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Comparative Nutritional Evaluation of Traditional Indian Snacks Incorporated with Partially Defatted Peanut Cake Flour and Fenugreek Leaves Powder Developed for Malnourished Children

Bindhya Dhanesh T.[1*], Anita Kochhar[2] and M. Javed[3]

[1,2]Department of Food and Nutrition, Punjab Agricultural University, Ludhiana, Punjab, India
[3]Department of Math., Stat. and Physics, Punjab Agricultural University, Ludhiana, Punjab, India
E-mail: dhanesh.bindhya@gmail.com

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ABSTRACT Adequate complementary feeding of infants with home based foods from the age of six months, while continuing breast feeding is crucial to prevent malnutrition. Thus, there is a need to popularize low cost complementary foods. Partially defatted peanut flour (DPF) is a cheap underutilized by-product of peanut after oil extraction with a high nutritional profile. Two value added products namely, *Matthi* and *Seviyan* incorporating 10 per cent partially defatted peanut cake flour (DPF) and one per cent fenugreek leaves powder (FLV) were developed. The nutritional analysis of the products revealed a significant increase in the proximate composition especially protein which was found to be 16.58 and 23.49 per cent, fat was observed to be 18.06 and 20.92 per cent, fiber was 1.43-2.94 per cent and energy was found to be 495.56 and 471.24 Kcal in the value added *Matthi* and *Seviyan* respectively. Mineral composition like iron, calcium and zinc also increased in the fortified products. Higher percent of *invitro* protein digestibility and higher amino acid profile was observed in the fortified products compared to the control which were not fortified. Hence, the study revealed that the value added products prepared using partially defatted peanut flour and powdered fenugreek leaves can be a promising solution to eradicate malnutrition.

INTRODUCTION

Nutrition of infants and young children is critical for their survival, cognitive development and growth not only during the childhood but for a healthy future. The treatment of malnutrition, as well as its prevention, among under five children requires consumption of nutritious food, including exclusive breastfeeding for the first 6 months of life and in combination with complementary foods thereafter till at least 24 months of age. With proper nutrition, provision of hygienic environment and access to timely preventive measures like immunization, vitamin A supplementation etc. as well as good prenatal care and child spacing is essential for healthy growth and development (Asfaw et al. 2015). Poverty and food insecurity seriously constrain accessibility of nutritious diets, including high protein quality, adequate micronutrient content and bioavailability, macro-minerals and essential fatty acids, low anti-nutrient content and high nutrient density. Hence, popularization of low cost nutritious food particularly for vulnerable groups like infants, young children and adolescent girls is of major concern.

Peanut meal, an underutilized by-product left after oil extraction is a rich source of protein. Peanut meal can be dried and ground in a flour form that can be added to various daily consumed foods (Zhao et al. 2012). Peanuts have a desirable fatty acid profile and are rich in vitamins, minerals and bioactive materials. Peanut flour which is most commonly used for fortification contains protein ranging in between 47-55 per cent which contributes to a good amount of protein. Peanut flour has also been used to replace animal protein in a variety of products. The cake contains 52.75 per cent protein, 14-25 per cent of carbohydrates, 11 per cent crude fiber and 4-6 per cent minerals (Bansal and Kochhar 2014).

Address correspondence to:
Bindhya Dhanesh T.
Thattil House, Parapilly Appartments,
Puthenvettuvazhy, Chembukkavu,
Thrissur 680 020, Kerala, India
Phone: 8281461686
E-mail: dhanesh.bindhya@gmail.com

Defatted groundnut flour produced from cake blends easily and enhances or enriches the nutritive value of wheat flour and other cereal flour (Purohit and Rajyalakshmi 2011). The defatted groundnut flour, an underutilized by-product of groundnut processing, has potentials to be used in food system as low fat groundnut concentrate to be used extenders in meat processing, in production of beverages, fermented products, composite flours and protein supplements of bakery products and weaning formulations. Hence, the present paper deals with the development of value added products using partially defatted peanut cake flour along with small quantities of powdered green leafy vegetables to enhance their nutritional profile so as to improve the nutritional status of malnourished by introducing in various nutritional feeding programmes.

