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Dietary Fiber and Mineral Enriched Carrot Pomace Powder Bread

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Abstract

Carrot pomace(CP) isa by-productof carrotjuiceprocessing industry. It contains largeamounts of dietary fiberand other valuable compounds.Dryingincreasethe shelf life of CP.Consumption of bakery products increasing but that contain negligible fiber and minerals therefore, continuous consumption may lead to major chronic diseases and mineral deficiencies.Bakery products easily modified into therapeutic products. Therefore, the present study was planned to develop bread enriched with fiber and minerals using CP and evaluate its nutritional composition. For that, CP was dried,ground, sieved to 240 (CPP), packed in polythene bag and stored until used. For product optimization Maida was replaced with 2,4,6,8 and 10% CPP in the commercial bread formula and evaluate sensorily (6penalistsX3times) using 9 point hedonic scale. The processing changes include increased proofing temperature and decreased time and vice-a-versa in baking.6% CPP replacement resulted into pour volume & texture. Thus CPP replacement level narrowed down to 1,2,3,4 and 5% for primary selectionand3.5, 4 and 4.5% for final selection using composite scoring test. The 4% CPP replacement scored highest. That is considered as Experimental Bread (EB). A consumer survey showed that 87.5% liked EB. Raw material, control and experimental bread were analysed for various nutrients using standard methods. The carbohydrate, calorie and protein content of CPP found about three fourth, third fifth and half as compared to Maida because of very high content of fiber. EB contains 238% more fiber and 32% more ash while 47% lesser energy then CB.

Keywords: Health food; bread; Carrot pomace; High fiber food; Mineral enrichment

Introduction

Carrot pomace, a by-product of carrot juice processing industry, contains large amounts of valuable compounds including dietary fiber. Thus could be explored in the development of food ingredients and dietary supplements.[1] Bakery products bear negligible fiber therefore its continuous consumption may lead to chronic diseases. Increasing health consciousness and easy modification of bakery products has led to their development as the therapeutic products.[3] Few authors used carrot pomace to develop cookies but hardly used for other bakery products. Therefore, a study was planned to develop the carrot pomace bread on the sensory characteristics. The fiber, mineral and nutritional composition of bread were studied.

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Materials and Methods

Preparation of Carrot Pomace Powder

Carrot pomace produced as by product after juice extraction as a part of experiential learning for the students for commercial purpose was collected

from the Center of Fruit Processing, Department of Horticulture, B A College of Agriculture, Anand Agricultural University, Anand, Gujarat, India. For juice extraction, carrot (*Daucus carota*) was obtained from the local market, cleaned, peeled, grated, juice extracted in juicer. The pulp left was dried and converted to powder as shown in Fig. 1 and used for further analysis and product development.

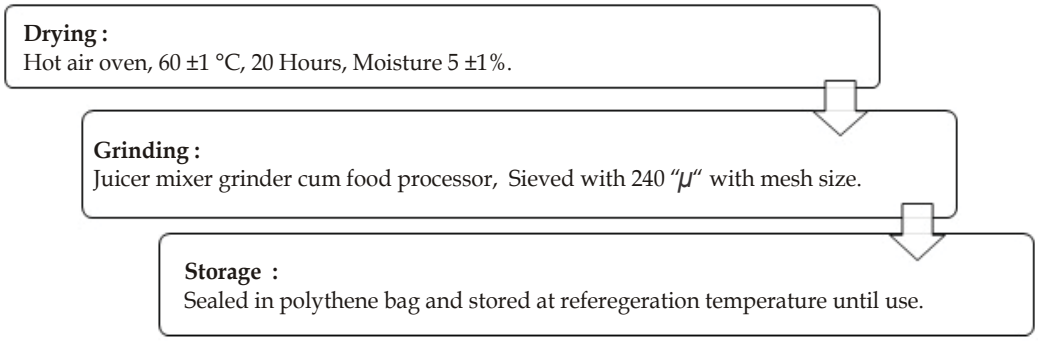

Fig.1:Processflow chartofcarrot pomace drying

Product Development

Bread was developed in the laboratory following scientific method as detailed below.

Recipe Optimization

Good quality raw materials were purchased from the local market, cleaned, packed in airtight PET jar and stored at refrigeration temperature until used. Maida was replaced with 2, 6, 8 and 10% of CPP in the commercial bread formula[4] using no dough time method of bread preparation. Repeated trials with changes in quantity of raw materials (yeast, water and acetic acid) as well as processing conditions (time and temperature for proofing and baking) were carried out to standardize the recipe.

Sensory Evaluation

The breads prepared using the adopted formula were sliced, randomized and presented to the panelists for evaluation of sensory characteristics. The breads were evaluated first for initial acceptability using a 9 point hedonic scale (6 members X 3 replications) on the day of preparation (i.e. day 0). For this, products were served on randomly coded paper plates at room temperature. Panelists were supplied with tap water for cleansing the palate between samples. Product evaluation was carried out under 'day light' illumination and in isolated booths within the laboratory.

Preliminary Screening

The ranks of hedonic rating were converted to scores and analysed statistically. The bread that scored the highest among CPP incorporated bread was selected for further refinement. Replacement rate of newly introduced raw ingredients were narrowed down in such a way that percent replacement of CPP of "selected product" remains some were in the middle.

Primary Selection

On the bases of these results, Maida was replaced with 1 to 5 % (with 1% interval) CPP for primary selection. That was carried out again by sensory evaluation but using a composite scoring test on the day of preparation. The sensory evaluation performa used was developed on the basis of Pyler.[9] A sensory judging panel was constituted with six panelists from among the faculties, staff and students of the School of Baking, Polytechnic in Food Science, College of Food Processing Technology as well as Dairy Science.

The panelists evaluated volume, colour and nature of crust, symmetry of shape and uniformity of bake and shape, texture and grain, crumb colour, taste and aroma and overall acceptability. Bread prepared using the commercial formula (i.e. 0% CPP) served as the control bread (CB) and was used for comparison. The bread that scored the highest among CPP incorporated bread was selected for final selection. Replacement rate of newly introduced raw ingredients were narrowed down in such a way that percent replacement of CPP of "selected product" remains some were in the middle.

Final Selection

For that, trials of bread preparation were carried out by replacing CPP with Maida at 3.5, 4 and 4.5% and evaluated as similar to primary selection. The bread ranked highest overall acceptability considered as the Experiemental Bread (EB) and used for subsequent study.

Consumer Survey

Once after evaluation by experts the consumer survey was carried out through sensory evaluation using five point hedonic scale. Total 200 respondent from among faculty members of Anand Agricultural University were randomly selected. Out of that 113 respondent assigned their selection. The samples were provided almost similar fashion to preliminary screening at a time of meeting.

Nutritional Evaluation

Maida, CPP, CB and EB were analysed for various nutrients namely moisture, protein (macro-Kjeldahl method), fat (soxhlet method), carbohydrate (anthrone method), energy (calculated), fiber (by digestion) and ash (muffle furnace burning) using standard methods.

Data Analysis

The standard SPSS program was run to analyse the data. All the data were tested for significance using the ANOVA / Duncan's test.[11]

Results and Discussions

Present study was planned to develop value added bread using CPP and also to assess its nutritional quality. The results obtained are discussed below.

Recipe Optimization

When Maida was replaced with CPP in the CB formula, quantity of yeast and acetic acid was increased from 1.5 to 1.75 % and 0.04 to 0.05 %, respectively in order to speedup the proofing. For the same purpose proofing temperature was increased from 37°C to 50°C. As a result proofing time was decreased by 10 minutes. The baking was carried out at 220°C for 15 minutes instead of 205°C for 20 minutes.The final formula and process flow chart adopted for bread processing is described in Table 1 and Figure 2, respectively

Preliminary Screening

The bread prepared by replacing 6 % CPP resulted in to pour volume and texture when judged using nine point hedonic scale during preliminary screening. Therefore, it was decided to prepare bread with 1 to 5 % (with 1% interval) CPP replacement level for primary selection.

Primary Selection

Composite scoring test was conducted for the selection of replacement level of CPP. CB containing no CPP scored the highest for all the sensory attributes studied. A decreasing trend in all the sensory attributes was also observed upon increasing the levels of CPP replacement. However, bread prepared using 4% replacement of CPP scored the highest among all the CPP replaced bread. Therefore, it was decided to prepare bread with 3.5, 4 and 4.5% CPP replacement level for final selection.

Final Selection

It can be seen from Table 2 that Volume of the CPP replaced breads scored more than acceptable with no significance difference but were significantly differ with CB. Similar the case with the Colour and nature of the crust as well as Symmetry of shape and uniformity of bake characteristics. The Crumb colour, Texture and grain and Taste and aroma of the CB differ significantly to the 4 and 4.5% CPP replaced breads but found acceptable by the panel of judges. Overall acceptability of bread prepared with 3.5 and 4% CPP replacement were significantly different than CB while bread with 4.5% CPP replacement significantly differ than all the three breads.

It is also observed that all the characteristics were increased initially upon increasing the CPP replacement level in bread preparation and there after decreased. Similar observations for overall acceptability were made by K shitij[5] while developing bun adding CPP. The bread prepared with 4% CPP replacement scored highest in all the characteristics among all CPP replaced breads and found acceptable i.e. scored more than half of the maximum score. However, Kshiti[5] suggested to use 2.5% CPP proportion for the development of buns while Navneet[8] and Shyamlal[10] concluded that CP can be used up to 6% and 8% level respectively, to incorporate into cookies as a source of dietary fiber.

Consumer Survey

Most of the faculty members (87.5%) found the EB acceptable i.e liked excellent, very good and good and was found at with the CB in all the likings. The detail liking of CB and EB are represented as Chart 1.

Nutritional Composition

The carbohydrate, calorie and protein content of CPP found about three fourth, third fifth and half as compared to *Maida* because of very high content of fiber. Proximate composition for *Maida* found more or less similar to reported by Baljeet.[2] Similarly ash content (3.15%) of CPP found almost equivalent (3.2) to reported by Baljeet[2] and protein content (5.51) found nearer to reported by Shyamlal

[10] as well as Ajay[1] i.e. 6.50 and 4-5%, respectively. Similarly fiber content (65.16%) estimated was also nearby reported (72.80%) by Baljeet[2] but quite higher to reported by Shyamlal[10] as well as Ajay[1] i.e.44.75% and 37 to 48%, respectively. These may be due varietal difference.

The fiber content of EB was found three times higher as compared to CB due to addition of CPP containing 65.61% total fiber. Shyamlal.[10] were also observed more than two and half times increase in fiber level in cookies developed by replacing *Maida* with 4% CPP as compared to cookies prepared without replacement of CPP. The energy value were reduced to half in EB as compared to CB. Both the situations have beneficial effect on chronic diseases. The ash content was 1.3 times higher in EB then CB. The results are supported by Shyamlal[10] who observed 1.6 times higher ash in 4% CPP replaced cookies then control. Thus the developed bread might be useful in some mineral deficiencies as nutraceuticals. Nutritional composition of principle raw ingredients as well as commercial and developed breads are depicted in Table 3. However, the percent change in selected nutrients are graphically represented in Chart 2.

Table 1: Formula for control and carrot pomace powder replaced breads

Product Ingredients	**Quantity (baker's percentage)**	
	Control Bread	**CPP Replaced Bread**
	(A)	(C)
Flour	100	96.0
CPP	Nil	4.0
Oil	2.0	2.0
Sugar (powdered)	5.0	5.0
Yeast (Dry)	1.5	1.75
Gluten	1.0	1.0
Salt	2.0	2.0
Water	64	70
Acetic acid	0.04	0.05
Processing conditions	**Temperature**	**Time (minute) /use of**
Weighing	RT	15
↓		
Kneading	RT	20, Spiral mixer
↓		
Scaling	RT	Cutter
↓		
Rounding	RT	Hand
↓		
Intermediate proofing	37° C	10, Proover
↓		
Moulding and Panning	RT	5
↓		
Proofing	37° C(C)	60 Proover
↓	50° C(E)	50 Proover
Baking	205°C(C)	20 Oven
↓	220°C (C)	15 Oven
Cooling	RT	60 Cooling rack
↓		
Slicing and Packing	RT	5, Slicer

Fig. 2:Process fFlow chart for control and experimental bread

Table 2: Sensory (composite) scores of breads prepared by replacing *Maida* with different levels of carrot pomace powder

Characteristic Product	Volume (15)	Crust character$ (5)	Shape and bake@ (10)	Crumb colour (10)	Texture and Grain (30)	Taste and aroma (20)	Overall acceptability (10)
Control #	13.25^{a}± 0.17	4.40^{a} ± 0.05	8.83^{a}± 0.11	8.83^{a}± 0.09	26.75^{a}± 0.25	17.94^{a}± 0.18	8.97^{a}± 0.11
3.5 % CPP	10.33^{b}± 0.29	3.69^{b}± 0.10	7.05^{b}± 0.15	7.00^{c}± 0.19	21.00^{c}± 0.72	13.77^{c} ± 0.35	6.88^{b}± 0.22
4.0 % CPP	11.08^{b}± 0.32	3.77^{b}± 0.07	7.66^{b}± 0.14	7.77^{b}± 0.10	22.66^{b} ± 0.36	14.77^{b}± 0.32	7.33^{b}± 0.14
4.5 % CPP	10.91^{b}± 0.23	3.77^{b}± 0.07	7.66^{b}± 0.16	7.44^{b}± 0.16	22.16^{b} ± 0.35	14.66^{b} ± 0.28	7.22^{c}± 0.12
'F' Value	23.56**	18.41**	27.10**	28.64**	29.51**	38.01**	34.11**
CV%	0.10	0.08	0.08	0.08	0.08	0.08	0.09

CPP = Carrot Pomace Powder # Control = 100% Maida (Baker's %),
$ Crust character = Colour and nature of the crust
@ Shape and bake = Symmetry of shape and uniformity of bake
All the replacements are based on baker's percentage
Values are Mean ±SEM scores of a composite scoring test by a panel of 6 judges X 3 replications
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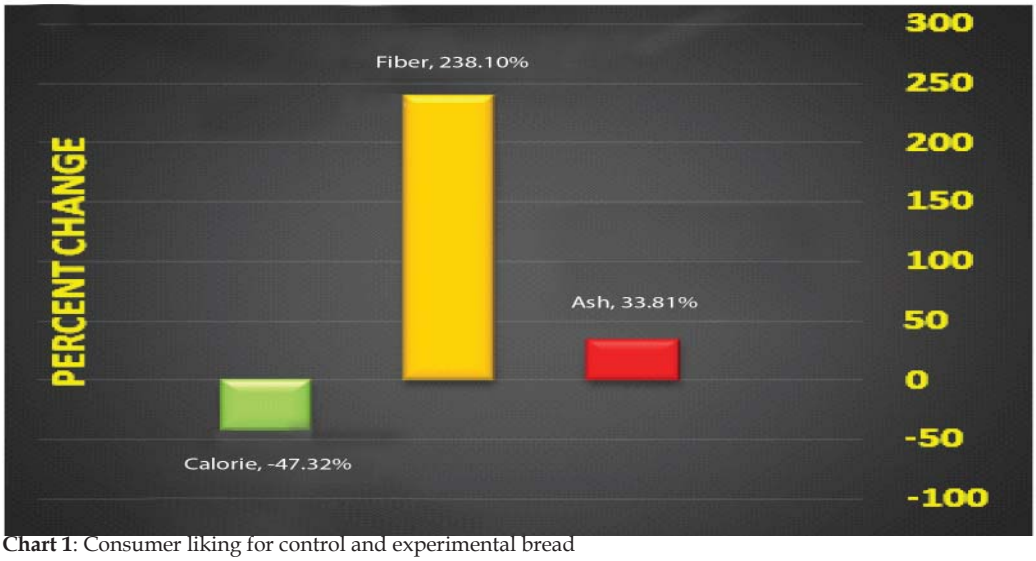

