian scenario itself is not well reported; in the northern part of India it forms a staple diet. Unfortunately, wheat and its close relatives, because of their content of "gluten", cause celiac disease, which is the best recognized form of gluten allergy. The yearly increase in the number of patients diagnosed with celiac disease appears alarming. Projections of this trend from our hospital data to the years 2010 and 2020 indicate an enormous increase in its incidence (Sood et al 2001).

Celiac disease is a digestive disease that damages the small intestine and interfere the absorption of nutrients from food. When the consumption of gluten takes place, the immune system reacts to the protein which gradually damages the villi in the small intestine. When the villi are damaged, the body is unable to absorb the vitamins minerals and other nutrients it needs to stay healthy (Feighery, 1999).The common symptoms are diarrhea, weight loss, and a lack of appetite. These symptoms occur because the immune system responds abnormally to a protein found in certain foods, like wheat, rye, barley, and their prepared products. The only acceptable treatment for celiac disease is strict adherence to a 100% gluten-free diet for life (Case, 2005).So, it is necessary to provide gluten free diet to the celiac patients to reduce the chance of complications. Chestnuts(alternative names of chestnuts are -water caltrop, water chestnut, buffalo nut, bat nut, devil pod, Singhara) as with all plant foods, contain no cholesterol and contain very little fat, mostly unsaturated, and no gluten (Klausner, 2000).

CHESTNUTS **BOILED CHESTNUTS**

Rice starches are widely available and offer potential in the formulation of gluten-free baked products (Eliasson & Larsson, 1993). People who are allergic to wheat will not have problems with rice (Prepared Foods, 1993). Hence, effort would be turn to explore and investigate the nutritional composition of gluten free flour, which are nutrients dense and can fulfill the requirement of the patients suffering from celiac disease to avoid the development of other deficiency diseases.

The main objective of the study was to estimate the nutrient content of prepared gluten free flour at household level by using chestnut and rice.

METHODOLOGY

Sample collection and sample preparation

The whole chestnut and basmati rice were collected from local market of Jaipur. The samples were washed and dried. The dried chestnut and Basmati rice were ground to a fine powder to make it flour and stored in air tight container for further analysis.

Proximate analysis

The proximate analysis (moisture, ash, protein, fiber, fat and carbohydrates) of all the flour samples was determined. The moisture content was determined using the oven method described by standard official methods of analysis of the AOAC (1984). The ash content was determined using the method reported in the handbook of AOAC (1984).The fat was determined using Soxhlet extraction method of AOAC (1984). The protein content of the samples was determined using the Micro Kjeldahl method of AOAC (1984). Crude fiber was determined in the sample using the standard methods of analysis of the AOAC (1984). Total percentage carbohydrate content was determined by the difference method as described by Edeogu et al. (2007).

As mentioned above Chestnuts and Rice does not contain gluten so estimation of gluten content did not require.

RESULTS AND DISCUSSION

The result of proximate analysis showed variation in concentration/proportions of biochemical (carbohydrate, fats and protein) and other contents (ash, fiber, moisture). Looking at the results of carbohydrate composition of prepared flour, it was found highest in the rice flour followed by combination flour and chestnut flour. The result depicted in the Table no 1 revealed that the value of carbohydrate in chest nut flour (77.09%) was higher as compared to the value reported in the study of Noitang et al (2009) on proximate analysis of China chestnut seeds, S. monosperma, that it was contained mostly carbohydrate 73.7% .While analyzing the fiber contents of prepared flour, chestnut flour had highest fiber composition (5.12%) and lowest value was found in rice flour (1.30%). On the other hand, intake of dietary fibers can lower the serum cholesterol level, risk of coronary heart disease, hypertension, constipation, diabetes, colon and breast cancer (Ishida et al., 2000). Dietary Recommendations for dietary fiber is 38 and 25 g/day for men and women of age 19-50, respectively (Institute of Medicine, 2002). The Food Guide Pyramid recommends 6-11 servings of Grains and starches in our daily diet. Nutritionally, chestnuts are similar to whole grains and offer a sweet, subtle flavor(Klausner,2000).Thus chestnut flour could be valuable sources of dietary fiber in the diet of celiac disease patient and protect form various diseases also. The ash content, which is an index of mineral contents in biota, was high in rice flour followed by combination flour and chest nut flour. The concentration of fat in prepared flour varied greatly and ranged between 0.86 and 4.37%.Chest nut flour obtained highest value (4.37%) and rice flour was obtained lowest value (0.86%). Flour samples were evaluated for protein content and results are shown in Table no1. The minimum percentage of protein content of flour was observed as 6.45 in chestnut flour and the maximum 7.13.in rice flour. The highest percentage of moisture was found in rice flour(6.30%) as comparison to other flour. Moreover, the results of proximate analysis of rice flour in the present study was slightly lower than reported by Prepare Foods(1993),that Rice is approximately 87% carbohydrates, 7 to 8% proteins and very low in fat.