Objectives

The paper aims for the development of value added traditional Indian snacks like *Matthi* and *Seviyan* using partially defatted peanut cake flour and powdered fenugreek leaves and details the enhancement of the nutritional profile of the products using standard procedures. The main aim is to eradicate malnutrition among the poor communities using cheap sources of high protein ingredients in everyday food.

METHODOLOGY

Formulation and Development of the Products

Formulation of two different products was based on standard procedures. Basically two treatments that is Control (without peanut flour and fenugreek leaves powder) and test sample for two salty snacks *Matthi* and *Seviyan* were prepared by the incorporation of defatted peanut cake flour and fenugreek leaves were based on different acceptance studies from previous literatures (Bansal 2013). The basic ingredient for *Matthi* was wheat flour and in the case of *seviyan* it was gram flour. As the study is based on development of high protein products, the basic ingredient used for all the products was replaced with cereal-pulse mix flour. Pulse flour was taken in one-third amount of cereal flour in *Matthi*. Pulse flour was the main ingredient and wheat flour was taken in one-third amount of pulse flour for the preparation of *seviyan*. This mix was replaced for the main ingredient that is wheat flour listed in the standard procedure. Wheat flour was used as a cereal source and chickpea flour was used as a pulse source.

The basic ingredients for the development of value added products such as flour and seasonal green leafy vegetables were procured from the local market of Ludhiana in a single lot. The greens used here was fenugreek leaves. Good quality peanuts without any damage were purchased. They were then roasted and de-skinned. The residual cake was then collected after the oil extraction which was done from the local markets of Ludhiana and further dried in the hot air oven at 65 ºC for half an hour. It was then later ground to fine powder. Fenugreek leaves were dried in a tray drier at 60°C for 5-6 hours (constant weight was achieved in this time). The dried fenugreek leaves were ground to fine powder and stored in separate airtight containers to prevent lumping or infestation. The standard recipes used for the development of the products are given below:

1. ***Matthi***- Refined wheat flour (100g), carom seeds and salt (1/2 tsp) were mixed with 7g of dalda thoroughly to prepare stiff dough using very little quantity of water. Small balls were rolled out, flattened, pricked with fork and deep fried in oil.
2. ***Seviyan***- Soft dough was prepared using 100g of chickpea flour, a teaspoon of salt, water and 5ml of oil. The dough was then extruded out using a *seviyan* machine into hot oil and deep fried.

Control samples for both the products were prepared using cereal pulse mix as shown in Table 1. Test samples for both the products were developed using 10 per cent peanut cake flour and 1 per cent of fenugreek leaves powder.

Sensory Evaluation of the Value Added Products

The ready-to-eat value added products were prepared in the Food Laboratory of Department of Food and Nutrition, Punjab Agricultural University, Ludhiana. Each of the two developed ready-to-eat value added products for malnourished children was prepared fresh, coded randomly and compared treatment wise by ten trained panelists including the faculty of department of Food and Nutrition of Punjab Agricul-

Table 1: Composition of value added products *Matthi* and *Seviyan* using DPF and FLP

Treatments	*Ingredients for the value added products with DPF and FLP(g)*			
	Wheat flour	*Chick pea flour*	*DPF*	*FLP*
Control	75	25	-	-
Test sample - *Matthi*	67.50	22.50	10	1
Test sample -*Seviyan*	22.50	67.50	10	1

*DPF- Partially defatted peanut cake flour, FLP- Fenugreek leaves powder

tural University in the age range of 45 to 55 years using 9 point hedonic scale for different parameters such as appearance, colour, texture, aroma, taste and overall acceptability (Larmond 1970). The sensory evaluation was conducted between 11 am to 12 pm which is regarded to be appropriate to get best results. Water and plain crackers were provided to the panelist so as to clear their taste buds after each sample.

Nutritional Analysis of the Value Added Products

The developed value added products both control and test samples were then subjected to nutritional analysis for proximate composition, mineral, vitamin and amino acid content using standard procedures. *Invitro* protein digestibility was also analysed. Both the control (without peanut flour and fenugreek leaves powder) and the test samples were analysed so as to compare the difference in the nutritional profile.