Chart 1: Consumer liking for control and experimental bread

Table 3: Nutritional composition of control and experimental bread

Nutrient	Flour	CPP	Control Bread	Experimental Bread	% Change
Moister (g%)	13.12 ± 0.12	8.10 ± 0.09	36.36 ± 0.25	36.23± 0.31	- 0.36± 0.09
Protein (g%)	11.28± 0.15	5.51± 0.04	11.37± 0.11	11.32± 0.15	- 0.44± 0.06
Fat (g%)	1.57± 0.01	2.12± 0.02	3.81± 0.02	3.90± 0.10	2.36± 0.10
Carbohydrate (g%)	85.39± 1.10	24.06± 0.54	83.13± 0.63	80.38± 0.82	3.31± 0.07
Calorie (K. Cal.)	400.82± 10.10	156.33± 4.82	494.96± 9.35	260.75± 4.50	- 47.32± 0.10
Fiber (g%)	1.08± 0.10	65.16± 1.80	1.05± 0.01	3.55± 0.12	238.10± 6.85
Ash (g%)	0.68± 0.01	3.15± 0.02	0.64± 0.05	0.85± 0.10	32.81± 0.08

CPP = Carrot Pomace Powder

Values are Mean ±SEM of 3 replications,

All the data except moisture is reported on dry weight bases

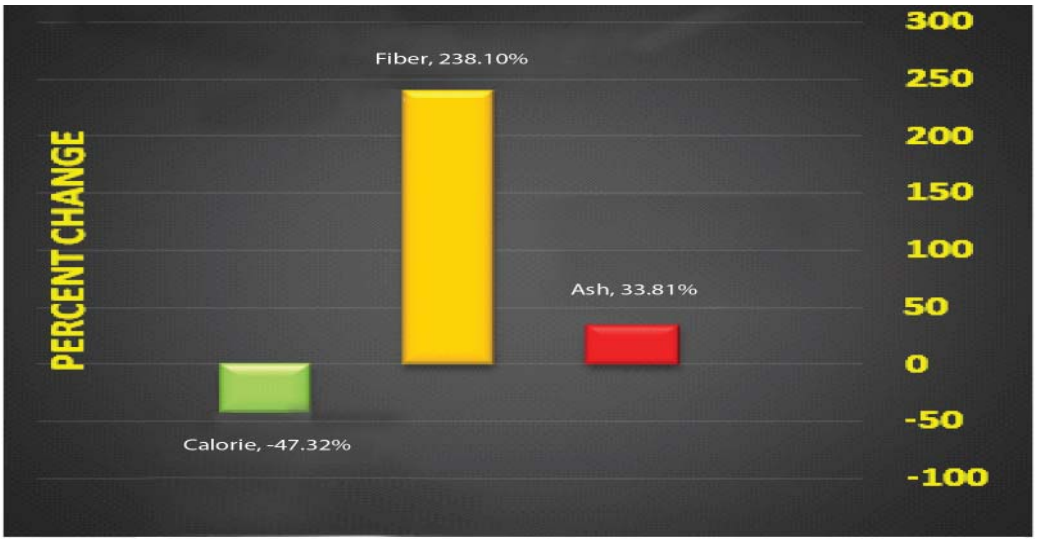

Chart 2: Percent change in selected nutrientsof experimental over control bread.

Conclusion

An acceptable quality high fiber bread by replacing maximum 4% *Maida* with CPP could be prepared by the optimized formula and procedure. It contains 238% more fiber and 33% more minerals while 47% less energy as compared to CB. Thus it may be useful in the dietary management of patient suffering from diabetes, hypercholestremia, constipation etc. chronic diseases as well as might be useful as nutraceuticals in some mineral deficiencies.

Future Scope

Like bread other bakery products such as biscuits, cookies, cakes and pastries could be modified to make it more fibrous, that may be useful for life style diseases.

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Original Article

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To Study the Effect of Imparting Nutrition Education on Nutrient Intake of 10-11 Year old Girls of Government Schools in Mumbai

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Abstract

Background: Quality of life of girls continues to be poor, more so in urban slums which can be solved by imparting nutrition education. *Objectives*: To assess the nutritional status of school going girls (10-11years), to provide nutrition education to the participants and to assess the efficacy of nutrition education on their nutritional status.*Method*: This interventional study was conducted in 100 girls in which anthropometric measurements and 24 hour dietary recall were taken. A self-designed questionnaire was administered which included general information and dietary habits. It also tested the nutritional knowledge of the participants and was scored. Multiple nutrition education sessions were imparted in each school through group discussion. Post- intervention nutritional knowledge was again tested along with anthropometric measurements & 24 hour dietary recall. Knowledge Increment percent was calculated. Statistical analysis was performed using SPPSS software for Windows version 20. $P < 0.05$ was considered to be statistically significant. *Results*: Dietary habits like skipping meals, eating junk food were recorded. Average weight was 29.4±6.06 kg which significantly increased to 29.8± 6.03 kg (p=0.00) and BMI had increased from 15.6± 2.33 kg/m2 to 15.8± 2.27kg/m2 (p=0.00). The pre-intervention nutritional knowledge score had significantly increased to 22.1± 3.22 (p=0.00) with 78.4% knowledge increment. Calorie consumption had significantly increased from 1461±238kcal/day to 1536±210kcal/day post intervention (p=0.00). A significant difference was also seen in the carbohydrate, protein, fats, iron and calcium (p=0.00). *Conclusion*: Nutrition education impacted positively on weight, BMI, level of nutritional knowledge and nutrient intake amongst the school going girls.

Keywords: Nutrition education; Anthropometric measurements; Knowledge increment; Dietary habits; Height; Weight; Energy; Junk food; School going girls; Iron; Calcium; Protein; Fats.

Introduction

Nutrition and health are important for everyone, but they are especially significant for children as it is directly linked to their growth and development; factors which will have a direct impact on their health as adults.[2] Children are the most vital human resource a country possesses. They hold the potential and set the limits of future development.[13] Global evidence suggests that under-nutrition continues to affect millions of children.[5] Every third child born is under weight. About half of the preschool and school age children suffer from under nutrition. [16] Children are the major sector of population suffering from nutrient deficiency. According to National Family Health Survey about 45.5 per cent of children are malnourished in India.[11]

Hence, a proper diet is essential from the very early stages of life for growth, development and active life. Nutrition focuses on the promotion of normal growth and development of infants, school going children, adolescence, and maintenance of adults including special need of pregnant women, lactating mothers and other vulnerable section of the community.[8]

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The school age period is nutritionally significant because this is the prime time to build up body stores of nutrients in preparation for rapid growth of adolescence.[12] The school going girls is in a state or process of growing up from puberty to maturity. They have to encounter a series of serious nutritional challenges not only affecting their growth and development but also their livelihood as adults. Thus it is not surprising that girl population who are "mother to be" is considers as the most important section on which the future of nation depends.[17]

Quality of life of school children, by all standards continues to be poor more so in rural areas and urban slums.[15] Urban slum dwellers are exposed to poor environmental conditions (overcrowding, poor quality drinking water and sanitation, no removal of waste). Ignorance and difficult conditions of life in the slums are likely to result in improper food habits, low health care use and hygiene awareness and lack of knowledge of the origin of sickness and proper measures for the cure. The situation is further worsened due to lack of necessary health centers, medicines, and health care personnel. Children living under such conditions are at especially high risk for health and nutritional problems.[19]

This can be solved by imparting nutrition and health education to gain the knowledge and develop the confidence and skills needed for establishing good dietary and health practices at various levels like family, school and national levels.[17] Nutritional knowledge is perceived as encouraging healthy eating habits hence, increase in nutritional knowledge is likely to influence eating behavior.[2] Health promotion from early stages in life has a major impact on health and well-being during childhood and later stages of life.[18] The nutrition education to the adolescent girls helps them to be decision makers about their food. Nutrition education can bring changes in their anthropometric measurements.[6]

There is a need to assess the impact of nutrition educational intervention on bringing about knowledge improvement of the group in relation to each of the individual topics covered in the educational intervention.[20] Therefore, the present investigation was carried out to check the impact of nutrition education on school going girls belonging to 10-11years of age using nutritional games, charts, leaflets, posters etc.

Methodology

The research proposal was approved by Inter System Biomedica Ethics Committee (ISBEC), Mumbai. This was an interventional study conducted in two government schools of Mumbai, Maharashtra with the consent of the Principal of the schools. The schools chosen for the study were Mahila Mandal's Kanya Vidyalay, Kurla and Mula Mulinche Samarth Vidhyalaya, Santacruz. 100 girls were selected from the age group 10-11 year belonging to fifth and sixth standard. Girls with a history of prolonged medical disorder within the past 12 months and any major systemic disease were excluded.

The data was collected pre and post intervention.

Pre-Intervention

The anthropometric measurements were taken which included height, weight & body mass index. Height was measured using non stretchable measuring tape and weighing scale was used to measure the weight of the participants using the WHO guidelines. BMI was calculated to measure weight status of participants and BMI cut-off for adolescent girls was referred from 2007 WHO cut off. One day 24-hour dietary recall was taken which evaluated the macronutrient intake of the participants. A self designed questionnaire, which included questions, related to their general information (age) and dietary habits was given to the participants. To evaluate the level of nutritional knowledge, the questionnaire also included questions about balanced diet, food practices, junk food, physical activity, hygiene and importance of nutrients and scoring was done.

Multiple nutrition education sessions were imparted to all the participants in each school through group discussion using charts, leaflets, posters etc. In this study there were some participants who were too young to understand words like balanced diet, vitamins and minerals. Hence, easy nutrition games were used to explain them the meaning of these words.

Post-intervention

The questionnaire was given again to participants, which only tested their nutritional knowledge along with anthropometric measurements and 24-hour dietary recall to assess the change in their overall nutritional status.

Formula used for the calculation of knowledge increment percent (KI %) using pre and post intervention scores was:

$$KI\% = \frac{\text{Post intervention score-Pre intervention score}}{\text{Pre intervention score}} \times 100$$

Statistical analysis

Statistical analysis was performed using SPPSS software for Windows version 20. All descriptive data was represented as mean ± SD and percentages. Paired T test was applied to analyze the significant difference in anthropometry, nutrient intake and post nutrition education knowledge. The frequency distribution was tabulated for various parameters used to test nutrition knowledge. $P < 0.05$ was considered to be statistically significant.

Results

Effect of nutrition education on 100 school-going girls with the mean age 10.62±0.48 years was presented in the current study. From the total participants 86% of them were non-vegetarian and 14% were vegetarian. 32% of the girls were skipping meals and 83% of the girls were eating junk food

Table 1: Pre & Post Intervention Anthropometric measurements of the study population

Anthropometric measurements	Intervention (Mean± SD)		t value	Significance (p)
	Pre-assessment	Post-assessment		
Average Height (cm)	136.8 ± 7.29	136.8 ±7.30	1.00	0.32
Average Weight (kg)	29.4 ± 6.06	29.8 ± 6.03	-6.08	0.00
Average Body Mass Index (kg/m^2)	15.6 ± 2.33	15.8 ± 2.27	-8.06	0.00

Table 2: Pre and post intervention nutritional knowledge of the participants

Nutrition Topics		Percentage of participants who answered correctly (%)	
Pre-Intervention		Post- intervention	
Basic nutrition knowledge			
Balanced diet	Definition of balanced diet	24	73
	Composition of healthy meal	87	95
	Plate concept	49	68
Food Practices	Serving of fruits per day	34	84
	Serving of vegetables per day	26	58
	Importance of small frequent meals	52	68
Junk Food	Harmful effects of junk food	20	70
	Unhealthy drinks	71	88
	Healthy snacks	52	87
Physical Activity & Hygiene			
Physical Activity	Importance of exercise	90	96
	Benefits of outdoor games	87	95
Hygiene	Awareness about washing hands before eating food	100	100
	Awareness about washing hands after using toilet	99	100
Importance of Nutrients			
Energy	Sources of energy giving food	24	57
Protein	Awareness about protein	55	94
	Rich source of protein	31	84
	Function of protein	6	68
Fat	Healthy sources of fat	2	54
Vitamin A	Importance & sources	64	87
Calcium	Importance in health	36	77
Water	Daily requirement of water	12	73

Table 3: Pre and Post Intervention Nutrient Intake

Nutrient Intake		Intervention (Mean± SD)		t value	Significance (p)
		Pre-assessment	Post-assessment		
Energy	Kcal	1461 ± 238	1536 ± 210	-9.51	0.00
Carbohydrate	Grams	222.0 ± 30.55	236.6 ± 28.18	-9.48	0.00
	Percentage	61.0 ± 2.97	61.8 ± 2.67	-4.08	0.00
Protein	Grams	40.8 ± 9.75	44.1 ± 9.31	-17.10	0.00
	Percentage	11.1 ± 1.35	11.43 ±1.35	-7.21	0.00
Fats	Grams	41.9 ± 8.70	41.1 ± 7.49	2.81	0.00
	Percentage	25.7 ± 1.93	24.0 ± 1.92	13.6	0.00
Iron	Milligrams	14.9±1.44	17.1±1.57	-16.59	0.00
Calcium	Milligrams	693±87.74	781±56.09	-14.49	0.00

on regular basis. Fig. 1 show that only 2% of the students consumed meat and poultry on daily basis and less than 50% of participants consumed milk or milk products daily which indicate towards the lack of protein in children's diet at this age. Whereas foods like chips, biscuits and candies were consumed on daily basis by 47% of the participants. Fried food was consumed sometimes by 76% of the girls. Grains and vegetables had the highest level of consumption by this age group (92% & 88% respectively).