Table No 1: Proximate composition of chestnut flour, rice flour and combination of chestnut + rice flour (50:50)

Proximate composition (g/100g)	Chestnut flour	Rice flour	Combination Flour (Rice: Chestnut) 50:50
Moisture (g)	6.01	6.30	5.91
Ash (g)	0.98	1.01	0.99
Crude fiber(g)	5.12	1.30	4.72
Protein (g)	6.45	7.13	7.02
Fat (g)	4.37	0.86	3.17
Carbohydrates(g)	77.09	83.40	78.19

Absence of gluten, low levels of sodium and high amounts of easily digested carbohydrate are all properties of rice, which are desirable for special diets (Eliasson & Larsson, 1993).

CONCLUSIONS

The chestnut flour was rich in fat and fiber whereas the rice flour was rich in the protein ash and carbohydrate so nutrient content of combination flour prepared by both of them was higher as compared to chestnut and rice flour alone. Therefore this nutrient rich gluten free flour would be utilized in future in place of wheat flour for making delicious recipes to provide an alternate to the patient of celiac disease to fulfill their nutrient requirements and gives the satiety to their diet also.

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ONSET OF TYPE 1 DIABETES IN A CHILD WITH HYPOTHYROIDISM: A CASE STUDY

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Type 1 diabetes mellitus in children and adolescents often present with autoimmune thyroid disorders. Thyroid disorders can have a major impact on glucose control. Studies have found that diabetes and thyroid disorders tend to coexist in patients. Both conditions involve a dysfunction of the endocrine system. **Objectives:** To know the case thoroughly since this is an interesting and rare case. **Methods and Results:** Case was selected in Sagar Hospitals in- patient service with the consent of the patient's parents. Present history was collected from the parents and past medical history from hospital medical records. The child was observed daily and studied till the discharge. Diabetic education was given to the parents along with the child in a series of classes. She was given a diet sheet according to insulin action along with discharge summary. **Discussion:** This child had hypothyroidism for the past 3.3 yrs and was on treatment. She presented with severe weakness, loss of weight and increasing hunger when she was admitted with diabetic ketoacidosis. **Conclusion:** Children treated for hypothyroidism need periodic and regular screening for diabetes mellitus is recommended.

Type 1 diabetes mellitus in children and adolescents often present with autoimmune thyroid disorders .Thyroid diseases and diabetes mellitus are the two most common endocrine disorders encountered in clinical practice. Diabetes and thyroid disorders have been shown to mutually influence each other and associations between both conditions have long been reported. (Krishna *et.al*, 2012)

On one hand, thyroid hormones contribute to the regulation of carbohydrate metabolism and pancreatic function, and on the other hand, diabetes affects thyroid function tests to a variable extent. Thyroid function is affected in diabetes. Hypothyroidism among diabetics has been frequently encountered. Asymptomatic thyroid dysfunction is one of the more common occurrences in the diabetic population particularly in type 1 diabetes (IDDM) (Shomom M, 2003)

Hypothyroidism is found in about 3% of patients with type 1 diabetes. Moreover, 13 to 20% of Type 1 diabetic patients have elevated blood TSH levels and anti-thyroid antibodies. Thyroid microsomal (peroxidase) antibodies are present in 5 to 40% of type 1 diabetes patients, and significant numbers of these patients present with or develop thyroid dysfunction. (Umpierrez *et al*, 2003)

Studies have found that diabetes and thyroid disorders tend to coexist in patients. Both conditions involve a dysfunction of the endocrine system. Thyroid disorders can have a major impact on glucose control, and untreated thyroid disorders affect the management of diabetes in patients (Patricia, 2000).