1. ***Proximate Composition*** - Proximate composites like Moisture, Crude Protein, Crude Fat, Crude Fiber, Crude Ash, Carbohydrates and Energy were analysed using standard procedures recommended by AOAC (2000).
2. ***Total Minerals*** - Elements namely iron, calcium, zinc and phosphorus were estimated using atomic absorption spectrophotometer (AAS, Varian model) after wet digestion (Piper 1950).
3. ***Vitamins*** – Ascorbic Acid was analysed using standard procedures given in AOAC (2000) and Beta carotene was estimated by column chromatography method as explained by Rangana (1995)
4. ***In vitro Protein Digestibility*** - It was carried out by analyzing the nitrogen content by macro kjeldahl method. The digestibility co-efficient of the protein was determined by subtracting the residual protein from the initial protein on the basis of 100g of the sample. (Akeson and Stachman 1964).
5. ***Amino Acids***- Amino acids like Tryptophan (Concon 1975), Methionine (Horn et al. 1946) and lysine (Carpenter 1960) as modified by (Booth 1971) were analysed.
6. ***Anti Nutritional Compostion***- Phytin phosphorous was analysed using the procedure suggested by Haug and Lantzsch (1983), Total phenols (AOAC 2000), Tannin (Ranganna 2001) and Aflatoxins from the samples were extracted by the method of Barabalok et al. (1975) and further detected using the Pressure Mini Column methods (PCM) recommended by Sashidhar et al. (1989).

Statistical Analysis

The nutritional analysis scores were analysed using paired t-test. The values are expressed as Mean±SE (Standard error)

RESULTS

Sensory Evaluation of the Value Added Products Using Defatted Peanut Cake Flour and Fenugreek Leaves Powder

Highest acceptable sensory scores were observed for the control products without the incorporation of peanut flour and fenugreek leaves powder. Significant difference in the scores of control as well as value added products were not observed. In case of *Matthi*, the control sample received a mean overall acceptability score of 7.90 while the value added sample received a score of 7.18 while in the case of *Seviyan*, control sample received a mean overall score of 7.68 and value added sample received 7.48.

Nutritional Evaluation of the Value Added Products

Proximate Composition

The proximate composition of both the control and test products were analysed and is pre-

sented in Table 2. The incorporation of partially defatted peanut cake flour and powdered fenugreek leaves to *matthi* and *seviyan* significantly increased the proximate composition of the products except in the case of carbohydrate content. The moisture content increased significantly (p<0.01) in the case of *matthi*. Although there was an increase in the moisture content of s*eviyan*, it was found to be statistically insignificant. A significant increase in the crude protein content of the products was observed compared to their control due to the addition of partially defatted peanut cake flour. The protein content for *matthi* and *seviyan* was found to be 16.58 and 23.49 per cent which increased from that of its control which was only 11.59 and 16.04 per cent respectively. Significant difference (p < 0.01) in the fat content was also observed in the products. The fat content increased from 18.86 to 20.92 percent in *matthi* and from 16.28 to 18.06 per cent in *seviyan* on the addition of peanut flour. The fiber content for both the value added products increased significantly (p <0.01, p <0.05).

A significant decrease (p <0.01) in the carbohydrate content of the products was observed on the addition of partially defatted peanut cake flour and powdered fenugreek leaves. The decrease in carbohydrate content was found to be 57.18 from 65.52 per cent in *matthi* and 51.72 from 62.65 per cent in *seviyan.* The total energy content of developed value added products increased significantly (p < 0.01). The energy content of *matthi* increased from 491.67 to 495.56 Kcal and in the case of *seviyan* the increase was observed from 469.53 to 471.24 Kcal. The increase in the energy content can be attributed by the significant increase in protein and fat.