Studying the Effect of Nutrition Education

Effect of nutrition education was seen on anthropometric measurements, nutritional knowledge and nutrient intake of the participants. According to table 1 there was no significant change in the height of the participants (p=0.32). The mean height pre-intervention was 136.8± 7.29 cm and post intervention the height was 136.6± 7.30cm. Whereas, there was an overall significant improvement in weight and body mass index (BMI) post intervention (p=0.00). Average weight was 29.4±6.06 kg which was significantly increased to 29.8± 6.03 kg and the BMI had increased from 15.6± 2.33 kg/m2 to 15.8± 2.27kg/m2.

The major components like balanced diet, food practices, junk food, physical activity, hygiene and importance of nutrients were included to test the level of nutritional knowledge of the participants before and after imparting nutrition education. The pre-intervention mean nutritional knowledge score was 13.2±2.83 which increased to 22.1± 3.22 post intervention (Fig. 2).The t paired test showed a significant improvement in the scores of the participants (p=0.00). Pre and post intervention, average knowledge increment of the participants was 78.4±44.47%.

Table 2 shows that there was almost a three times increase in the percentage of students who answered questions correctly regarding balanced diet. Post-intervention 73% students answered question correctly based on balanced diet. Knowledge about healthy snacks was also increased, as the percentage of correct answers was increased from 52 to 87%. Concept of harmful effects of junk food had the maximum increase in the percentage of students who answered correctly post intervention; three times increase was found. Knowledge based on importance of nutrients amongst the participants had a tremendous progress in the study. Only 55% of participants were aware about protein which was increased to 94% post intervention. Amongst them 68% of the students retained the knowledge of function of protein. Information about healthy source of fat increased from 2% participants to 54% (twenty-seven times increase in number of students). Improvement in knowledge about other micronutrients was also found.

Nutrient intake was assessed by taking 24-hour recall pre and post intervention. Pre intervention the mean energy was found to be 1461±238 kcal, which was significantly increased to 1536±210 kcal post intervention (p=0.00). But the energy intake by the participants was less than the recommended dietary allowance of ICMR (2010) that is 2010 kcal/ day. The table 3 shows that there was a significant improvement in the intake of all the macronutrients and micronutrients (p=0.00). After imparting nutrition education, the mean carbohydrate consumption was significantly increased from 222± 30.55grams to 236.6± 28.18 grams. 3.3 gram increase was seen in mean protein intake post intervention. Whereas, the mean fat intake was decreased by 0.8 grams. A significant difference was also seen in the percent energy from carbohydrate, protein and fats (p=0.00). The mean intake of iron had increased from 14.9mg to 17.1mg. There was almost 200mg increase in the calcium intake post intervention. But the average intake of both calcium and iron was found to be less than RDA of ICMR (2010)

Discussion

School age is considered as a dynamic period of growth and development because children undergo physical, mental, emotional and social changes. In other words the foundations of good health and sound mind are laid during the school age period.[5] Hence the present study was formulated with the objective, to assess the impact of nutrition education on the nutritional status of school age girls.

The present study showed overall poor nutritional status of the participants along with poor dietary habits. Dietary habits of the school going girls of 10-11 year age group showed skipping meals and consumption of junk food by more than 80% of the girls on daily basis. Habit of consuming healthy foods like dairy products, fruits, eggs and poultry was less. Similar results were seen by Kumar and Mishra (2019) who reported poor consumption of food groups like milk and fruits in adolescent girls (10-19 years). They found that extreme poverty, low status of girls and lack of awareness were the main causes of under nutrition conditions in adolescent girls.[9] Study done by Puri et al (2008) reported high consumption of junk food in adolescents similar to our findings.[14] Das et al. (2016) also reported high intake of fried food amongst adolescent girls and intake of most nutrients was below Recommended Dietary Allowances (RDA) of Indian Council of Medical Research.[4]

This study showed improvement in overall nutritional status and nutritional knowledge of the school going girls by imparting multiple nutrition education sessions. Improvement in their nutritional knowledge score with knowledge increment was recorded. Similarly, there was 24% knowledge increment seen in adolescent girls in a study done in 2013 and there was a significant improvement in the test scores after imparting nutrition education to the students.[18] Also, Mittal et al. (2016) studied that in the age group of 7-10 years and 11-14 years, after playing nutritional knowledge games there was a definite improvement in the nutritional knowledge of children, while the amount may vary from child to child.[10]

Access of nutritional knowledge was poor in the participants. Majority of them were not aware about balanced diet, food practices and importance of macro and micronutrients. Nutrition education was an attempt to bring a significant change in the health status of the girls as they need special attention due to increased demand of their physiological growth. Study done by Vijyapushpam et al. (2010) reported improvement in the overall nutrition and health knowledge of the student volunteers after the intervention as there was an increase in the mean score of the students. The study also stated that post intervention, the percentage of students who answered questions correctly based on energy and protein doubled.[20] Puri et al. (2008) reported that health education resulted in increase in awareness about balanced diet from 42.4% to 82.2% and there was a significant increase in the consumption of calories post intervention.[14] Whereas, Choudhary et al. (2008) reported that there was no differential gain in the scores regarding nutritional messages like balanced diet, food intake pattern and dietary habits, only significant gain was seen in hygiene practice related question.[3]

Significant increase in energy intake was observed in all subgroups of rural and urban areas to which nutrition education was imparted through different methods belonging to urban area amongst participants belonging to early adolescent group. Before imparting nutrition education the energy intake by the subjects was much lower than recommendations by ICMR. They also found that imparting nutrition education had a significant increase in the intake of proteins in the subjects of early adolescence period.[1] Hence, it is suggested that nutrition education can be inducted in the school curriculum to bring about important modifications in the dietary pattern of school going children.

Conclusion

Findings of the study showed that exposure to nutrition education impacted positively on anthropometric measurements like weight and BMI, level of nutritional knowledge and nutrient intake amongst the school going girls. Special attention should be given to meet the nutritional needs of children, as they constitute one fifth of the country's population. Imparting nutrition education through group discussion using charts, leaflets, posters can help children to consume appropriate food. "What to eat and why" is an essential aspect of child's education. It is expected that the nutrition education improves nutritional knowledge, eating behavior of adolescent girls, foster their eating habits in their daily lives and improve their nutritional status and health.

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Review Article

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Multi-Potential Influence of Gut Microbiota on Human Health

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Abstract

It is not surprising than an adult human body contains hundred trillion bacteria. The composite microbial genome found in the mammalian gastrointestinal tract is termed as gut microbiome. Various metagenomic studies have tried to dissect out the distribution of microbiota in gut and the diversity of microbiome functionally related to the health conditions. Also these microbiomes are risk factors for illness such as asthma, inflammatory bowel disease and metabolic disorders. Human health is regulated by gut microbiome in many different ways, such as direct stimulation of afferent neurons of the enteric nervous system via vagus nerve to central nervous system inflammation, protection against infection, generation of innate memory and functional reprogramming of bone marrow progenitors. In this review article, authors discussed how the varying composition of gut microbiota at different situations related directly or indirectly to human health.

Keyword: Gut microbiota; Bioreactor; Gastrointestinal tract (GI tract); Innate immunity.

Introduction

Year 2002 is the year of microbiology, after discovery of full sequencing of microbial genes and microbial diversity was assessed to species level with inter individual variations at genus.[1] 60% of the weight of total of human stool is live plus dead bacteria. Till 2004, there was no clear recommendation that bacteria in the human gut could be a factor of controlling multiple function of body along with mental health[2] and then new field of research started with the study of the gut brain connection. Bacteria in the gut are BIOREACTOR, that process food. Being a bioreactor system, human gut requires regular feeding with a basic nutritional diet which can ensure the prime performance and regulate human health[3] and developing health management system depends upon the identical clinical evaluation of gut micribiome. Large numbers of metagenomic studies are initiated for the trasnslational research. But validations of independent data still need to be correlated with host quality of life with corresponding functional physiological functional outcomes. Such kind of data obtained by Valles CM et al., which provides a link of microbiome in human gut with that of mental health and their results showed the faecal metagenomes identified the microbial synthesis potential of the dopamine metabolite 3,4 dihydroxyphenylacetic acid as correlating positively with mental quality of life and indicated a potential role of microbial γ-aminobutyric acid production in depression.[4] Jeroen Raes says "The relationship between gut microbial metabolism and mental health is a controversial topic in microbiome research". In reality most of the bidirectional research study between gut microbiota and brain communication has been explored in animal models and human research yet to be confirmed. A study from young rat pups suggested that

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when pups were separated from their mothers, the stress early in the life could lead to long term changes in their life.[5] Later it has been reported that stressbehaviours of animals decreased and their brain chemistry changed when probiotic bacterium given to mouse,[6] however mice with severed vagus nerve did not get the same benefits. In 2018, Elaine Hsiao's discovery has the potential to impact on the research showing that GABA acts like a sort of brake for brain cells by which it reduces the activity in neuronal networks in properly balanced way and most importantly that GABA was provided by the gut microbiome.[7] May be not in the term, but the original theory similar to modern concept which indicates microbiomes are helpful and they give healthy and endurance of life.

Classification of Gut Microbiota

At all the surfaces of mucosa and barrier, trillions of microorganisms such as bacteria, fungi, viruses, archaea, protists and multicellular eurkaryotes are constitutively colonized and collectively referred as microbiota. The greatest diversity of microbes present in the gastrointestinal tract. Healthy human harbour over 1014 bacterial cells and represents hundered of species, which encode 150 times more genes than the human genome.[8] In human gut, four common dominant bacterial phyla are Firmicutes, Bacteroidetes, Actinobacteria, and Proteobacteria. Most bacteria belong to the genera Bacteroides, Clostridium, Faecalibacterium, Eubacterium, Ruminococcus, Peptococcus, Peptostreptococcus, and Bifidobacterium. The traditional setting for classifications and phylogenetic tree are based upon the morphological and phenotypic nature as shown in fig. 2.[9] However recent scientific community is more interested primarily identified by their molecular sequences because such molecular identification is much more straight forward to do in high throughput than morphological or phenotypic characterization. Considering the "omics" based approaches, the functional classification of microbiota are of two types (i) metagenomics classifications which is based on gene contents or gene sequencing or simply reveals "who is there," (ii) metabolomics classifications based on metabolic functions or system level functions or simply reveal "what they are doing". Classification of microbiota based upon whole-genome sequencing is going to have a profound impact on clinical research and practice and epidemiological studies.[10]

Origin of Gut Microbiota

Revolutionised medicine tries to understand the hidden bacteria inside the wall of digestive system. The Microbiota present in gut is not homogenous throughout and microbial composition varies along the GI tract. There occurs a great diversity among different age group as well as in different geographical regions. Several biopsy reports from healthy individuals were analysed and report shows that at different sites of the intestine different bacterial groups are enriched and form colony.[11] The question comes, from where these bacteria come and how they enter into GI tract. The source is from mother, food, environmental niche or skin niche. Immediately at birth, colonization of the human gut with microbes begins and it passes through birth canal and show similarity with mothers. [12] The microbial composition after 1 year of age starts developing and shaping the compositions of microbiota.[13] After the initial establishment, the microbiome of individual person relatively simple and varies widely between individuals with time.[14,15] Research data from mouse studies are performed in highly controlled environments, where exposure to microbes from sources other than littermates and parents is limited. Hence, large amount of investigations are needed to establish the role of parental inoculations in determining the gut microbiota composition of next generation.

Feasting and fasting

Ours feasting diet consists of mainly carbohydrate, Protein and fat. These foods have wide influence on the composition of the gut microbiome[16] and acute changes in diet alters the microbial niche within just 24 hours and reverse back to base line by 48 hours.[17] High-fat or high-sugar diets are more prone to circadian rhythm disruption[18] and anaerobic microflora along with bactiroids number enhanced by fat reach diet.[19] Distal part of the gut support to host health through biosynthesis of vitamins and essential amino acid and effects of microbiota on toll-like receptors (TLR) promotes the local intestinal immunity.[20]

Our digestive tract is the sanctuary of microbes. Inside our body trillions of microbes flourishing in different shapes and sizes and inhabit various parts of your body, particularly in gut. The majority of the gut microbiota is composed of anaerobes and their number increases while moving from proximal towards distal of GI tract[21] (shown in fig 1). These colonies of microbes get their feed, what we eat. Based on what we give our gut bugs, they can do digest and metabolize food and can convey the message to our brain when we feel full or hungry. In alteration, there is significant impact when we give ether no food, too much of food or too much food at the wrong times of day.