Name: xxx **Age:** 9.6 yrs **Gender:** Female
Date of Birth: 12.10.2002 **Birth wt:** Unknown
Adopted child [when 3 months old]
Milestones: Normal **Immunization:** Normal according to schedule
Occupation: Primary School - 4th Standard [bright student]
Presenting Complaints: Weakness, Polydypsia, polyuria since 15 days, excessive fatiguability, H/O Weight loss 3.5 kg in last 15 days. No fever, altered sensorium. No H/O pain abdomen.
Chief complaints: Generalised weakness, polyurea, polydypsia, decreased intake, conscious, not active, loss of appetite - 15days, neurologically normal, anemic, dehydration, general condition normal, oedma – nil, no abdominal pain,
Diagnosis: Diabetic Ketoacidosis and Hypothyroidism
Past Medical History : K/C/O Hypothyroidism, H/O scabies, Hypochromatic microcytic anaemia.
Van Wyk Grumbach syndrome: (Van Wyk and Grumbach described a syndrome of juvenile hypothyroidism, precocious puberty and ovarian enlargement. These findings undergo complete regression with thyroid hormone replacement therapy. This diagnosis can be made on the basis of imaging findings and thyroid function analysis).
Upper Respiratory Tract Infection – admitted in the hospital at 5 yrs 1 month age.
Mother Noted: Rashes on the skin, loss of scalp hair, Excess sleep, increased wt gain esp, abdominal fat, Symptoms of withdrawal
On medication: Sever Hypothyroidism On 12.08.2007 Thyroxine 75 mcg 1-0-0

Table 1: Van Wyk Grumbach syndrome

Date	Age Y M	Symptoms	Tests	Treatment
29.10.2008	6	1st episode of p.v bleeding spotting for 5 -6 days. White discharge	Did not come to hospital	Not following treatment
31.12.2008	6.2	2nd episode of p.v bleeding spotting 10 – 11 days white discharge Puffed up face, dry scaly skin Ankle jerks charecterstically Knee jerks brisk ++	Thyroid enlarged No nodules seen or felt	Thyroxine 75 mcg 1-0-0
24.02.2009	6.4	3rd episode of bleeding 13 days spotting	LFT Normal Urine analysis Normal	Thyroxine 75 mcg 1-0-0 - 6/7 Thyroxine 75 mcg 1-0-0- 1/7
26.05.2009	6.7	Slimmed Clinically uthyroid Not enlarged No discharge or spotting	--	Same as above.
28.08.2009	6.11	No further bleeding Occasional white discharge. Active	TFT normal	Thyroxine 75mcg 1-0-0 7/7

Table 2: Thyroid profile and Bone age

Date	Actual age (Y.M)	Free T4	Free T3	TSH	T3 mcg/ml	T4 mcg%	Bone age (Y.M)
12/01/09	6.3	-	-	-	-	-	3.3
15/07/09	-	1.24	3.55	16.76			-
06/12/09	-	-	-	3.79	1.41	12.96	-
05/04/11	-	-	-	9.47	0.94	11.2	-
30/04/11	8.6	-	-	11	-	13.7	6.6

Table 3: Age, Height, weight, hemoglobin details

Date	Age (Y.M)	Ht (cms)	Wt (kgs)	BSA (m2)	Hb (g/dl)	Ideal Wt for Ht (kg)	Ht age (Y M)	Wt age (Y M)
12/01/09	6.3	100	19.6	0.72	7.4	15	4	7.2
24/02/09	6.4	101.3	17.3	-	9.1	15	4	5
26/05/09	6.7	103.5	16.6	0.68	6.5	15	4.5	4.2
28/08/09	7.1	106	17.6	0.72	7.3	16	5	5
10/05/10	7.6	111.2	19.7	0.77	-	17	5.6	7.2
30/04/11	8.6	116	23.6	0.87	-	19	6.7	9.3
10/04/12	9.6	120	20	-	-	20	7.5	7.5

PET and Thyroid scan report

Moderately enlarged thyroid gland with no evidence of nonfunctional nodules in either lobe of thyroid gland. Presented with hypothyroidism and precocious puberty.

Ultra sound scan of pelvis

Bilateral polycystic ovaries, uterus shows peripurbertal morphology

Precocious purberty with thelarche (beginning of breast development) and menarche, constituting Van Wyk Grumbach syndrome. (is characterized by juvenile hypothyroidism, delayed bone age, and isosexual precocious puberty.)