Amino Acid Profile

An increase in the amino acid concentration was observed on the addition of partially defatted peanut cake flour and fenugreek leaves powder as depicted in Table 3. Statistically significant (p<0.01) increase from 445.09 to 540.98 mg per 100gm in the lysine content of *matthi* was observed while the increase in lysine content of *seviyan* was non-significant (948.04 to 1016.96 mg/100g). While methionine and tryptophan increased significantly (p<0.01) in both the products on fortification with peanut flour and fenugreek leaves powder. Methionine content among the products was highest for *seviyan* on

Table 2: Proximate composition of developed products on dry weight basis (g / 100 g)

Products	*Moisture*	*Crude Protein*	*Crude Fiber*	*Crude Fat*	*Total Ash*	*Carbohydrates (by differences)*	*Energy (Kcal/100g)*
Matthi (control)	3.32±0.008	11.59±0.017	0.23±0.012	18.86±0.035	0.48±0.014	68.85±0.027	491.67±0.19
Test (DPF+FLP)	3.44±0.014	16.58±0.015	1.43±0.161	20.92±0.040	0.88±0.017	60.48±0.056	495.56±0.13
t-value	18.500**	175.09**	7.272*	46.641**	122.00**	288.261**	80.032**
Seviyan (control)	2.35±0.014	16.04±0.096	1.75±0.017	16.28±0.037	1.25±0.017	64.55±0.020	469.53±0.36
Test (DPF+FLP)	2.54±0.018	23.49±0.280	2.94±0.020	18.06±0.029	1.79±0.012	54.23±0.153	471.24±0.09
t-value	5.584NS	19.937**	77.904**	36.386**	93.531**	76.780**	6.279*

Values are expressed as Mean±SE (Standard Error)
*Significant at 5% level (p<0.05) **Significant at 1% level (p<0.01) NS- Non Significant

Table 3: Amino acid content of the developed products (mg / 100 g)

Products	*Lysine*	*Methionine*	*Tryptophan*
Matthi (control)	445.09±1.098	158.53±0.176	125.44±0.822
Test (DPF+FLP)	540.98±0.693	177.67±0.371	151.26±0.293
t-value	65.929**	86.588**	23.318**
Seviyan (control)	948.04±1.170	180.29±0.035	133.43±0.110
Test (DPF+FLP)	1016.96±17.634	204.76±0.281	149.97±0.266
t-value	4.184NS	84.513**	48.952**

Values are expressed as Mean±SE (Standard Error)
**Significant at 1% level (p<0.01) NS- Non Significant

the addition of partially defatted peanut cake flour and the increase was found to be 180.29 mg/100g in the control to 204.76 mg/100g in the value added treatment. While for *matthi* the increase was observed from 158.53 to 177.67mg/100g. The tryptophan content increased significantly (p<0.01) from 125.44 to 151.26 mg/100g in the case of *matthi* and the increase in *seviyan* was from 133.43 to 149.97 mg/100g.

Mineral And Vitamin Concentration

The products were analysed for minerals like calcium, iron, zinc, phosphorus and vitamins like vitamin C and Beta carotene and the comparison between the control and value added samples are presented in Table 4. Significant increase (p < 0.01) in the calcium, iron and phosphorus content of the developed products were observed on the addition of partially defatted peanut cake flour and fenugreek leaves powder compared to its control. The calcium content increased from 24.38 to 29.13 mg/100g for *matthi* and 50.39 to 55.04 mg/100g in *seviyan* while the increase in the iron content of *matthi* was from 2.52 to 4.18 mg/100g and 3.14 to 4.98 mg/100g in the case of *seviyan*. The increase in the phosphorus content was observed to be from 122.38 to 132.57mg/100g in *matthi* while a decrease from 141.09 to 131.68 mg/100g in *seviyan* was observed after the addition of partially defatted peanut cake flour and fenugreek leaves powder. While in the case of zinc, although only slight increase was observed in both the value added products, the increase was found to be statistically significant. The increase (p <0.01) in zinc content of *matthi* was found to be from 1.18mg/100g in control to 1.49 mg/100g in the value added sample while the increase (p <0.05) in *seviyan* was from 1.33 to 1.59 mg/100g.

The vitamin C and beta carotene content reduced significantly on fortification of the products. The vitamin C content of *matthi* reduced significantly (p<0.01) from 0.24 to 0.12 mg/100g and the significant reduction (p < 0.05) was found to be 0.81 to 0.54 mg/100g. In a similar way, the β-carotene content of both *matthi* and *seviyan* reduced significantly (p< 0.01) from 21.99 to 20.21 mg/100g and 91.73 to 85.79 mg/100g respectively. The reduction may be due to the processing of raw materials.