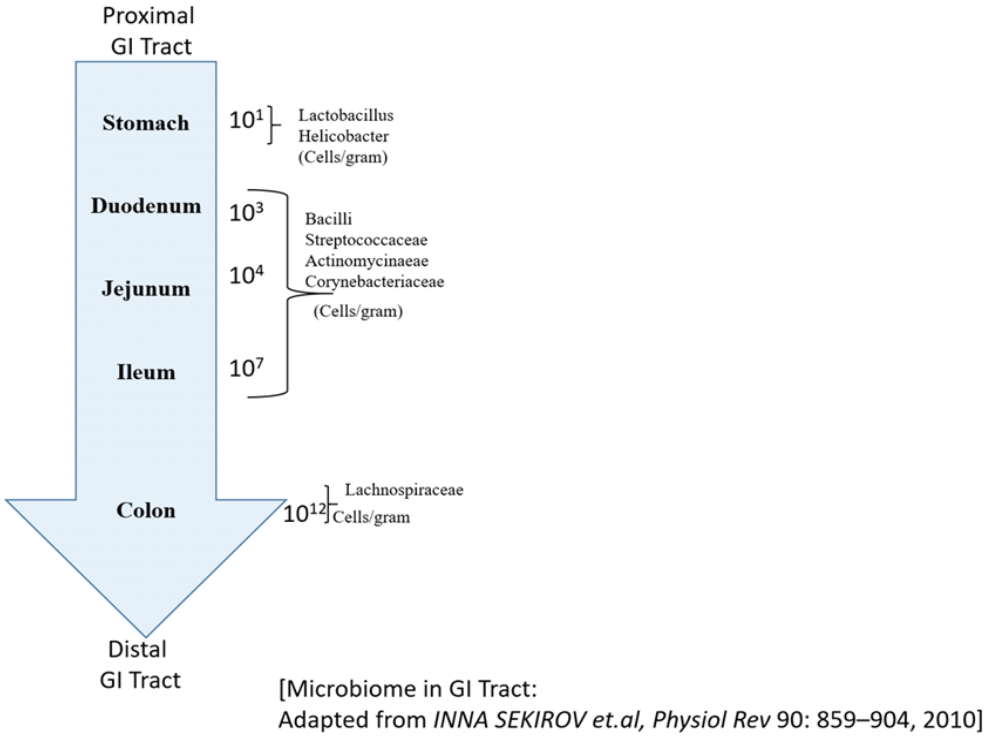

Fig. 1: Microbiome in GI Tract

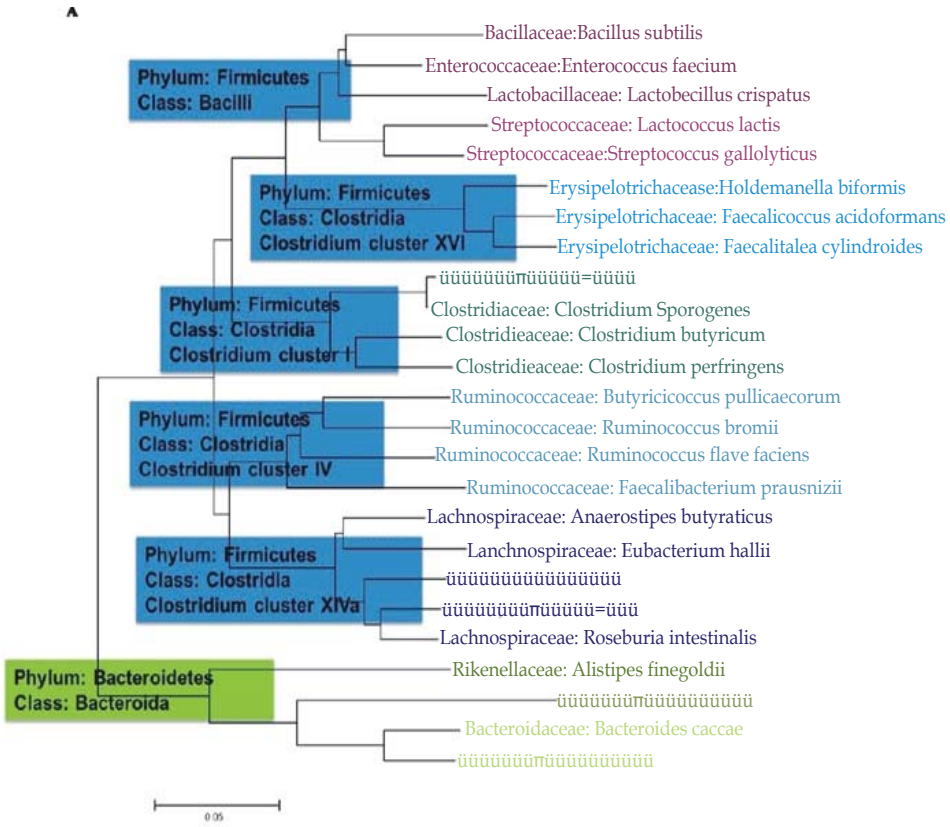

Fig. 2: Phylogenic classification of microbiota: Adapted from: Thesis on "Improving broiler gut health by prebiotic stimulation of butyrate-producing bacteria" submitted by Celine De Maesschalck, Ghent University, January 2015

Also intermittent fasting may have an impact too. Hence it is essential to consider our health of gut which in turn takes care of us to next level. Large number of study and systematic review in medical journal report that overweight obese adults follow weight loss diet. Those diets can be categorised into low carbohydrate, low fat and moderate macronutrient. The question arises whether losing weight and losing the gut microbiota happens side by side. Several recent studies using preclinical model demonstrate that bacteria when ingested in adequate amounts positive mental activity have been reported through the alteration of electrical activity.[22] Effects of fasting have been studied by various researcher and reports show the beneficial effect of metabolic markers.[23] In fasting, altered functions of gut microbiota indicate that (i) transition of white adipose tissue to brown adipose tissue occurs, which is a beneficial reaction (ii) increased level of acetate and lactate (iii) upregulation of monocarboxylate transporter in various tissues such as beige adipose cells, hepatic steatosis, insulin resistance and ameliorates obesity.[23] Time restricted feeding or intermediate fasting is an eating pattern which involves "feeding window" and "fasting window". During fasting period, gut microorganisms change the host physiology and number of functions in body. Gut microbiota helps in supply of alternative energy sources, such as ketone bodies[24] and various research studes in other animals supports the data.[25]

Function of Microbiota

In 1885, Louis Pasteur speculates that animals lacking bacteria in their gut would die.We realize the truth. Consequences of food what we eat has many different functions depending upon the type of food we eat. Metabolic health is regulated by diversities of microbiome.[26,27] and circardian rhythm is entertained by the food signals.[28] During healthy state, body's immune system reacts with pathomicrobes while tolerant for beneficial microbiota and that beneficial microbiota are called "Symbiont".[29,30] At the same time, many other species of bacteria are viewed as opportunistic pathogens or pathobionts and the immune system of our body carefully monitor the flora communities of our gut to maintain the host defence.[31,32] Microbiota of gut regulates the T cell homeostasis and their differentiation.[33] Microbes of gut interact with immune cells and induce them to secrete cytokines that circulate through the blood and reach at brain. Lipopolysaccharides provide low-grade tonic stimulation to the innate immunity through bacteria dysbiosis. Gut microbiota interacts with enteroendocrine cells and produce neuroactive peptides that sends signal to brain.[34] Gut microbes shape the architecture of sleep and stress reactivity of the hypothalamic pituitary adrenal axis. They influence memory, mood, and cognition and are clinically and the rapeutically relevant to a range of disorders, including alcoholism, chronic fatigue syndrome, fibromyalgia, and restless legs syndrome. In the immune cell development and function, gut microbiota plays a crucial role.[35, 36] Recent findings showed that the presence of previously encountred memories present in the non-immune cells of the hosts where the key players are host and gut microbe.[37,38] Gut microbes performs a great role in host the innate immune. Pattern recognitionreceptors (PRRs), expressed by innate immune cells such asdendritic cells (DCs), monocytes/macrophages, and naturalkiller (NK) cell which are key regulators and act as sensor for host microbe communications.[39-42] Gut Microbes are the intersection of diet and health. For survival of trillions of microbes reside inside the gut, dietary nutrients are essential. Hence to promote the metabolic health, mental health and immunological health, it is important to monitor the gut microbiota.

Gut Microbiota Regulate Innate Immunity

Innate immunity and its memory are involved with myeloid cells such as dendritic cells, monocytes and macrophages, innate lymphoid cells including natural killer cells, and bone marrow progenitor cells.[43] The microbiota derived ligands, products and any metabolic intermediate products initiates and affect the innate immune cells through the PPR. Pattern recognition receptors (PPRs) are the key molecular players that communicate the host and microbes.The training of PPRs expressing innate cells of microbiomeare prerequisite of protective innate immunity mechanism during secondary exposure/infection of pathogens.[44]

Role of Microbiota in Drug Metabolism

In comparison to overall microbial community, the gut microbiota contains a relatively active subgroup. There is remarkable variation in the proportion of physiologically active group of microbiota in healthy individual with that of unhealthy individuals those who takes drugs. Gut microbiome not only altered physiologically by short term exposer of drugs or xenobiotics, but also composition of overall microbiota and gene expression get altered significantly. These responses of change in gut microbiota and the molecular pathway involved in the xenobiotic metabolism and

the resting potential damage from the signalling molecules.[45] The human gut is an ecosystem harbouring diversified microbiota, productive bacterial community, shows a surprizing level of temporal variations with temperature, pH, nutrient variety and antibiotics. Also it seems the molecular pathways are inter related with the change of phage exposure, bile acids, host immunity and other ill-defined factors.[46]

Future Prospective

Many gut microbiota identified as probiotics and those were originally isolated from the gastrointestinal tract, and they were defined by the Food and Agriculture Organization of the United Nations (FAO)/WHO as "live Microorganisms. These probiotics are administered in adequate amounts confer a health benefit on the host. However systematic study and mechanism need to be clearly defined how these gut microbiota exert their beneficial effects on the host through (i) interference with potential pathogens (ii) improvement of barrier function (iii) immunomodulation (iv)production of neurotransmitters and (v) memory induction.An important clinical and scientific question is whether adopting a regular, intermittent fasting regimen is a feasible and sustainable population based strategy for promoting gut microbiota and metabolic health. The future clinical research should answer these questions.

Conclusion

Convenient amount of evident demonstrate that there is a very intimate relationship of host and gut microbiota. Several studies using preclinical data shows that microbiota involves in multifactorial function and it is highly reasonable. Supporting clinical finding are awaited.

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Review Article

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Nutrimental and Ethnomedicinal Potential Plants of the Qur'an: An overview: V

T P Mall

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Abstract

Our ancient literatures of Hindus', Muslims as well as of Cristian's are full of plants described about their nutrimental and medicinal potential. A significant number of plants described in their texts are still unidentified because of least or no interest in plant taxonomy among neither grate scientists in well-developed different organisations nor respected teachers of Universities or Colleges of repute. We can say with confidence that there are no teachers who can teach Plant Taxonomy in significant numbers of academic institutions. A man of Biotechnology can do nothing if he/she cannot identify the plant on which the work has to be worked out. As a result, due to non-identification of plants we cannot use our wealth of knowledge which has been provided by our ancestors present in form of scripts.

We were presented a book written by M I H Farooqi entitled "Quruani Poudhe Vagayanic Dhristi Se" while in Seminar organised by UP Biodiversity Board, Lucknow. We found that there are seventy one plants being reported in Holy Qur'an and Bible. We have consulted the literatures available as well as the tribal of Bahraich about the uses of the plants available. The perusal of the alphabetical list of plants of Holy Qur'an reveals that there are 71 plant species representing 48 genera of 30 families. Brassicaceae, Cucurbitaceae and Moraceae family were found to be the biggest family represented by 6 plant species each whereas Caesalpiniaceae, Papilionoideae and Poaceae with 5 plant species each; Rosaceae and Rhamnaceae with 4 plant apecies; Mimosaceae, Liliaceae, Pinaceae, Euphorbiaceae, Oleaceae, Lytharaceae, Lamiaceae and Arecaceae with 2 plant species and rest fourteen species viz., Malvaceae, Asclepidiaceae, Lauraceae, Bixaceae, Dipterocarpaceae, Juglandaceae, Cuprassaceae, Lecnoraceae, Loranthaceae, Anacardiaceae, Sterculiaceae, Ericaceae, Salvadoraceae, and Vitaceae is being represented by single plant species each.

Keywords: Ethnobotanical; Ethnomedicinal; Potential; Plants; Qur'an.

Introduction

Herbal Medicine is the oldest form of medicine known to mankind. It was the mainstay of many early civilizations and still the most widely practiced form of medicine in the world today,

Ethnobotany is one of the most interesting themes of economic botany which might have first of all came into the existence probably when earliest man of "stone age" observed the animals mostly the apes and monkeys eating certain plants or plant parts ex. Fruits, leaves and even inflorescences to satisfy their hunger. Therefore, on the basis of plants usage first of all by animals and later on by the human beings the concepts of Ethnobotany and Ethnozoology were evolved, which merged into a common term known as Ethnobiology. However, the term Ethnobotany was first of all used in the last of 19th century by JW Harsh Berger (1895) to indicate the interrelationship of plants with aboriginal people or tribal societies [Trivedi and Sharma, 2011]. In many parts of the world, wild plants are obtained from forests or wild areas designated for extractive resources and managed by local communities [Jadhav et al., 2011]. Wild edible plants provide food quantity as well as medicines [Patale et al., 2015].

India is one of the twelve mega-biodiversity countries of the World having rich vegetation with a wide variety of plants. As per the 2001 census, the tribal population of India is 8.43 crore, constituting 8.2% of total population of the country [Annual Report, 2005-2006]. With enormously diversified

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ethnic groups and rich biological resources, India represents one of the great emporia of ethnobotanical wealth [Pal, 2000]. Even today, trial's and certain local communities in India still collecting and preserving locally available wild and cultivated plant species for their day today life [Mahishi et al., 2005 and Ayyanar et al., 2010].

We were presented a book written by M I H Farooqi entitled "Quruani Poudhe Vagayanic Dhristi Se" while in Seminar organised by UP Biodiversity Board, Lucknow. We found that there are seventy one plants being reported in Holy Qur'an and Bible. We have consulted the literatures available as well as the tribal of Bahraich about the uses of the plants available. The perusal of the alphabetical list of plants of Holy Qur'an reveals that there are 71 plant species representing 48 genera of 30 families. Brassicaceae, Cucurbitaceae and Moraceae family were found to be the biggest family represented by 6 plant species each whereas Caesal piniaceae, Papilionoideae and Poaceae with 5 plant species each; Rosaceae and Rhamnaceae with 4 plant apecies; Mimosaceae, Liliaceae, Pinaceae, Euphorbiaceae, Oleaceae, Lytharaceae, Lamiaceae and Arecaceae with 2 plant species and rest fourteen species viz., Malvaceae, Asclepidiaceae, Lauraceae, Bixaceae, Dipterocarpaceae, Juglandaceae, Cupras saceae,Lecnoraceae,Loranthaceae, Anacardiaceae, Sterculiaceae, Ericaceae, Salvadoraceae, and Vitaceae is being represented by single plant species each. We have enumerated five plants viz., *Acacia nilotica, Acacia senegal, Acacia seyal, Alhgi maurorum and Allium cepa* in detail in first part and eight plants viz., *Allium sativum, Astragaluh adscendens, Bombax ceiba, Brassica arabica, Brassica juncea, Brassica nigra, Brassica rapa and Brassica schimperi* in second part of the manuscript. and in third part of the manuscript we have enumerated seven plants viz., *Butea monosperma, Calotropis gigantean, Cedrus libani, Cedrus deodara, Ceratonia siliqua, Cinnamomum camphora and Citrullus colocunthis*. In the fourth part we have enumerated eight plants viz., *Cochlospermum religiosum, Cucumis melo, Cucumis utilisimus, Cucurbita pepo, Cydonia vulgaris, Dryobalamops aromaticum, Euphorbia resinifera and Ficus benghalensis*. In the present fifth part we are enumerating nine plants viz., *Ficus carica, Ficus elastica, Ficus racemose,Ficus religiose, Ficus rumphi,Fraxinus ornus, Hordeum vulgare, Juglans regia, Juniperus oxycedrus*.The present review is an attempt to compile most of the information available regarding the distribution, cultivation, phytochemical characteristics, Ayurvedic properties, ethno-pharmacological, medicinal and non-medicinal uses of the plants.

Eumerations:

Ficus caricaLinn.,Common fig(Moraceae):

Synonyms:

Caprificus insectifera Gasp., *Caprificus leucocarpa* Gasp., *Caprificus oblongata* Gasp., *Caprificus pedunculata* (Miq.) Gasp., *Caprificus rugosa* (Miq.) Gasp., *Caprificus sphaerocarpa* Gasp., *Ficus albescens* Miq., *Ficus burdigalensis* Poit. & Turpin, *Ficuscaprificus* Risso, *Ficus colchica* Grossh., *Ficus colombra* Gasp., *Ficus communis* Lam., *Ficus deliciosa* Gasp., *Ficus dottata* Gasp.*Ficus globosa* Miq., *Ficus hypoleuca* Gasp., *Ficus hyrcana* Grossh., *Ficus kopetdagensis* Pachom., *Ficus latifolia* Salisb., *Ficus leucocarpa* Gasp. *Ficus macrocarpa* Gasp., *Ficus neapolitana* Miq., *Ficus pachycarpa* Gasp.*Ficus pedunculata* Miq., *Ficus polymorpha* Gasp., *Ficus praecox* Gasp., *Ficus regina* Miq., *Ficus rugosa* Miq., *Ficus silvestris* Risso, *Ficus rupestris* (Hausskn. ex Boiss.) *Azizian*.