Physical Examination:

Patient is moderately built and nourished.

Conscious and oriented.

No pallor, icterus/ cyanosis/ Clubbing/ Lymphadenopathy/ edema.

Pulse: 118/min

Blood Pressure: 120/90mm Hg

Respiration Rate: 22/min

Temp: 98.4 F

CVS(Cardio Vascular System): S1, S2 (+) , No murmurs
RS(Respiratory System): NVBS (+) clear
PA(Per-Abdomin) : Soft, BS(+)
Saturation – 98%
Social History: Very quiet, non social with highly educated adoptive parents [mother – LIC officer, Father IIM professor].
Exercise: 1½(dancing, cycling, playing) , TV viewing – 3hrs/day

Anthropometric measurements:
Age: 9.6 yrs **Ht:** 120cm, (5th percentile) **Wt:** 20Kg (10th percentile) **BMI:** 13.8 (< 3rd centile)
Ideal Wt for Age: 25 - 27 kg Ideal Wt for Ht: 18 kg

Table 4: General Random Blood Sugar details (gm/dl)

Date	Timings & GRBS							
	3 a.m	6 a.m	9a.m	12.30 noon	3.30 pm	6.30 p.m	9.30 p.m	11.00 pm
10/04/12	230	210	409	341	451	385	310	395
11/04/12	317	187	538	215	343	576	-	-
12/04/12	373	-	437	183	427	398	268	-
13/04/12	318	-	405	226	307	538	183	-

Urine ketones – urine sample was collected at different hours:
10/4/2012: Positive at 1am , 9am, 2.30 pm,6 pm
10.04.2012 and 11/4/2012 ketones were negetive. (9.30pm, 9am)

Table 5: Biochemical Parameters

Test	10/04/12	11/04/12	12/04/12	13.04.2012	Normal Values
Sodium	136	137	138	-	134-145 mmol/L
Potassium	2.67	2.73	2.63, 3.90	4.48	3.5-5.1 mmol/L
Chloride	108.8	105.8	101.2	98.7	97-111 mmol/L

Table 6: Dietary Assessment: Lactovegan
24 hr dietary recall - past diet history

Energy	Carbohydrate		Protein		Fat		Iron
K.cal	gms	% of energy	gms	% of energy	gms	% of energy	mg
1585	254	64	50	12.6	41	23	13.9

Table 7: Hospital Diet:

Day	Energy	Carbohydrate		Protein		Fat		Iron
	K.cal	gms	% of energy	gms	% energy	gms	% of energy	Mg
1	1815	255	56	58	12.2	53	30	28.5
2	1870	271	58	61	13	60	29	28.9
3	1940	286	59	65.5	13.5	58.8	27.3	31.7

Course in the Hospital

9 yrs 6 months female child came to the Hospital on 9/4/12 with complaints of weakness, polyurea, polydypsia, loss of weight. On examination general randon blood sugar (GRBS) was 471 mg/dl, urine ketone bodies was positive and admitted in the hospital. On 1st day she was put on Human Actrapid short acting insulin on a sliding scale depending on the GRBS readings before and after every meal along with infusion of normal saline 60ml/hr and urine ketone bodies testing on every urine sample. Next day 2 units Human Actrapid, DNS + 3.5 ml KCL at 60ml/hr were started as the patient had Hypokalemia. The Hypokalemia was corrected and urine ketones shown negative. Patient improved clinically and was stable at the time of discharge with combination of two short and long acting insulin injections per day along with suitable diet plan along with thyroid medication.

Medications

1. Injection Actrapid 6 units and Insulatard 10units morning before Breakfast.
2. Injection Actrapid 4 units and Insulatard 6 units evening before dinner.
3. Tablet Thyronorm 100mcg 1-0-0
4. Diet: 1800 – 1900 Kcal Diabetic diet with 3 meals & 3-4 snacks with high fibre and rich in iron.