Invitro Protein Digestibility

A significant (p < 0.01) increase in the *in-vitro* protein digestibility was observed in the value added products *matthi* and *seviyan* prepared using partially defatted peanut cake flour

Table 4: Mineral and Vitamin content of the developed products (mg / 100 g) # on fresh weight basis

Products	*Calcium*	*Iron*	*Zinc*	*Phosphorus*	*Vitamin C#*	*â carotene*
Matthi (control)	24.38±0.056	2.52±0.014	1.10±0.015	122.38±0.715	0.24±0.005	21.99±0.032
Test (DPF+FLP)	29.13±0.100	4.18±0.032	1.49±0.024	132.57±0.295	0.12±0.003	20.21±0.059
t-value	71.339**	89.803**	29.000**	17.767**	35.000**	45.463**
Seviyan(control)	50.39±0.047	3.14±0.030	1.33±0.025	141.09±0.962	0.81±0.006	91.73±0.177
Test (DPF+FLP)	55.04±0.33	4.98±0.031	1.59±0.005	131.68±0.284	0.54±0.022	85.79±0.281
t-value	13.014**	29.859**	8.667*	13.877**	10.000*	12.996**

Values are expressed as Mean±SE (Standard Error)
*Significant at 5% level (p<0.05) **Significant at 1% level (p<0.01) NS- Non Significant

and fenugreek leaves powder as shown in Table 5. On the addition of peanut flour in the products, the in-vitro protein digestibility increased from 42.97 to 60.22 per cent for *matthi* and 57.89 to 68.69 per cent for *seviyan.* The increase is contributed by the addition of partially defatted peanut cake flour.

Table 5*: Invitro* protein digestibility (%) of the developed products

Products	*In vitro protein digestibility*
Matthi (control)	42.97±0.688
Test (DPF+FLP)	60.22±0.280
t-value	49.489**
Seviyan (control)	57.89±0.205
Test (DPF+FLP)	68.69±0.054
t-value	66.540**

Values are expressed as Mean±SE (Standard Error)
**Significant at 1% level (p<0.01)

Antinutritional Composition

The antinutritional composition analysed were phytin phosphorous, total phenol, tannin and aflatoxin content of developed products and is presented Table 6. A statistically significant increase was observed in the phytate content of *matthi* from 81.01 to 84.04mg/100g while the increase in phytate content of *seviyan* was insignificant which was found to be from 89.28 to 90.12. With respect to the tannin content, a significant (p<0.01) reduction in the tannin content of the value added products were recorded. Tannin content reduced from 50.91 to 48.92 mg/100g and 44.25 to 41.99 mg/100g for *matthi* and *seviyan* respectively. Total phenols increased significantly (p<0.01) in *matthi* from 89.99 to 92.22mg/100g while for *seviyan* in total phenol content reduced significantly from 91.85 to 90.26 mg/100g. Aflatoxin was not detected in any of the value added products because of the heat treatments applied to the flour and during the cooking process of product development.

DISCUSSION

Sensory Evaluation of Value Added Products Incorporated with Partially Defatted Peanut Cake Flour and Fenugreek Leaves Powder

The control sample of *Matthi* received a mean overall acceptability score of 7.90 while the value added sample received a score of 7.18 on the other hand for *Seviyan*, control sample received a mean overall score of 7.68 and value added sample received 7.48. Traditional Indian snack *matthi* were prepared with peanut flour at 10, 20 and 30 per cent level of incorporation by Bansal (2013) and observed that it was highly acceptable with an incorporation of 10 per cent of peanut flour. Incorporation of 'Keerae' (*Amaranthus paniculatus*) upto 4 per cent level in products like *Mathri* and *Thalipeeth* was found to be acceptable as reported by Gupta and Prakash (2011). Kaur et al. (2015) prepared *Matthi* incorporating dehydrated *palak* (*Beta vulgaricus* L.) and reported that the products were acceptable at 4 per cent level.