Ficus carica is an Asian species of flowering plant in the mulberry family, known as the common fig or fig. It is the source of the fruit also called the fig and as such is an important crop in those areas where it is grown commercially. Native to the Middle East and Western Asia, it has been sought out and cultivated since ancient times and is now widely grown throughout the world, both for its fruit and as an ornamental plant [Gustavus, 1901; RHS, 2008]. The species has become naturalized in scattered locations in Asia and North America[Wu Hua Guo, 1753; Biota of North America Prog, 2014].

Ficus carica is a gynodioecious (functionally dioecious)[Waynes, 2009], deciduous tree or large shrub, growing to a height of 7-10 m, with smooth white bark. Its fragrant leaves are 12–25cm long and 10-18cm across, and deeply lobed with three or five lobes. The complex inflorescence consists of a hollow fleshy structure called the syconium, which is lined with numerous unisexual flowers. The flowers themselves are not visible from outside the syconium, as they bloom inside the infructescence. Although commonly referred to as a fruit, the fig is actually the infructescence or scion of the tree, known as a false fruit or multiple fruit, in which the flowers and seeds are borne. It is a hollow-ended stem containing many flowers. The small orifice (ostiole) visible on the middle of the fruit is a narrow passage, which allows the specialized fig wasp *Blastophaga psenes* to enter the fruit and pollinate the flower, whereafter the fruit grows seeds.

The edible fruit consists of the mature syconium containing numerous one-seeded fruits (druplets) [Waynes, 2009]. The fruit is 3-5 cm long, with a green skin, sometimes ripening towards purple or brown. Ficus carica has milky sap (laticifer). The sap of the fig's green parts is an irritant to human skin[Purdu Univ., 2014].

The common fig tree has been cultivated since ancient times and grows wild in dry and sunny areas, with deep and fresh soil; also, in rocky areas, from sea level to 1,700m. It prefers relatively light free-draining soils, and can grow in nutritionally poor soil. Unlike other fig species, *Ficus carica* does not always require pollination by a wasp or from another tree, [Wolfe, 2014; Ferguson, 2007] but can be pollinated by the fig wasp, *Blastophaga psenes* to produce seeds. Fig wasps are not present to pollinate in colder countries like the United Kingdom[Peters, 2003].

Ficus carica is dispersed by birds and mammals that scatter their seeds in droppings. Fig fruit is an important food source for much of the fauna in some areas, and the tree owes its expansion to those that feed on its fruit. The common fig tree also sprouts from the root and stolon tissues.

The infructescence is pollinated by a symbiosis with a fig wasp ie., *Blastophaga psenes*. The fertilized female wasp enters the fig through the scion, which has a tiny hole in the crown, the ostiole. She crawls on the inflorescence inside the fig and pollinates some of the female flowers. She lays her eggs inside some of the flowers and dies. After weeks of development in their galls, the male wasps emerge before females through holes they produce by chewing the galls. The male wasps then fertilize the females by depositing semen in the hole in the gall. The males later return to the females and enlarge the holes to enable the females to emerge. Then some males enlarge holes in the scion, which enables females to disperse after collecting pollen from the developed male flowers. Females have a short time (<48 hours) to find another fig tree with receptive scions to spread the pollen, assist the tree in reproduction, and lay their own eggs to start a new cycle[Peters, 2003].

The edible fig is one of the first plants that was cultivated by humans. Nine subfossil figs of a parthenocarpic, and therefore sterile, type dating to about 9400-9200 BCE were found in the early Neolithic village Gilgal I in the Jordan Valley, 13 km north of Jericho. The find precedes the domestication of wheat, barley, and legumes, and may thus be the first known instance of agriculture. It is proposed that thissterile but desirable type was planted and cultivated intentionally, one thousand years before the next crops were domesticated e.g.,wheat and rye[Kisley et al., 2006a, b and Lev-Yadun et al., 2006].

Figs were widespread in ancient Greece, and their cultivation was described by both Aristotle and Theophrastus. Aristotle noted that as in animal sexes, figs have individuals of two kinds, one, the cultivated fig that bears fruit, and one, the wild capri fig that assists the other to bear fruit. Further, Aristotle recorded that the fruits of the wild fig contain psenes (fig wasps); these begin life as larvae, and the adult psen splits its "skin" (pupa) and flies out of the fig to find and enter a cultivated fig, saving it from dropping. Theophrastus observed that just as date palms have male and female flowers, and that farmers (from the East) help by scattering "dust" from the male on to the female, and as a male fish releases his milt over the female's eggs, so Greek farmers tie wild figs to cultivated trees. They do not say directly that figs reproduce sexually, however[Leroi, 2014].

Figs were also a common food source for the Romans. Cato the Elder, in his c. 160 BCEDe Agri Cultura, lists several strains of figs grown at the time he wrote his handbook: the Mariscan, African, Herculanean, Saguntine, and the black Tellanian (De agri cultura, ch. 8). The fruits were used, among other things, to fatten geese for the production of a precursor of foie gras. Rome's first Emperor Augustus was reputed to have been poisoned with figs from his garden smeared with poison by his wife Livia.[Beard, 2013a; Cassius, 1924] For this reason, or perhaps because of her horticultural expertise, a variety of fig known as the Liviana was cultivated in Roman gardens[Beard, 2013b].

It was cultivated from Afghanistan to Portugal, also grown in Pithoragarh in the Kumaon hills of India. From the 15th century onwards, it was grown in areas including Northern Europe and the New World [Gustavus, 1901]. In the 16th century, Cardinal Reginald Pole introduced fig trees to Lambeth Palace in London.

In 1769, Spanish missionaries led by Junipero Serra brought the first figs to California. The Mission variety, which they cultivated, is still popular [Roeding, 1903] The fact that it is parthenocarpic (self-pollinating) made it an ideal cultivar for introduction.

The common fig is grown for its edible fruit throughout the temperate world. It is also grown as an ornamental tree, and in the UK the cultivars 'Brown Turkey'[Storey et al., 1977] and 'Ice Crystal'

mainly grown for its unusual foliage [RHS, 2018] have gained the Royal Horticultural Society's Award of Garden Merit [AGM Plants, 2017].

Figs are also grown in Germany, mainly in private gardens inside built up areas. There is no commercial fig growing [Feigenernte] The Palatine region in the German South West has an estimated 80,000 fig trees. The variety Brown Turkey is the most widespread in the region [Seiler, 2016a]. There are about a dozen quite widespread varieties hardy enough to survive winter outdoors mostly without special protection. There are even two local varieties, "Martinsfeige" and "Lussheim", which may be the hardiest varieties in the region [Seiler, 2016b].

Figs can be found in continental climates with hot summers as far north as Hungary and Moravia. Thousands of cultivars, most named, have been developed as human migration brought the fig to many places outside its natural range. Fig plants can be propagated by seed or by vegetative methods. Vegetative propagation is quicker and more reliable, as it does not yield the inedible caprifigs. Seeds germinate readily in moist conditions and grow rapidly once established. For vegetative propagation, shoots with buds can be planted in well-watered soil in the spring or summer, or a branch can be scratched to expose the bast (inner bark) and pinned to the ground to allow roots to develop [Figs, 2016].

Two crops of figs can be produced each year [Figs, 2016] The first or breba crop develops in the spring on last year's shoot growth. The main fig crop develops on the current year's shoot growth and ripens in the late summer or fall. The main crop is generally superior in quantity and quality, but some cultivars such as 'Black Mission', 'Croisic', and 'Ventura' produce good breba crops

There are three types of edible figs [NAFE, 2009]: Persistent (or common) figs have all female flowers that do not need pollination for fruiting; the fruit can develop through parthenocarpic means. This is a popular horticulture fig for home gardeners. Dottato (Kadota), Black Mission, Brown Turkey, Brunswick, and Celeste are some representative cultivars.

Caducous (or Smyrna) figs require cross pollination by the fig wasp with pollen from caprifigs for the fruit to mature. If not pollinated the immature fruits drop. Some cultivars are Marabout, Inchàrio, and Zidi.

Intermediate (or San Pedro) figs set an unpollinated breba crop but need pollination for the later main crop. Examples are Lampeira, King, and San Pedro.

There are dozens of fig cultivars, including main and Breba cropping varieties, and an edible caprifig (the Croisic). Varieties are often local, found in a single region of one country [Figs, 1996: Janick and Moore, 1975].

The Kadota cultivar is even older, being mentioned by the Roman naturalist Pliny in the 1st century A.D. [Storey et al., 1977].

Figs contain diverse phytochemicals under basic research for their potential biological properties, including polyphenols, such as gallic acid, chlorogenic acid, syringic acid, (+)-catechin, (−)-epicatechin and rutin [Vinson, 1999; Veberic et al., 2008] Fig colour may vary between cultivars due to various concentrations of anthocyanins, with cyanidin-3-O-rutinoside having particularly high content [Solomon et al., 2006].

In some old Mediterranean folk practices, the milky sap of the fig plant was used to soften calluses, remove warts, and deter parasites [Landranco, 2001].

Like other plant species in the Moraceae family, contact with the milky sap of Ficus carica followed by exposure to ultraviolet light can cause Phytophotodermatitis, [Polat et al., 2008; Son et al., 2017] a potentially serious skin inflammation. Although the plant is not poisonous per se, F. carica is listed in the FDA Database of Poisonous Plants [FDA Poisonous Plant Database, 2018].

Organic chemical compounds called furanocoumarins are known to cause phytophotodermatitis in humans [McGovern and Barkley, 2000]. The common fig contains significant quantities of two furanocoumarins, psoralen and bergapten [Zaynoun et al., 1984] The essential oil of fig leaves contains more than 10% psoralen, the highest concentration of any organic compound isolated from fig leaves [Li et al., 2011] Psoralen appears to be the primary furanocoumarin compound responsible for fig leaf-induced Phytophotodermatitis.

Psoralen and bergapten are found chiefly in the milky sap of the leaves and shoots of F. carica but not the fruits [Zaynoun et al., 1984]. Neither psoralen nor bergapten were detected in the essential oil of fig fruits [Li et al., 2011]. Thus, there is no conclusive evidence that fig fruits cause Phyto photodermatitis.

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Ethnobotanical Potential:

Figs can be eaten fresh or dried, and used in jam-making. Most commercial production is in dried or otherwise processed forms, since the ripe fruit does not transport well, and once picked does not keep well. The widely produced fig roll is a biscuit (cookie) with a filling made from figs.

Fresh figs are in season from August through to early October. Fresh figs used in cooking should be plump and soft, and without bruising or splits. If they smell sour, the figs have become over ripe. Slightly under ripe figs can be kept at room temperature for 1–2 days to ripen before serving. Figs are most flavourful at room temperature [BBC Good Food, 2016].

Fruit are consumed either raw or cooked [Chittendon, 1951; Simmons, 1972; Grieve, 1984; Uphof, 1959].

Sweet and succulent, a fully ripe specimen is an exquisite fruit that almost literally melts in the mouth [Fern, 2014].

The fruit is often dried for later use [Facciola, 1990] and this dried fruit is a major item of commerce. Figs are usually pear-shaped and up to 5cm in diameter [Huxley, 1992].

The latex from the sap can be used to coagulate plant milks [Facciola, 1990].

Wood - pliable but porous and of little value [Grieve, 1984; Poluninand Huxley,1987]. It is used for hoops, garlands, ornaments etc [Polunin and Huxley, 987]. When saturated with oil and covered with emery is used as a substitute for a hone [Grieve, 1984].

Ethnomedicinal Potential

A decoction of the leaves is stomachic [Duke and Ayensu, 1985]. The leaves are also added to boiling water and used as a steam bath for painful or swollen piles [Duke and Ayensu, 1985].

The latex contains the proteolytic enzyme ficin - this has the property of destroying round worms and, in some instances, hook-worms [Flora Malesiana Series-1]. The enzyme, however, is more or less injurious to the intestine [Flora Malesiana Series-1].

The latex from the stems is used to treat corns, warts and piles [Grieve, 1984; Polunin and Huxley,1987; Duke and Ayensu, 1985]. It also has an analgesic effect against insect stings and bites [Chief, 1984].

The fruit is mildly laxative, demulcent, digestive and pectoral [Grive, 1984; Chief, 1984; Duke and Ayensu, 1985].

The unripe green fruits are cooked with other foods as a galactagogue and tonic [Duke and Ayensu, 1985]. The roasted fruit is emollient and used as a poultice in the treatment of gumboils, dental abscesses etc [Grieve, 1984].

Syrup of figs, made from the fruit, is a well-known and effective gentle laxative that is also suitable for the young and very old [Chevallier, 1996; Fern, 2014].

A decoction of the young branches is an excellent pectoral [Chief, 1984].

The plant has anticancer properties [Duke and Ayensu, 1985].

Ficus elasticaRoxb. ex Hornem.Rubber fig, Rubber plant(Moraceae):

Synonyms:

Ficus clusiifolia Summerh. 1929, *Ficus cordata* Kunth and Bouché 1846, *Ficus elastica* var. *belgica* Bailey and Bailey, *Ficus elastica* var. *benghalensis* Blume, *Ficus elastica* var. *decora* Guillaumin, *Ficus elastica* var. *karet* (Miq.) Miq., *Ficus elastica* var. *minor* Miq., *Ficus elastica* var. *odorata* (Miq.) Miq., *Ficus elastica* var. *rubra* Bailey and Bailey, *Ficus karet* (Miq.) King, *Ficus skytinodermis* Summerh., *Ficus taeda* Kunth & Bouché, *Macrophthalma elastica* (Roxb. ex Hornem.) Gasp., *Visiania elastica* (Roxb. ex Hornem.) Gasp.

Ficus elastica, the rubber fig, rubber bush, rubber tree, rubber plant, or Indian rubber bush, Indian rubber tree, is a species of plant in the fig genus, native to eastern parts of South Asia and southeast Asia. It has become naturalized in Sri Lanka, the West Indies, and the US State of Florida [Wu et al., 2013; Flora of North America].

It is a broadleaf evergreen shrub or large tree in the banyan group of figs, growing to 30-40 m, rarely up to 60 m tall, with a stout trunk up to 2m in diameter. The trunk develops aerial and but tressing roots to anchor it in the soil and help support heavy branches.