Model diet plan/ day:

7.00– 7.30 am: Breakfast:		Idli/ small dosa or chapathi – 3 Sambar/chutney/sabji – 1/2-3/4 cup Milk – 3/4cup (150ml)
9.30 – 10.00am:	Mid-morning:	Thick veg/tomato/corn soup with fruit Watermelon 1, bowl or oats porridge – 1 cup
12.30 – 1.00 p.m:	Lunch:	Chapathi 2 Nos + 1/2 cup rice Sprouts/thick dhal – 1/2 cup Vegetable – 1 cup each (1green leafy veg + other veg) Curd – 1/2 cup
3.30 – 4.00 p.m:	Evening snack	Brown bread sandwich with mint or coriander chutney Milk: 3/4 cup (150 ml)

6.00 pm:	Late evening:	Salad or soup along with 2 biscuits if required after exercise
7.00 – 7.30 p.m:	Dinner:	Same as lunch
9.30 – 10.00 p.m:	Bed time:	Milk 3/4 cup + High fiber or multigrain biscuits 2 Nos or Fruit 1 No

Oil allowance per day – 15 gms (3-4 tea spoons).
Standard measures: 1 cup = 200 ml, 1 tea spoon = 5 gms, 1 table spoon= 15 gms

DISCUSSION

9.6 year old child came to the hospital with complaints of Diabetic ketoacidosis, dehydration and hypokalemia. Patient stayed in the hospital for 4 days and clinically improved. Child had severe hypothyroidism at 5 yrs age and commenced with thyroxine. Her parents didnot continue this treatment for long and she presented with precocious puberty with premature thelarche and menarche, constituting Van Wyk Grumbach syndrome from 6 year age on wards. She had dyshormonogenic goitre with positive perchlorate discharge test and polycystic ovaries on ultrasound pelvis. After counselling the parents and recommencing therapy, she has done extremely well and is clinically and biochemically euthyroid and then on regular follow up, On the treatment she had lost 3 kg weight and her puberty has been curtailed.

Child not came for follow up for one year and now she presented with Type 1 diabetes. Type 1 diabetes mellitus in children and adolescents often present with autoimmune thyroid disorders. Miguel Fernandez-Castaner et al reported that nearly one-third of newly diagnosed type 1 diabetes patients have coexistent thyroid autoimmunity with a high prevalence of thyroid dysfunction. The prevalence of hypothyroidism in Type 1 diabetes is higher in females than in males (Fernández-Castañer et al, 1999)

CONCLUSION

Type 1 diabetes mellitus, particularly with hypothyroidism superimposed, thus becomes an highly interesting aspect for a detailed study. Consequently, a systematic approach to diabetic checkup in patients with thyroid problems and thyroid testing in patients with diabetes is recommended. Diet plays an important role in treating diabetic children according to the insulin action to control the blood sugars.

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EFFECT OF A NEWLY DEVELOPED FERMENTED BEVERAGE ON THE NUTRITIONAL STATUS OF HYPERCHOLESTEROLEMIC WOMEN

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Cardiovascular diseases (CVD) are the number one cause of death globally, more people die annually from CVD than from any other cause. An estimated 17.5 million people died from cardiac ailments in 2003, representing 30 percent of all global deaths of these deaths, an estimated 7.6 million were due to CVD and 5.7 million were due to stroke. Over §0 percent of CVD deaths take place in low and middle income countries and occur almost equally in men and women. By 2015, almost 20 million people will die from CVD, mainly from heart disease and stroke (WHO, 2008).

The regular and moderate consumption of alcohol and in particular wine may reduce the risk of CVD up to 50 percent. It promotes both short term and long term cardio protective effect. Polyphenolic compounds such as anthocyanins and tannins give wine its characteristic colour and flavour. They decrease the oxidative transformation of bad cholesterol in the body, called low density lipoprotein or LDL-cholesterol, preventing oxidised LDL cholesterol from accumulating on blood vessel walls that would lead to CVD. Hence, this study will throw a light to study the effect of the newly developed fermented beverage on the nutritional status of the hypercholesterolemic women (Chikritzhs *et al.*, 2003).

MATERIALS AND METHODS

Specific Objectives

- To assess the baseline nutritional status of the study population on the anthropometric parameters, selected biochemical parameters, blood pressure levels and dietary intake.
- To develop a fermented beverage using apple, beetroot and carrot and to evaluate the sensory quality using a 5 point score card.
- To analyze the nutrient content and assess the shelf life of the fermented beverage using microbial analysis on the 1st day, 31st day and 61st day of storage.
- To study the effect of the newly developed fermented beverage on the anthropometric measurements, selected biochemical parameters and blood pressure levels of hypercholesterolemic women (experimental group) on the 1st and 46th day and compare the same with hypercholesterolemic women (control group) without any supplementation.