Nutritional Evaluation of the Value Added Products

Proximate Composition

An increase in the moisture content in *matthi* and *seviyan* may be contributed by the addition of fenugreek leaves powder. The significant increase in the protein content is attributed by the peanut flour incorporated in both the products. Agarwal and Sharma (2013) noted a significant increase in *matthri* fortified with garden cress seed flour with respect to protein and fat while the difference in other proximate parame-

Table 6: Antinutritional composition in the developed products (mg / 100 g)

Products	*Phytin Phosphorus*	*Total Phenol*	*Tannin*
Matthi (control)	81.01±1.056	89.99±0.042	50.91±0.015
Test (DPF+FLP)	84.04±0.646	92.22±0.029	48.92±0.442
t-value	7.066*	43.456**	4.575*
Seviyan (control)	89.28±0.325	91.85±0.064	44.25±0.304
Test (DPF+FLP)	90.12±0.020	90.26±0.072	41.99±0.028
t-value	2.568NS	13.159**	6.822*

Values are expressed as Mean±SE (Standard Error)
*Significant at 5% level (p<0.05) **Significant at 1% level (p<0.01) NS- Non Significant

ters were found to be insignificant. *Matthri* when incorporated with dried green leafy powder (mint, spinach and carrot leaves) were found to have high protein content of 7.44 per cent (Verma and Jain 2012). Significant difference ($p < 0.01$) in the fat content was observed in the products which were contributed by the oil present in the partially defatted peanut cake flour and also by the fat used for frying *matthi* and *seviyan.* The increase in fiber content can be due to the incorporation of powdered fenugreek leaves in the products. Similar observations were obtained with respect to the total ash content of the value added foods. The decrease in carbohydrate content of both the value added products may be attributed by the addition of partially defatted peanut cake flour and fenugreek leaves powder which is low in carbohydrate content and on replacing wheat flour by some amount must have reduced the carbohydrate content. Similar study conducted by Bansal (2013) reported that the proximate composition of *matthri, seviyan, panjiri* and biscuits increased significantly for all proximate parameters except for moisture and ash.

Amino Acid Profile

The highest amino acid profile was observed in *seviyan* which was due to the use of chickpea flour as the basic ingredient instead of wheat flour in the cereal-pulse mix. Significant increase in the lysine content of *matthi* was observed. Compared to the 100 per cent cereal biscuits, sorghum soy and wheat soy 1:1 ratio composite biscuits had at least double the protein content and the lysine content increased by 500-700 percent (Serrem et al. 2011). Khanam and co workers (2013) also reported that supplementary foods prepared by incorporating soy protein concentrate, whey protein concentrate along with green gram dhal flour to roasted wheat flour increased the methionine content significantly and was more than the recommended pattern given by FAO/WHO for supplementary foods. Omwamba and Mahungu (2014) reported a concentration of 88-90 per cent lysine content in Protein-Rich Ready-to-Eat Extruded Snack from a composite blend of rice, sorghum and soybean flour. Statically significant increase in the methionine content is due to the addition of defatted peanut cake flour which has a high amino acid and protein profile.

Mineral and Vitamin Concentration

The increase in the mineral content of *matthi* and *seviyan* is contributed by the addition of partially defatted peanut cake flour and powdered green leafy vegetables. Similar trend of increase in minerals like calcium and iron in *matthi, seviyan, panjiri* and biscuits incorporated with different levels of peanut flour were observed by Bansal (2013). *Matthri* when incorporated with dried green leafy powder (mint, spinach and carrot leaves) were found to have high iron content of 5.37mg (Verma and Jain 2012). In a study conducted by Nailwal (2012), the iron content in *mathi, seviyan* and *ladoo* was reported to be 1.53, 3.40 and 2.98 mg / 100 g with a calcium content of 44.1, 45.7 and 36.7 mg / 100 g for *mathi, seviyan* and *ladoo respectively*.

Significant reduction in the vitamin C and β carotene was observed for both the products after fortifying them with peanut flour and fenugreek leaves powder. This may be due to the reason that peanut flour is deficient in these vitamins and replacement of some amount of wheat flour and chickpea flour reduced the vitamin content. Peanut flour required more roasting during preparation due to which the vitamin C content must have reduced in all the products. Sadana and co workers (2008) noticed a considerable increase in the calcium, iron and beta carotene content of *seviyan* when fortified with germinated wheat and soybean flour.