It has broad shiny oval leaves 10-35 cm long and 5-15 cm broad; leaf size is largest on young plants, occasionally to 45 cm long, much smaller on old trees typically 10 cm long. The leaves develop inside a sheath at the apical meristem, which grows larger as the new leaf develops. When it is mature, it unfurls and the sheath drops off the plant. Inside the new leaf, another immature leaf is waiting to develop.

As with other members of the genus Ficus, the flowers require a particular species of fig wasp to

pollinate it in a co-evolved relationship. Because of this relationship, the rubber plant does not produce highly colourful or fragrant flowers to attract other pollinators. The fruit is a small yellow green oval fig 1cm long, barely edible; these are fake fruits that contain fertile seeds only in areas where the pollinating insect is present.

The natural range of rubber ranges from Nepal in the north to Indonesia, Bhutan, Northeastern India, Burma and China (Yunnan) and Malaysia. It has been widely introduced in most tropical regions of the world, including Hawaii and the West Indies. Finally, in Europe, it can be found in the sheltered gardens of the Côte d'Azur and on the Spanish and Italian coast.

In parts of India, people guide the roots of the tree over chasms to eventually form living bridges [Living Root Bridges]

Ficus elastica is grown around the world as an ornamental plant, outside in frost free climates from the tropical to the Mediterranean and inside in colder climates as a house plant. Although it is grown in Hawaii, the species of fig wasp required to allow it to spread naturally is not present there.

Most cultivated plants are produced by vegetative propagation. This can be done by cuttings or by layering. This last method consists in notching the stem of the plant. The wound, which leaves the latex of the plant oozing, is coated with cuttings hormones and tightly wrapped with moist foam. The whole is covered with a plastic film and left a few months at the end of which new roots have developed from the axillary buds. The stem is then weaned and the new plant can be repotted.

Ficus elastica yields a milky white latex, a chemical compound separates from its sap and carried and stored in different cells. This latex was formerly used to make rubber [Wu et al., 2013] but it should not be confused with the Pará rubber tree, the main commercial source of latex for rubber making. Just as with *Hevea brasiliensis*, the latex of *Ficus elastica* is an irritant to the eyes and skin and is toxic if taken internally [Elvin, 2012].

All parts of the plant contain an abundant milky white latex, which has been tested for use in the manufacture of rubber, but without economic and technical results; the rubber is actually produced from the sap of the rubber tree.

It prefers hill forest, particularly on cliffs and limestone hills [Flora Malesiana Series-1].

In cultivation, it prefers bright sunlight but not hot temperatures. It has a high tolerance for drought, but prefers humidity and thrives in wet, tropical conditions. Ornamental hybrids (such as Robusta) have been derived from *Ficus elastica* with broader, stiffer and more upright leaves than the wild form. Many such hybrids exist, often with variegated leaves.

Ethnobotanical Potential

Young leaves are eaten as vegetable [Mansfeld's Database of Agricultural and Horticultural Plants].

The very young leaf tips, harvested before the leaves have expanded, are eaten as a salad [Medicinal Plants of the Philippines].

A latex is obtained from the bark of the stem and larger branches [Plant Resources of Southeast Asia;Flora Malesiana Series-1]. This can be used for all applications of natural rubber, such as tyres, rubber components for cars and machines and consumer products such as footwear, sport goods, toys and gloves [Plant Resources of Southeast Asia].

Traditionally, the latex is used to line baskets of split rattan, to make them water tight [Plant Resources of Southeast Asia], and has sundry other applications [Flora Malesiana Series-1].

The rubber made from this plant contains 4 - 20% resin, which hardens over time and decreases the rubber's elasticity [Plant Resources of Southeast Asia]. The rubber has relatively short chains of polyisoprenes of low molecular weight: 78 000. It is soluble in cajeput oil (*Melaleuca cajuputi* Powell). The rubber is hypoallergenic to individuals allergic to the proteins found in Hevea brasiliensis rubber products [Plant Resources of Southeast Asia].

The latex of wild as well as planted trees can be collected by tapping the bark, generally only of the stem and larger branches, though root bark may also be tapped. It is best to harvest when the air humidity is high, as drier conditions cause the latex to coagulate too fast and rain reduces the rubber content of the exudate. Traditionally the bark is cut with a knife or small axe, later incisions are made with a gouge to better control the depth of cutting and to limit the wounding of the cambium. In the bark the laticifers are found closest to the cambium in a fibrous tissue which is difficult to cut. If the incision is not deep enough, the tissue containing most laticifers is not tapped and yield is low. A deep incision damages the cambium and hence influences the vitality of the tree. A V-shaped gouge can also be used to make horizontal incisions up to 5 cm wide and some 20 cm long, the length never exceeding half the circumference of the tree. These cuts are about 40 cm apart and on opposite sides of

the tree. A herringbone system is also been applied, in which a central vertical channel transports the latex from grooves made at an angle of 45° with the vertical to a container driven into the bark of the tree. Inside the inclined grooves the fibres are punctured or cut at intervals of 2–3 cm, to tap the laticifers closest to the cambium. This, however, also punctures or cuts the cambium layer. An advantage of the herring bone system is that the latex is collected as a fluid and is of better quality than the 'scrap' collected from the horizontal incisions or from underneath the tree. The latex drips from the horizontal incisions for about 2–3 minutes and is collected on a mat or on leaves placed underneath the tree. The coagulated latex is collected 2–3 days later; when stripped off the incision a milky residue oozes from the wound, but this liquid contains no rubber. A well developed planted tree can be tapped after 6–7 years, but with increasing age (and circumference of the tree) when the first tapping is done, both yield as well as rubber content of the latex increase. There has been much debate and experimenting on the frequency of tapping. In this respect it is important that the latex extracted is not replaced and that there is no anastomosis between the laticifers, so only the latex from the immediate vicinity of the tapping wound exudes. This is why consecutive tapping's, whether every day or once a year for three years, have shown a marked decrease in yield. Yields in g/tree from a tapping trial with 55 trees in Bogor for four harvests at intervals of 2, 3, and 4 years were 238g, 67g, 70g and 320g. This suggests that it takes four years before the laticifers are reconstituted. Provided the tree will survive, it is therefore, more rational to extract the maximum amount of latex at once, rather than tapping trees several times over a period of few years [Plant Resources of Southeast Asia].

The 'scrap' from *Ficus elastica* is sorted by hand and cleaned. The latex is difficult to coagulate: neither heating nor adding organic or mineral acids, even concentrated sulphuric acid, or alkali, will cause it to coagulate. Instead, it must be beaten and kneaded, and alcohol must be added. This yields a superior product which does not become sticky with time. Ammonia and tannin have been used as coagulants in Peninsular Malaysia. The 'scrap' and the coagulated latex are pressed into blocks, cakes or sheets before being traded [Plant Resources of Southeast Asia].

The latex showed toxicity to the juveniles of the nematode Meloidogyne javanica [Plant Resources of Southeast Asia].

The fibrous bark has been used for the manufacture of clothes and ropes [Plant Resources of Southeast Asia].

The wood is of poor quality, but is occasionally applied for boards, posts, boats and fuel [Plant Resources of Southeast Asia].

Ethnomedicinal Potential

A decoction of the aerial rootlets is used as a vulnerary [Medicinal Plants of the Philippines].

The latex has been successfully used to treat five cases of trichiasis [Medicinal Plants of the Philippines].

Ficus racemosa Linn,Umar, Gular, Cluster Fig, Dharma Patra (Moraceae)

Synonyms:

Covellia glomerata (Roxb.) Miq., *Covellia lanceolata* (Buch.-Ham. ex Roxb.) Miq., *Covelliamollis* Miq., *Ficus acidula* King, *Ficus chittagonga* Miq., *Ficus glomerata* Roxb., *Ficusglomerata* var. *chittagonga* (Miq.) King, *Ficus glomerata* var. *elongata* King, *Ficus glomerata* var. *miquelii* King, *Ficus glomerata* var. *mollis* (Miq.) King, *Ficus goolereea* Roxb., *Ficus henrici* King, *Ficus lanceolata* Buch-Ham. ex Roxb., *Ficus lucescens* Bl.,*Ficusmollis* (Miq.) Miq. *Ficus racemosa* var. *miquelii* (King) Corner, *Ficus racemosa* var. *mollis* (Miq.) Barrett, *Ficus racemosa* var. *vesca* (F. Müll. ex Miq.) Barrett, *Ficus semicostata* F. M. Bailey, *Ficus trichocarpa* Decne., *Ficus vesca* F. Müll. ex Miq., *Urostigma lucescens* (Bl.) Miq.

Trees, ca. 30 m tall. Stem profusely branched, with thick, brownish grey bark; young shoots faintly scabrid. Stipules 10-15 x 3-5mm long, deciduous, triangular, entire along margins, acute at apex, pubescent outside, glabrous inside. Leaves 9-22 cm long, alternate; lamina 6-14 × 3.5-8 cm, elliptic to ovate, rounded or cuneate at base, entire along margins, acute at apex, pubescent both sides; mid vein prominent; basal vein 1 pair, reaches up to ca. 1/3 of lamina; secondary veins 4-8 pairs; reticulation distinct; petiole 1.5-6 cm long, minutely pubescent when young, becoming brown and scurfy at age. Receptacles clustered on up to 25 cm long leafless branchlets on main trunk and branches; peduncle ca. 1 cm long, pubescent; puberulous when young. Basal bracts 3, green, greenish pink or mauve, 2-3 × 2 mm, triangular or broadly ovate, obtuse to rounded at apex, pubescent outside, glabrous inside. Fig body 35-50 mm across, sub-globose, pyriform to subobovate, pubescent, reddish after ripening; ostiole plane or slightly sunken, closed by 5-6 apical bracts, the mouth is occupied by rows of bracts; stipe up to 7 mm long, pubescent. Male Flowers ca. 3 mm

long, ostioler, in 2-3 rings, sessile; tepals 3-4, membranous, completely envelop the stamens; stamens 2; the filaments united at base, length ca. 2 mm; anther ovate. Gall Flowers distributed everywhere in syconium, 4-5 mm long; stalk 2-3 mm long; tepals 4, ca. 2 mm long, ovate to elliptic, jointed below, free above, dentate-lace-rate along margins, acute to minutely acuminate at apex; ovary rough; style short, lateral; stigma clavate. Female Flowers ca. 4 mm long, sessile or very minutely stalked; tepals 3, 2-3 mm long, jointed at base, lanceolate, irregularly dentate and clefted along margins, acute to acumi-nate at tip; ovary sessile, red spotted; style 1-2mm long, subterminal; stigma clavate[Kumar et al., 2011]. Phenology: March–July.

Distribution: India (Throughout up to low hills), Nepal, China, Bangladesh, Myanmar, Sri Lanka, Indochina, Pakistan, Malaysia, Australia.

Ethnobotanical Potential

The leaves are chopped and given to cattle and elephant as fodder.

Wood is not durable but used as well curbs as well as in doors, cross pieces for carts, rice mortars, matchboxes [Anonymous, 1956].

The ripe fruit is used in the preparation of cold jelly [Kumar et al., 2011].

Ethnomedicinal Potential

It is used in Folk medicine, Ayurveda, Siddha, Unani and Sowa Rigpa.

Sowa rigpa is a Traditional Tibetan medicine, also known as Sowa-Rigpa medicine, is a centuries-old traditional medical system that employs a complex approach to diagnosis, incorporating techniques such as pulse analysis and urine analysis, and utilizes behaviour and dietary modification, medicines composed of natural materials (e.g., herbs and minerals) and physical therapies (e.g. Tibetan acupuncture, moxibustion, etc.) to treat illness.

The Tibetan medical system is based upon Indian Buddhist literature (for example Abhidharma and Vajrayana tantras) and Ayurveda. It continues to be practiced in Tibet, India, Nepal, Bhutan, Ladakh, Siberia, China and Mongolia, as well as more recently in parts of Europe and North America. It embraces the traditional Buddhist belief that all illness ultimately results from the three poisons: ignorance, attachment and aversion. Tibetan medicine follows the Buddha's Four Noble Truths which apply medical diagnostic logic to suffering.

Root is useful in hydrophobia, dysentery and diabetes.

The bark is used in asthma and piles and as a wash for wounds also.

The unripe fruit is useful in cough, biliousness, leucorrhoea and blood diseases.

The ripe fruit is useful in blood diseases, biliousness, burning sensations, fatigue, urinary discharges, thirst, leprosy, menorrhagia, nose bleeding, chronic bronchitis, dry cough, loss of voice, diseases of the kidney and spleen [Kumar et al., 2011].

The milk is aphrodi-siac and vulnerary and used in inflammations, also ad-ministered in piles and diarrhoea and in combination with sesame oil in cancer [Kirtikar & Basu, 2001].

Ficus religiosa Linn.Pipal, Sacred fig, Peepal, (Moraceae):

Synonyms

Ficus caudata Stokes, *Ficus peepul* Griff., *Ficus rhynchophylla* Steud., *Ficus superstitiosa* Link, *Urostigma affine* Miq., *Urostigma religiosa* (L.) Gasparrini.

Peepal is unrivalled for its antiquity and religious significance. No other tree is claimed to have such long life one in Sri Lanka, said to have been planted in the year 288 B.C., still lives and flourishes. The Prince Siddhartha is known to have sat in meditation under a Bo tree and there found enlightenment from which time he became known as the Buddha. So, from then on, the tree was sacred to Buddhists. Hindus associate the tree with the three gods Brahma, Vishnu and Shiva, Vishnu being reputed to have been born under a Peepal, which is therefore, Vishnu himself in the form of a tree. A grand papal tree is a perfect shade tree, and village meetings are often conducted under a peepal tree. It is a large deciduous tree with a pale stem often appearing fluted on account of the numerous roots which have fused with the stem. Leaves leathery 4-8 inches long by 3-5 inches wide, somewhat egg shaped or rounded, tailed at the tip and heart shaped at the base, or sometimes rounded. The young leaves are frequently pink, change to copper and finally to green. Flowers minute within the receptacle. Fruit is a fig.

Ficus religiosa, commonly called bow tree, Bodhi tree, peepul and sacred fig, is native to Southeast Asia, southwest China, India and the Himalayan foothills. It is a large broadleaf evergreen tree with wide-spreading branching that grows to 60-100′ tall. Over time, the trunk may grow to as much

as 9' in diameter. In native monsoon climates, this tree is semi-deciduous to deciduous. It is epiphytic. Tree seed (often deposited by birds) may germinate in upper tree crevices, producing dangling, non-parasitic, aerial roots that grow to the ground, root in the soil and produce trunks. Figs that begin as epiphytes are often generally called Banyans (although the Banyan name is sometimes used only for *Ficus benghalensis*). Bo tree develops an attractive pale grey bark. Ovate-rounded, glossy, dark green leaves (to 7" long) are cordate with distinctive, extremely narrow, elongated tips. In its native habitat, the fruits of this tree (globular figs to 1/2" diameter) appear solitary or in pairs, emerging green but ripening to purple. Bo tree is sacred to followers of Buddhism and Hinduism because Gautama Buddha, the founder of Buddhism, reportedly sat under such a tree (known as the Bodhi tree) when he received enlightenment (bodhi). The oldest plant in the world of known planting date is the *Ficus religiosa* tree called Sri Maha Bodhi which was planted at the temple at Anuradhapura, Sri Lanka, in 288 B. C. Today the bo tree is revered as a symbol for prosperity, happiness, good fortune and long life.