Design of the Study

The study was a pre-test, post–test experimental design. The study was designed to determine the effect of supplementation of a newly developed fermented beverage on the anthropometric measurements, selected biochemical parameters and blood pressure levels of the subjects.

Selection of Samples

The subjects were selected based on purposive sampling technique. Hypercholesterolemic women with serum total cholesterol above 200 mg/dl were selected for the study. Twenty four subjects were selected for the study. Twelve subjects were assigned to the control group and twelve subjects to the experimental group.

Criteria for Selection of Samples

- Women in the age group of 40-50 years participated in the study.
- Subjects with serum total cholesterol levels above 200 mg/dl participated in the study.
- Subjects who were not on any hypocholesterolemic drugs or botanicals.
- Willingness of the subjects to participate in the study.

Duration of the Study

The study was carried out for a period of 45 days. The anthropometric measurements, biochemical and Clinical parameters were assessed on the 1st day and 46th day.

Development and Assessment of the sensory quality of the Fermented Beverage

A fermented beverage was developed with apple, beetroot and carrot. The carrots and beetroot were washed and chopped and simmered till tender. The chopped apple, raisin and sugar were kept in the fermentation bucket and the strained carrot and beetroot liquors were added. It was stirred vigorously to dissolve the sugar. When cooled, citric acid and yeast were added. The beverage was left to ferment for ten days. The beverage is ready for consumption. All the subjects were instructed to consume their normal diet without any dietary restrictions. The subjects in the test group were instructed to take 100 ml of the fermented beverage at any time of the day.

Sensory attributes are the most significant quality parameters for determining consumer acceptance (Heinio et al., 2002). Food quality is an important concept because the food people choose depends largely on quality. The acceptability of the fermented beverage was checked by a panel of judges using sensory method of evaluation. The panel members were briefed about the purpose of the study and they were instructed on the method of scoring. The fermented beverage was evaluated using a 5 point score card. The fermented beverage was evaluated for attributes like appearance, colour, texture, taste, flavour and over-all acceptability and was given a maximum score of 5 for excellence and a minimum score of 1 for poor quality.

Nutrient Analysis

The total antioxidant, carbohydrate, beta carotene and vitamin C content of the fermented beverage were estimated. Frappe Assay test was conducted to estimate the total antioxidant content in the fermented beverage. The carbohydrate content is estimated using the Anthrone method and beta carotene using the centrifuge method. The vitamin C is estimated using the titration method

Shelf Life of the Fermented Beverage

The shelf life of the fermented beverage was analysed using standard plate count and pour plate method.

Assessment of Nutritional Status

Anthropometric measurements were used to assess the nutritional status of the individuals. Height, body weight, waist circumference, hip circumference were measured and the anthropometric indices like body mass index and waist-hip ratio were calculated.

Biochemical Analyses

The blood samples for biochemical analyses were drawn after a 12-hour overnight fast. The following biochemical estimations were carried out in the clinical laboratory, Chennai.

- Estimation of fasting plasma glucose concentration by the Hexokinase method.
- Estimation of serum total cholesterol levels by the CHOD-PAP enzymatic endpoint method.
- Estimation of serum HDL cholesterol by the direct enzyme clearance method.
- Estimation of serum triglyceride by the GPO-PAP method.
- Serum LDL-C, Serum VLDL-C: were calculated.

The study was approved by the Institutional Ethics Committee. The individual consent from the subjects was obtained before the commencement of the study. The subjects in the experimental group were briefed by the investigator about the significance of the study. They were instructed that blood sample would be collected on the 1st and the 46th day of the supplementation period in a twelve hour fasting state in order to assess the fasting plasma glucose level and serum lipid profile of the subjects. On the first day of the study, all the selected subjects were requested to report at the laboratory between 8:00 am and 9:00 am in a 12 hour fasting state. The initial height, body weight, waist and hip circumferences and the blood pressure levels were recorded. Blood samples were drawn from these subjects for the estimation of the biochemical parameters. With the help of sterile disposable syringes, two millilitre of venous blood was drawn from the antecubital vein and the blood samples were transferred to clean non-heparinised vials and centrifuged at 2500 rpm for 10 minutes. Serum from the blood was then aspirated and used for the estimation of fasting plasma glucose level and serum lipid profile. The subjects in the control group were instructed to follow the similar procedure on 1st day and 46th day of the study period. They were not given any supplementation and were requested to follow their habitual dietary pattern.