Invitro Protein Digestibility

The in vitro protein digestibility of the products increased considerably which was statistically significant ($p<0.05$) due to the fortification of products with peanut flour and fenugreek leaves powder. In vitro protein digestibility of raw peanuts was found to be 92.65 per cent (Abdualrahman 2013) while for partially defatted peanut cake flour it was found to be 98.99 per cent (Zhao et al. 2012). The authors reported that the processing of peanut to flour reduces the antinutritional component which in turn increases in vitro protein digestibility and protein availability. Baba et al. (2012) In vitro protein digestibility of sprouted sorghum fortified with peanut and cow pea was found to be 96.9 per cent which was significantly higher than sorghum sprouts (89.9%).

Antinutritional Composition

Significant increase in the phytin phosphorus and total phenols were observed in *matthi* while in the case of value added *seviyan* significant increase was observed with respect to total phenols only. Tannin significantly reduced in the case of both products after incorporating peanut flour and fenugreek leaves powder. The tannin and phytate content were reduced in complementary foods formulated from the combination of fermented popcorn, African locust and bambara groundnut seed flour (Ijarotimi and Keshinro 2013). Phytate and Tannin content were reported to be in acceptable limits in three complementary test gruels developed by blending sorghum (fermented), soybean (boiled and dehulled) and moderately ripe plantain flour in different ratios (Onoja et al. 2014). Five nutritious samples of breakfast cereal were produced by mixing the flours (white rice-Soybean composites with graded levels of defatted coconut flour) at increasing ratios were prepared by Ojali and co workers (2015) and reported tannin compositions in a safe limit range.

Aflatoxin was not detected in the value added *matthi* and *seviyan*. Tannins and aflatoxin B1 were not detected in the fresh samples of peanut flour based value added products like fryums, chutney powder, extruded snacks, noodles, biscuits and *laddoo* (Purohit and Rajyalakshmi 2011). Soher et al. (2013) studied the contamination of peanut samples by aflatoxins as well as in chicken burgers incorporated with deoiled peanut flour. They noticed that aflatoxin G1 (AFG1) was absent in all peanut samples; whereas, trace amounts of aflatoxin G2 (AFG2) was detected and recorded 0.170, 0.905 and 0.760 mg/kg, respectively for three samples out of five of the burger which was contributed by the growth in chicken meat.

CONCLUSION

Two Indian traditional value added products namely *Matthi* and *Seviyan* prepared using cereal-pulse mix, partially defatted peanut cake flour and fenugreek leaves powder were highly acceptable. For salty snacks like *Matthi and Seviyan* partially defatted peanut cake flour was added at a concentration of 10 per cent. Sensory evaluation of products prepared using peanut flour and different proportion of powdered fenugreek leaves revealed that the acceptable level of fortification of fenugreek leaves powder in *Matthi* and *Seviyan* was found to be 1 per cent.

Nutritional analysis of the test sample to that of control revealed a statistically significant increase in all the proximate components like protein, fat, fiber and energy except carbohydrates. An increase in minerals like calcium, zinc and iron was also observed but there was a decrease in phosphorus content in all the products. Amino acids like lysine, tryptophan and methionine increased significantly due to the addition of peanut flour compared to the control with an increase in *invitro* protein digestibility for all products. Insignificant differences were seen in the antinutritional composition of the products on fortification with peanut flour and fenugreek leaves powder. Thus, on the basis of this present study, these products are highly recommended for various supplementary programmes aiming to eradicate malnutrition among the vulnerable groups.

RECOMMENDATIONS

From the above paper, it is clear that partially defatted peanut cake flour can improve the nutritional profile in many products especially with respect to protein, fat and energy. The paper recommends extending the incorporation of partially defatted peanut cake flour in other locally available snacks, sweets, bakery products etc. Supplementation studies in malnourished individuals using products prepared incorporating partially defatted peanut flour with other cereal flours can also be recommended to know the efficacy of these value added products.

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