It is widely planted in temple premises. It is distributed in East Himalayas; planted and naturalised in India and neighbouring countries.

Phytochemicals

The stem bark of *Ficus religiosa* are reported phytoconstituents of phenols, tannins, steroids, alkaloids and flavonoids, β-sitosteryl-D-glucoside, vitamin K, n-octacosanol, methyl oleanolate, lanosterol, stigmasterol, lupen-3-one [Sheetal et al., 2008].

The active constituent from the root bark of *Ficus religiosa* was found to be β-sitosteryl-D-glucoside, which showed a peroral hypoglycemic effect in fasting and alloxan diabetic rabbits and in pituitary-diabetic rats.

The fruits contain 4.9% protein having the essential amino acids, isoleucine, and phenylalanine [Oliver beaver, 1977].

The seeds contain phytosterolin, β-sitosterol, and its glycoside, albuminoids, carbohydrate, fatty matter, coloring matter, caoutchoue 0.7–5.1% [Khare, 2004].

Ficus religiosa fruits contain flavonols namely kaempeferol, quercetin, and myricetin [Bushra and Farooq, 2008].

Leaves and fruits contain carbohydrate, protein, lipid, calcium, sodium, potassium, and phosphorus [Ruby et al., 2000].

The aqueous extract of dried bark of *Ficus religiosa* has been reported to contain phytosterols, flavonoids, tannins, furanocoumarin derivatives namely bergapten and begaptol [Chandrasekar et al., 2010]

Ethnobotanical Potential

Leaves are used for medicinal purposes.

Considered a holy tree in the Hindu tradition.

Figs eaten by birds. Fodder forgoat,cattle.

It is a poor fuelwood.

Culturally significant.Used in tanning and dyeing.

The tree is harvested from the wild for local use as a food, medicine and source of materials. It is cultivated in the tropical regions of the world, mainly as ornamental tree with various uses [Mansfield Data base].

Fruits edible though not tasty [PROSA]. The small figs are used mainly as a famine food, eaten when nothing better is available [Uphof, 1959; World agroforestry Centre].

Leaf buds[Mansfield's data base]edible though not tasty[PROSA].

Eaten in times of scarcity[Hedrick, 1972].

The bark contains tannins and is used as a dye for cloth [PROSA; Howard, 1934; Mansfield's data base].

A latex obtained from the plant is used for making varnishes [Mansfield's data base].

A gum (is this the latex [Fern, 2014] obtained from the tree is used as a sealing wax [Uphof, 1959].

It is used by artificers for filling up the cavities of ornaments [Uphof, 1959].

The fibrous bark is used to make paper [PROSA].

The greyish-white wood is very light in weight and very soft [Howard, 1934]. It is moderately durable under cover and quite durable under water [World Agroforestry Centre]. The low-quality wood may be used for packing cases and matches [PROSA].

The wood is used for fuel [World Agroforestry Centre].

Ethnomedicinal Potential:

It is used in folk medicine, Ayurveda, Homoeopathy, Siddha, Unani, Sowa rigpa and Traditional Chinese medicine.

The fruits, leaves, bark and even the latex are used to prepare herbal remedies.

Herbs have always been the principal form of

medicine in India. Medicinal plants have curative properties due to the presence of various complex chemical substances of different composition, which are found as secondary plant metabolites in one or more parts of these plants. It is used traditionally as antiulcer, antibacterial, antidiabetic, in the treatment of gonorrhoea and skin diseases [Chandrasekaret al., 2010]

The leaves and twigs are alterative, antidote, aphrodisiac, astringent, antigonorrhoeal and laxative [PROSA]. It is used as an antidote against bites of venomous animals, and for the treatment of haemoptysis and fistula [PROSA].

Fresh sap from the leaves is used to cure diarrhoea, cholera and for wound healing [PROSA].

An infusion of the bark is drunk as an antidiabetic [PROSA].

A decoction of the bark is used as skin wash to treat scabies, ulcers and skin diseases [PROSA].

The aerial roots are diuretic [PROSA].

They are used in the treatment of ascites and are chewed by women to promote fertility [PROSA].

Antimicrobial activity

Aqueous and ethanolic extracts of *F. religiosa* leaves showed antibacterial effect against *Staphylococcus aureus, Salmonella paratyphi, Shigella dysenteriae, S. typhimurium, Pseudomonas aeruginosa, Bacillus subtillis, S. aureus, Escherichia coli, S. typhi* [Valsaraj et al., 1997; Mouse et al., 1994; Farrukh and Iqbal, 2003]. In another study, chloroform extract of fruits showed antimicrobial effect against *Azobacterchroococcum, Bacillus cereus, B. megaterium, Streptococcus faecalis, Streptomycin lactis, and Klebsiella pneumonia*[Mousa et al., 1994]. The ethanolic extract of leaves showed antifungal effect against *Candida albicans* [Farrukh and Iqbal, 2003]. Aqueous, methanol, and chloroform extracts from the leaves of F. *religiosa* were completely screened for antibacterial and antifungal activities. The chloroform extract of F. *religiosa* possessed a broad spectrum of antibacterial activity with a zone of inhibition of 10-21 mm. The methanolic extracts possessed moderate antibacterial activity against a few bacterial strains. There was less antibacterial activity or none at all using aqueous extracts. The extracts of *F. religiosa* were found to be active against Aspergillus niger and Penicillium notatum. The extracts from the leaves exhibited considerable and variable inhibitory effects against most of the microorganisms tested[Farrukh and Iqbal, 2003; Hemaiswarya et al., 2009].

Anthelmintic activity

Ficus religiosa bark methanolic extract was 100% lethal for *Haemonchus contortus* worms [Kaushik et al., 1981]. The stem and bark extracts of F. religiosa proved lethal to Ascaridia galli in vitro. The latex of some species of *Ficus* (Moraceae), i.e., *Ficus hispida*, *F. carica* was also reported to have anthelmintic activity against *Syphacia obvelata, Aspiculuris tetraptera,* and *Vampirolepis nana* [De Amorin et al., 1999].

Immunomodulatory activity

The immunomodulatory effect of alcoholic extract of the bark of *F. religiosa* was investigated in mice. The study was carried out by various haematological and serological tests. Administration of extract remarkably ameliorated both cellular and humoral antibody response. It is concluded that the extract possessed promising immunostimulant properties [Mallurvar and Pathak, 2008].

Wound-healing activity

The effect of hydroalcoholic extract of *F. religiosa* leaves on experimentally induced wounds in rats using different wound models results in dose-dependent wound-healing activity in excision wound, incision wound, and burn wound. A formulation of leaves extract was prepared in emulsifying ointment at a concentration of 5% and 10% and applied to the wounds. In excision wound and burn wound models, the extract showed significant decrease in the period of epithelization and in wound contraction (50%). A significant increase in the breaking strength was observed in an incision wound model when compared to the control. The result suggests that leaf extract of *F. religiosa* (both 5% and 10%) applied topically possess dose-dependent wound-healing activity[Naira et al., 2009].

Anticonvulsant activity

Methanolic extract of figs of *F. religiosa* had anticonvulsant activity against maximum electroshock (MES) and picrotoxin-induced convulsions, with no neurotoxic effect, in a dose-dependent manner. *F. religiosa* extract showed a significant protection in MES and picrotoxin-induced convulsion models in a dose-dependent manner [Damanpreet and Rajesh, 2009].

Hypolipidemic activity

Dietary fibre content of food namely peepalbanti, *F. religiosa*, cellulose, and lignin were

predominating constituents in peepalbanti, fed at 10% dietary level to rats, induced a greater resistance to hyperlipidemia than cellulose. Teent had the most pronounced hypocholesterolemic effect that appeared to operate through increased faecal excretion of cholesterol as well as bile acids. Dietary hemicellulose showed a significant negative correlation with serum and liver cholesterol and a significant positive correlation with fecal bile acids. The dietary fibre influenced total lipids, cholesterol, triglycerides, and phospholipids of the liver to varying extents[Agarwal and Chauhan, 1988].

Hypoglycemic activity

β-Sitosterol-D-glycoside was isolated from the root bark of *F. glomerata* and *F. religiosa*, which has a peroral hypoglycaemic activity[Ambike and Rao, 1967].

Ficus rumphii BlumeMock Bodh Tree, Mock Peepul Tree, Pakar(Moraceae):

Synonyms: *Ficus affinior* Griff.,*Ficus conciliorum* Oken, *Ficus cordifolia* Roxb., *Ficus coriacea* Aiton, *Ficus damit* Gagnep., *Ficus populiformis* Schott ex Miq.,*Ficus populnea* Kunth & C.D.Bouché, *Urostigma cordifolium* (Roxb.) Miq., *Urostigma rumphii* (Blume) Miq.

Ficus rumphii is a deciduous tree that can grow to a height of 20 metres [Flora of China,1994;PROSA]. The plant often begins life as an epiphyte, growing in the branch of another tree; as it grows older it sends down aerial roots which, when they reach the ground quickly form roots and become much thicker and more vigorous. They supply nutrients to the fig, allowing it to grow faster than the host tree. The aerial roots gradually encircle the host tree, preventing its main trunk from expanding, whilst at the same time the foliage smothers the foliage of the host. Eventually the host dies, leaving the fig to carry on growing without competition [PROSA 310]. The plant is harvested from the wild for local use as food and medicine [PROSA 310]. The tree is often cultivated as an ornamental and shade tree along avenues [PROSA; Mansfield's Database of A and H Plants].

It is commonly found in E. Asia - southern China, India, Bhutan, Nepal, Myanmar, Malaysia, Thailand, Indonesia, Vietnam.

The habitat is along trails at elevations from 600 - 700 metres [Flora of China, 1994] and rocky coasts [PROSA].

Ethnobotanical Potential:

Fully ripe fruits are consumed either raw or cooked [Hedrick, 1972; PROSA; Mansfield's Database of A & H Plants].

Young leaves are consumed either raw or cooked [PROSA; Mansfield's Database of A & H Plants].

The bark yields a rough cordage [PROS].

The soft wood is used as a fuel and for the production of charcoal [PROSA].

Ethnomedicinal Potential:

The latex and fruits are emetic and anthelmintic, and used to treat itch [PROSA].

The latex is given internally as a vermifuge and for the relief of asthma [PROSA].

FraxinusornusLinn. Mannaash, South European flowering ash (Oleaceae):

Synonym

Ornus europaea

Fraxinus ornus, the manna ash [BSBI List, 2007] or South European flowering ash, is a species of Fraxinus nates to southern Europe and southwestern Asia, from Spain and Italy north to Austria, Poland and the Czech Republic, and east through the Balkans, Turkey, and western Syria to Lebanon and Armenia [Rushforth, 1999; Flora European; Med- Chek List].

Fraxinus ornus is a medium-sized deciduous tree growing to 15-25 m tall with a trunk up to 1 m diameter. The bark is dark grey, remaining smooth even on old trees

The buds are pale pinkish-brown to grey-brown, with a dense covering of short grey hairs.

The leaves are in opposite pairs, pinnate, 20–30 cm long, with 5 to 9 leaflets; the leaflets are broad ovoid, 5-10 mm long and 2-4 cm broad, with a finely serrated and wavy margin, and short but distinct petioles 5-15 mm long; the autumn colour is variable, yellow to purplish.

The flowers are produced in dense panicles 10–20 cm long after the new leaves appear in late spring, each flower with four slender creamy white petals 5–6 mm long; they are pollinated by insects.

The fruit is a slender samara 1.5-2.5 cm long, the seed 2 mm broad and the wing 4-5 mm broad, green ripening brown[Rushforth, 1999; Mitchell, 1974,1982].

Fraxinus ornus is frequently grown as an ornamental tree in Europe north of its native range for its decorative flowersthe species is also sometimes called "flowering ash".

Ethnobotanical Potential:

A sugary extract from the sap may be obtained by making a cut in the bark [Rushforth, 1999], this was compared in late medieval times (attested by around 1400 AD [Oxford English Dictionary] with the biblical manna, giving rise to the English name of the tree, and some of the vernacular names from its native area (fresno del maná in Spanish, frassino da manna in Italian). In fact, the sugar mannose and the sugar alcohol mannitol both derive their names from the extract.

This tree is commercially grown in Sicily for manna which is a sweet, gummy sap taken from slits made in the bark.

Manna - a sweetish exudate is obtained from the stems by incision [Hedrick, 1972; Grieve, 1984;Bean, 1981;Chakravarty, The Pl Wealth of Iraq;Hill, 1952; Facciola, 1990]. The quality is better from the upper stems. A mild sweet taste[Chakravarty, The Pl Wealth of Iraq]. its main use is as a mild and gentle laxative [Hill, 1952], though it is also used as a sweetener in sugar-free preparations and as an anti-caking agent [Bown, 1995]. The tree trunk must be at least 8 cm in diameter before the manna can be harvested [Grieve, 1984]. A vertical series of oblique incisions are made in the trunk in the summer once the tree is no longer producing many new leaves [Grieve, 1984]. One cut is made every day from July to the end of September. A whitish glutinous liquid exudes from this cut, hardens and is then harvested [Hedrick, 1972]. Dry and warm weather is essential if a good harvest is to be realised [Grieve, 1984]. The tree is harvested for 9 consecutive years, which exhausts the tree. This is then cut down, leaving one shoot to grow back. It takes 4 - 5 years for this shoot to become productive [Hedrick, 1972]. Average yields of 6 kilos per hectare of top-quality manna, plus 80 kilos of assorted manna are achieved [Hedrick, 1972].

The wood, although of good quality, has limited economic potential because the trunks are often narrow and do not grow straight [IUCN Red List].

The wood is a good fuel and makes an excellent charcoal [IUCN Red List].

The tree is able to colonize open habitats in the wild and grows rapidly when young, so quickly becomes established. It can be used as a pioneer species when restoring native woodland [IUCN Red List; Ken Fern].

Fraxinus species in general are gross feeders with an extensive, fibrous root system, which makes transplanting easy, but means that other species will often not grow well if planted nearby, especially if they are shallow rooted[Huxley, 1992],

The manna obtained from the trunk is a gentle laxative and a tonic[Grieve, 1984; Uphof, 1959]. It is especially valuable for children and pregnant women[Grieve, 1984; Bown, 1995]. Its action is normally very mild, though it does sometimes cause flatulence and pain[Grieve, 1984].