RESULTS AND DISCUSSION

The present study was designed to determine the effect of supplementation of fermented beverage on the anthropometric measurements, selected biochemical parameters and blood pressure levels in 12 hypercholesterolemic women. The effectiveness of this supplementation was compared with that of an equal number (n=12) of hypercholesterolemic women without any supplementation. The total study period was 46 days.

Sensory Evaluation of the Newly Developed Fermented Beverage

The mean score for the attributes of the newly developed fermented beverage are given in Table 1

Table 1-Mean Scores of Attributes of Fermented Beverage

Fermented Beverage	Appearance	Colour	Taste	Texture	Flavour	Overall acceptability
	4.5	4.5	4	4	4	4.2

The mean score for the attribute appearance and colour was 4.5 out of a total mean score of 5.0. The newly developed fermented beverage had an overall acceptability of 4.0 out of a total mean score of 5.0. This indicates that the newly developed fermented beverage is good and has an excellent sensory quality.

Shelf Life of the Newly Developed Fermented Beverage

It was observed that the sample when screened for Escherichia Coli using Brilliant Bile Green broth and Mac Conkey's broth showed no growth of the organism, thereby confirming the absence of *Escherichia Coli* in the newly developed fermented beverage.

Nutrient Analysis

The newly developed fermented beverage contained 2970 μM/ml of total antioxidant content, 13.55 mg of Carbohydrate content, and 12.3μg of beta carotene and 12.6 mg of Vitamin C content for 100 ml.

Anthropometric measurements

The mean values of the anthropometric measurements of the experimental group are given in Table 2

Table 2 -Mean values of the Anthropometric Measurements of the Experimental Group

Variables	Experimental group(N=12)				
	Before Mean ± S.D	After Mean ± S.D	Mean difference	't' value	'p' value
Height (cms)	155±3.72	155±3.72	--	---	---
Weight (kg)	77.83±10.10	76±9.71	↓ 1.83	5.32	0.00
BMI(kg/m^2)	32.5±3.70	31.7±3.43	↓ 0.71	4.29	0.001
Waist circumference (inches)	34.75±4.9	34.33±4.49	↓ 0.42	2.15	0.054
Hip circumference (inches)	32.5±3.70	31.7±3.43	↓ 0.71	1.91	0.082
Waist-hip ratio	0.88±0.10	0.87±0.1	↓ 0.01	1.72	0.113

It can be observed that in the experimental group, the mean body weight of the subjects decreased and consequently, the calculated body mass index of the subjects also decreased after supplementation. The waist circumference ($p \leq 0.054$), hip-circumference ($p \leq 0.082$) and waist-hip ratio ($p \leq 0.113$) decreased after supplementation; however the difference was not statistically significant.

The mean values of the anthropometric measurements of the control group are given in Table 3.

Table 3: Mean values of the Anthropometric Measurements of the Control Group

Variables	Control group(N=12)				
	Before Mean ± S.D	After Mean ± S.D	Mean difference	't' value	'p' value
Height (cms)	156±4.40	156±4.40	--	---	---
Weight (kg)	77.66±10.87	78.53±11.26	↑-0.92	-4.01	0.002
BMI(kg/m^2)	31.87±3.66	32.25±3.80	↑-0.39	-4.03	0.002
Waist circumference (inches)	34.20±5.9	34.56±6.2	↑-0.42	-3.10	0.010
Hip circumference(inches)	39.83±6.03	40.10±6.21	↑-0.25	-2.60	0.026
Waist -hip ratio	0.85±0.04	0.85±0.04	↑-0.004	-1.94	0.078

It is observed that in the control group, the mean body weight of the subjects increased after the study period and therefore, the calculated Body Mass Index also increased to 32.25±3.80 kg/m^2 after the study period. The mean waist circumference, hip circumference increased and there was no change in the mean waist-hip ratio (0.85±0.04) of the subjects before and after the study period. The increase in the body weight ($p \leq 0.002$), BMI ($p \leq 0.002$), waist circumference ($p \leq 0.002$), hip circumference ($p \leq 0.010$) was found to be statistically significant. There was no significant difference in the waist-hip ratio.