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Hordeum vulgare Linn., Barley, Common barley (Poaceae)

Synonyms:

Frumentum hordeum, Hordeum sativum, Hordeum nigrum, Hordeum durum, Secale orientale

Barley, *Hordeum vulgare*, cereal plant of the grass family Poaceae and its edible grain. Grown in a variety of environments, barley is the fourth largest grain crop globally, after wheat, rice, and corn.

Barley is commonly used in breads, soups, stews, and health products, though it is primarily grown as animal fodder and as a source of malt for alcoholic beverages, especially beer.

Hordeum vulgare is an annual grass featuring erect stems with few, alternate leaves. Barley comes in two varieties, distinguished by the number of rows of flowers on its flower spike. Six-row barley has its spike notched on opposite sides, with three spikelet's at each notch, each containing a small individual flower, or floret, that develops a kernel. Two-row barley has central florets that produce kernels and lateral florets that are normally sterile. Whereas six-row barley has a higher protein content and is more suited for animal feed, two-row barley has a higher sugar content and is thus more commonly used for malt production.

One of the first cultivated grains of the Fertile Crescent, barley was domesticated about 8000 BCE from its wild progenitor *Hordeum spontaneum*. Archaeological evidence dates barley cultivation to 5000 BCE in Egypt, 2350 BCE in Mesopotamia, 3000 BCE in northwestern Europe, and 1500 BCE in China. Barley was the chief bread plant of the Hebrews, Greeks, and Romans and of much of Europe through the 16th century. Genetic studies suggest that Tibet was an additional, independent centre of domestication for cultivated barley

Barley is adaptable to a greater range of climate than any other cereal, with varieties suited to temperate, subarctic, or subtropical areas. Although it does best in growing seasons of at least 90 days, it is able to grow and ripen in a shorter time than any other cereal. Cultivation is possible even in very short seasons such as those of the Himalayan slopes, although the yield there is smaller than in less harsh areas. Barley, with greater resistance to dry heat than other small grains, thrives in the near-desert areas of North Africa, where it is mainly sown in the autumn. Spring-sown crops are especially successful in the cooler, moist areas of western Europe and North America.

Barley has a nutlike flavour and is high in carbohydrates, with moderate quantities of protein, calcium, and phosphorus and small amounts of the B vitamins. Because it contains little gluten, an elastic protein substance, it cannot be used to make a flour that will produce a porous loaf of bread. Barley flour is used to make an unleavened type, or flatbread, and to make porridge, especially in North Africa and parts of Asia, where it is a staple food grain. Pearl barley, the most popular form in many parts of the world, consists of whole kernels from which the outer husk and part of the bran layer have been removed by a polishing process. It is added to soups. Barley has a soft straw, used mostly as bedding for livestock and as a feed providing bulk roughage.

Ethnobotanical Potential

Seed - cooked as a whole grain or ground up and used as a flour for making bread, porridges etc [Hedrick, 1972;Chief, 1984; Uphof, 1959;Facciola, 1990]. It has a low gluten content and so is unsuitable for making wheat-type breads [Bown, 1995; Ken Fern].

The seed can be fermented into sourdough and many other fermented foods such as 'tempeh' and 'miso'[Facciola, 1990]. The seed can also be sprouted and added to salads or the sprouted seed juiced and the juice drunk as a health-food drink [Facciola, 1990].

The decorticated seed is called pearl barley. This is no longer viable since the decortication process damages the embryo.

It is used in soups, stews etc. [Bown, 1995]. Malt is obtained by sprouting the whole seed and then roasting it. The seed is then ground into a flour and boiled in water. The resulting liquid is very sweet and can be used in making beer or other drinks, and as a nutritious sweetener in various foods [Chief, 1984; Uphof, 1959].

The roasted (unsprouted) seed is used as a coffee [Uphof, 1959; Facciola, 1990] and a salt substitute.

The stems, after the seed has been harvested, have many uses. They are a source of fibres for making paper, a biomass for fuel etc, they can be shredded and used as a mulch [Carruthers, 1986; Hill,1952].

Ethnomedicinal Potential:

The shoots are diuretic [Duck and Ayensu, 1985]

The seed sprouts are demulcent, expectorant, galactofuge, lenitive and stomachic [Yeung, 1985; Duck and Ayensu, 1985]. They are sometimes abortifacient [Duck and Ayensu, 1985]. They are used in the treatment of dyspepsia caused by cereals, infantile lacto-dyspepsia, regurgitation of milk and breast distension [Yeung, 1985]. They are best not given to a nursing mother since this can reduce milk flow [Yeung, 1985].

The seed is digestive, emollient, nutritive, febrifuge and stomachic [Duck and Ayensu, 1985]. It is taken internally as a nutritious food or as barley water (an infusion of the germinated seed in water) and is of special use for babies and invalids [Bown, 1995]. Its use is said to reduce excessive lactation [Bown, 1995].

Barley is also used as a poultice for burns and wounds [Grieve, 1984; Uphof, 1959; Yeung, 1985; Duck and Ayensu, 1985].

The plant has a folk history of antitumor activity [Duck and Ayensu, 1985].

The germinating seed has a hypoglycaemic effect preceded by a hyperglycaemic action [Duck and Ayensu, 1985].

Modern research has shown that barley may be of aid in the treatment of hepatitis, whilst other trials have shown that it may help to control diabetes [Chevallier, 1996].

Barley brain may have the effect of lowering blood cholesterol levels and preventing bowel cancer [Chevallier, 1996].

Other uses for bronchitis and diarrhoea, and as a source of folic acid and vitamin B12 and B6.

Weight loss [Karalliedde and Gawarammana, 2008].

Juglans regia Persian walnut, English walnut, Circassian walnut, common walnut, (Juglandaceae):

Juglans regia, commonly called English walnut or Persian walnut, is native to Asia and southeast Europe (Balkans). It is a deciduous tree that typically grows 40-60′(less frequently to 100′) tall

with and a spreading rounded crown. This is the tree that is grown commercially in the West Coast states for the walnuts that are sold in stores. It is also grown ornamentally in many parts of the U.S., and is valued for its fine grained wood that is used to make cabinets, furniture and gunstocks. Bark is gray and smooth. Odd pinnate compound leaves (to 16″ long), each with 5-7 (infrequently to 13) oblong leaflets. Leaves are late to emerge in spring and early to drop in fall. Leaves are strongly aromatic when crushed. Fall colour is an undistinguished yellow. Yellowish green monoecious flowers appear in late spring (May-June), the male flowers in drooping hairy catkins and the female flowers in short terminal spikes. Female flowers give way to edible nuts, each being encased in a smooth green husk. Nuts mature in autumn. Nutsare thin shelled, making the kernels easy to extract. Many cultivars of this species are available in commerce.

The habitat is Forests in the Himalayas, preferring a northerly aspect in the west but a southerly or westerly aspect in the east of the range [Cribb and Wild, 1976].

Genus name comes from the Latin names jovis meaning of Jupiter and glans meaning an acorn. Specific epithet means kingly, in reference to the superior quality of the nuts.

Range of occurrence is E. Europe to N. Asia. More or less naturalized in S. Britain.

Ethnobotanical Potential

Seed are consumed raw or used in confections, cakes, ice cream etc [Hedrick, 1972; Mabey, 1974; Loewen feld and Back; Harrison et al., 1975; Facciola, 1990]. A delicious flavour.

The seed can also be ground into a meal and used as a flavouring in sweet and savoury dishes [Facciola, 1990].

The unripe fruits are pickled in vinegar [Facciola, 1990].

An edible oil is obtained from the seed [Grieve, 1984; Chiej, 1984; Schery- PL for Man; Facciola, 1990], it should not be stored for any length of time since it tends to go rancid quickly [Chiej, 1984; Bianchin et al., Fruits of the World]. The oil has a pleasant flavour and is used in salads or for cooking [Facciola, 1990].

The sap is tapped in spring and used to make a sugar [Rosengarten, 1984].

The finely ground shells are used in the stuffing of 'agnolotti' pasta [Facciola, 1990]. They have also been used as adulterant of spices [Duke, 1983].

The dried green husks contain 2.5 - 5% ascorbic acid (vitamin C)–this can be extracted and used as a vitamin supplement [Duke, 1983]. The leaves are used as a tea [Facciola, 1990].

A yellow dye is obtained from the green husks [Grieve, 1984; Chiej, 1984; Polunin, 1969; Rosengarten, 1984]. It is green [Niebuhr, 1970]. The green nuts (is this the same as the green husks) and the leaves are also used [Niebuhr, 1970]. The rind of unripe fruits is a good source of tannin [Gupta, 1945]. A brown dye is obtained from the leaves and mature husks[Grieve, 1984; Chiej, 1984; Boullemier, 1985; Rosengarten, 1984; Grae, 1974]. It does not require a mordant and turns black if prepared in an iron pot [Grae, 1974]. The dye is often used as a colouring and tonic for dark hair [Bown, 1995]. The leaves and the husks can be dried for later use [Buchanan, Weavers Garden]. A golden brown dye is obtained from the catkins in early summer. It does not require a mordant [Grae, 1974]. A drying oil is obtained from the seed. It is used in soap making, paints, etc. It is not very stable and quickly goes rancid[Chiej, 1984; Lust, 1983; Harrison et al., 1975; Uphof, 1959]. The nuts can be used as a wood polish. Simply crack open the shell and rub the kernel into the wood to release the oils. Wipe off with a clean cloth [Grieve, 1984; Maybey, 1979; Ken Fern]. The dried fruit rind is used to paint doors, window frames etc [Singh and Kachroo, 1976] (it probably protects the wood due to its tannin content). The shells may be used as anti skid agents for tyres, blasting grit, and in the preparation of activated carbon [Duke, 1983]. The leaves contain juglone, this has been shown to have pesticidal and herbicidal properties [Duke and Ayensu, 1985]. The crushed leaves are an insect repellent [Uphof, 1959; Usher, 1974]. Juglone is also secreted from the roots of the tree, it has an inhibitory effect on the growth of many other plants [Allardice, 1993]. Bark of the tree and the fruit rind are dried and used as a tooth cleaner. They can also be used fresh [Singh and Kachroo, 1976; Gupta, 1945]. Wood–heavy, hard, durable, close grained, seasons and polishes well. A very valuable timber tree, it is used for furniture making, veneer etc [Chittendon, 1956; Grieve, 1984; Chiej, 1984; Uphof, 1959; Usher, 1974; Gupta, 1945].

Ethnomedicinal Potential

The walnut tree has a long history of medicinal use, being used in folk medicine to treat a wide range of complaints [Duke, 1983].

The leaves are alterative, anthelmintic, anti-inflammatory, astringent and depurative [Launert, 1981;Duke and Ayensu, 1985]. They

are used internally the treatment of constipation, chronic coughs, asthma, diarrhoea, dyspepsia etc [Launert,1981]. The leaves are also used to treat skin ailments and purify the blood [Launert,1981; Duke and Ayensu, 1985]. They are considered to be specific in the treatment of strum us sores [Chopra et al., 1986].

Male inflorescences are made into a broth and used in the treatment of coughs and vertigo [Duke and Ayensu, 1985]. The rind is anodyne and astringent [A Bare Foot Doctors Manual]. It is used in the treatment of diarrhoea and anaemia [Bown, 1995].

The seeds are antilithic, diuretic and stimulant [Duke and Ayensu, 1985]. They are used internally in the treatment of low back pain, frequent urination, weakness of both legs, chronic cough, asthma, constipation due to dryness or anaemia and stones in the urinary tract [Yeung, 1985].

Externally, they are made into a paste and applied as a poultice to areas of dermatitis and eczema [Yeung, 1985].

The oil from the seed is anthelmintic [Duke and Ayensu, 1985]. It is also used in the treatment of menstrual problems and dry skin conditions [Bown, 1995].

The cotyledons are used in the treatment of cancer [Duke and Ayensu, 1985].

Walnut has a long history of folk use in the treatment of cancer, some extracts from the plant have shown anticancer activity [Duke and Ayensu, 1985].

The bark and root bark are anthelmintic, astringent and detergent [Duke and Ayensu, 1985; Chopra et al., 1986].

The plant is used in Bach flower remedies–the keywords for prescribing it are 'Oversensitive to ideas and influences' and 'The link-breaker' [Chancellor, 1985].

Juniperus oxycedrus Linn., Cade, Cade Juniper, Prickly juniper, Prickly cedar (Cupressaceae):

Juniperus oxycedrus is an evergreen Tree growing to 15 m at a medium rate. It is in leaf all year, and the seeds ripen in October. The species is dioecious, individual flowers are either male or female, but only one sex is to be found on any one plant so both male and female plants must be grown if seed is required. and is pollinated by Wind. The plant is not self fertile.

Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: acid, neutral and basic (alkaline) soils and can grow in very alkaline soils.

It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought.

Habitats are dry hills, sandy and rocky places [Flora of Europaea, 1964].

Range of occurrence is Europe–Mediterranean.

Ethnobotanical Potential:

An oil distilled from the heartwood is used medicinally and as a parasiticide. It is also used as an immersion oil in microscopic work [Usher, 1974].

Ethnomedicinal Potential:

The plant yields the essential oil 'Oil of Cade' by destructive distillation of the wood [Grieve, 1984]. It is used externally in the treatment of skin diseases such as psoriasis and chronic eczema [Grieve, 1984]. It is a good parasiticide in cases of psora and favus [Grieve, 1984]. Antiseptic [Usher, 1974].

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The methods section should include only information that was available at the time the plan or protocol for the study was written such as study approach, design, type of sample, sample size, sampling technique, setting of the study, description of data collection tools and methods; all information obtained during the conduct of the study belongs in the Results section.

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Present your results in logical sequence in the text, tables, and illustrations, giving the main or most important findings first. Do not repeat in the text all the data in the tables or illustrations; emphasize or summarize only important observations. Extra or supplementary materials and technical details can be placed in an appendix where it will be accessible but will not interrupt the flow of the text; alternatively, it can be published only in the electronic version of the journal.

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Include summary of key findings (primary outcome measures, secondary outcome measures, results as they relate to a prior hypothesis); Strengths and limitations of the study (study question, study design, data collection, analysis and interpretation); Interpretation and implications in the context of the totality of evidence (is there a systematic review to refer to, if not, could one be reasonably done here and now?, What this study adds to the available evidence, effects on patient care and health policy, possible mechanisms)? Controversies raised by this study; and Future research directions (for this particular research collaboration, underlying mechanisms, clinical research). Do not repeat in detail data or other material given in the Introduction or the Results section.

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Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979–2001. www.statistics.gov.uk/downloads/theme_health/HSQ 20.pdf (accessed Jan 24, 2005): 7–18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

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