Biochemical Parameters

The mean values of serum lipid profile of the experimental group are given in Table 4.

Table 4-Comparison of Mean values of the Serum Lipid Profile and Fasting Plasma Glucose Level of the Experimental Group

Variables	Experimental group (N=12)				
	Before Mean±S.D	After Mean±S.D	Mean difference	't' value	'p' value
Total cholesterol (mg/dl)	224.53±39.50	206.77±39.40	↓17.75	6.30	0.00
LDL cholesterol(mg/dl)	123.02±19.80	110.70±23.10	↓12.35	3.30	0.007
VLDL cholesterol (mg/dl)	61.92±22.94	59.3±21.40	↓2.60	4.80	0.001
HDL cholesterol (mg/dl)	51.99±13.02	55.24±13.84	↑-3.30	-3.50	0.005
TG cholesterol(mg/dl)	300.3±3.70	277.4±3.43	↓22.84	6.10	0.00
Fasting plasma glucose level (mg/dl)	140.5±35.11	121.70±29.41	↓18.83	5.03	0.00

It is observed that in the experimental group, the mean serum total cholesterol, LDL-c, VLDL-c, TG and fasting plasma glucose level of the subjects was found to decrease after the supplementation. The mean HDL cholesterol of the subjects before the supplementation was 51.99±13.02 mg/dl and it increased to 55.24±13.84 mg/dl after the supplementation.

The decrease in the total serum cholesterol level (p=0.00), TG (p=0.00), LDL-c (p=0.007), VLDL-c (p=0.001) and fasting plasma glucose level (p=0.00) was found to be significant. The increase in the HDL-c (p=0.005) was also found to be statistically significant.

The mean values of serum lipid profile of the control l group is given in Table 5

Table 5- Mean values of the Serum Lipid Profile and Fasting Plasma Glucose Level of the Control Group

Variables	Control group(N=12)				
	Before Mean±S.D	After Mean±S.D	Mean difference	't'value	'p' value
Total cholesterol (mg/dl)	255.20±49.03	256.96±40.96	↑-1.80	--7.96	0.00
LDL cholesterol(mg/dl)	128.70±8.93	129.90±9.4	↑-1.23	--4.74	0.001
VLDL cholesterol (mg/dl)	50.4±20.82	51.10±21.10	↑-0.71	--2.32	0.041
HDL cholesterol (mg/dl)	58.04±7.50	56.50±7.80	↓1.56	-4.41	0.001
TG cholesterol(mg/dl)	302.70±77.63	304.71±78.10	↑-2.04	--4.70	0.001
Fasting plasma glucose level (mg/dl)	125.50±30.84	127.20±32.40	↑-1.70	--2.5	0.03

In the control group the mean serum total cholesterol, LDL-c, VLDL-c, TG and fasting plasma glucose level of the subjects increased after the study period. The mean HDL cholesterol was found to be 58.04±7.50 mg/dl before the study period and it decreased to 56.50±7.80 mg/dl after the study period. The increase in the total serum cholesterol level ($p \leq 0.00$) LDL-c ($p \leq 0.001$), VLDL-c ($p=0.041$), TG ($p=0.001$) and fasting plasma glucose level ($p \leq 0.030$) was found to be statistically significant. The decrease in the HDL cholesterol ($p \leq 0.001$) was also found to be significant.

Blood pressure levels

In the experimental group, the mean systolic blood pressure level decreased from134±5.2mmHg to 133±5 mm Hg and diastolic pressure 85±5.3mmHg remained the same. The difference was not statistically significant. In the control group the systolic blood pressure increased from 121±8.3mm Hg to 122±8.3mm Hg and diastolic pressure increased from 77±5 mm Hg to 78±6.3mm Hg but was not statistically significant.

CONCLUSION

The newly developed fermented beverage had a positive effect on the selected biochemical parameters and clinical parameters by reducing the anthropometric measurements, total cholesterol, LDL-c, VLDL-c, TG and fasting plasma glucose level and blood pressure levels and increasing in the HDL cholesterol. The fermented beverage is a safe product because of the absence of pathogenic Escherichia coli micro-organisms. Since it is low in calorie it could be an excellent substitute for the regular carbonated and other sweetened beverages.

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