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Research Paper

Fortified protein rich soya product "Nutrameal - Shakti Aahar" and its sensory, nutritional and microbiological analysis

■ MAMTA TIWARI, KHUSHBOO GUPTA **AND** GUNJAN SANADYA

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■ **ABSTRACT :** Soybean contains high amount of protein, dietary fibre and polyunsaturated fatty acids and has numerous therapeutic benefits. Due to its health beneficial properties it was incorporated with other ingredients and turned into sattu and a new product Nutrameal - Shakti Aahar, formulated in this endeavour. Prepared Nutrameal - Shakti Aahar (both sweet as well as salted) was subjected to sensory analysis. Estimation of moisture, protein, fat, carbohydrate, calcium and iron was done. Microbial load of fresh Nutrameal - Shakti Aahar sample was assessed. Both sweet and salted Nutrameal - Shakti Aahar was liked by the experts. Its appearance, colour and overall acceptability were liked moderately (scores 7.0) by the panel members. Both type of Nutrameal - Shakti Aahar were highly nutritive. They were excellent source of protein and contained sufficient amount of carbohydrate and fat. Microbial content was with in limits, hence, products were safe to consume. Level of fatigue was decreased with regular intake of sweet Nutrameal Shakti Aahar. Weight gain and efficiency level of rural women was enhanced with its consumption. It can be concluded that the products were tasty, healthy, safe to use and low in cost thus can be a part of daily diet of individual, without changing their regular dietary consumption.

■ **KEY WORDS:** Fortified protein, Soya product, Nutrameal-Shakti Aahar, Sensory, Nutritional analysis, Microbiological analysis

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See end of the paper for authors' affiliations

MAMTA TIWARI
Directorate of Prioritization, Monitoring and Evaluation, Agriculture University, KOTA (RAJASTHAN) INDIA
Email : mamtatewari63@gmail.com

Soybean is a legume which is grown all over the world for its rich protein and oil contents. It is now recognized for its value in protecting and enhancing health. Soybean has high protein content and is rich in carbohydrates, fats (omega 3 fatty acids), minerals, vitamins (Chaudhary *et al.*, 2011), phytochemicals, isoflavons and phytic acid (Mridula *et al.*, 2009). It contains 43.2 g protein, 20.9 g carbohydrates, 19.5 g fat, 240 mg calcium, 432 calorie, 11.5 iron and reasonable amount of minerals and vitamins (Singh and Sahay, 2002). The health benefits of soybean includes lower blood cholesterol, check constipation, good for diabetics, prevents cardio-vascular diseases (Omoni and Aluko, 2005), overall health promotion, prevent cancer,

osteoporosis and helpful in menopause (Hindustan Times, Oct., 8, 2001). The World Food Programme (WFP) in keeping with its consistent efforts to alleviate hunger and malnutrition among children and mothers across the world, is promoting India mix – soya:wheat (25:75) and soya:maize:wheat (20:40:40) based low cost micro nutrients-fortified pre cooked food supplement, for Indian women and children, the most vulnerable group of the population.

In India Rajasthan, Madhya Pradesh and Maharashtra are the largest producer of soybean. In Rajasthan it produces in abundance at Hadoti region mainly in KOTA (Tiwari and Sanadya, 2017). It is considered as a main cash crop of this region. The soya protein has all the essential amino acids in adequate quantities except sulphur containing amino acids. Soybean is an excellent source of dietary fibre, vegetable protein, complex carbohydrates, polyunsaturated fat, soluble fibres and phytoestrogens (isoflavons) that may be beneficial in prevention of hyperglycemia (Jenkins *et al.*, 2003; Jain *et al.*, 2014a). It appears from several studies that soy based diets may provide benefits in conditions associated with impaired glucose tolerance, hyperlipidemia and reduce insulin sensitivity (Kang *et al.*, 2006).

Regular intake of soybean reduces the possibility of breast cancer and problems of manopause. It is helpful in controlling heart diseases. More than 25 gm of soybean intake per day sometimes create digestive problems. For regular intake of soybean it can be mixed in 1/ 8 ratio with wheat flour (Tiwari *et al.*, 2016). Now a days ready to eat foods are very popular due to convenience, easy availability and low cost. In previous studies various ready to eat products; *i.e.*, vermicelli (Jain *et al.*, 2014b), instant kheer mix (Gupta *et al.*, 2014), upma mix (Jain *et al.*, 2015; Yadav and Sharma, 2008), soy sattu (Mridula *et al.*, 2007), sattu (Dabas *et al.*, 2005; Deshpande *et al.*, 2004), sev (Singh and Singh, 1989), vegetable cereal mix (Gupta *et al.*, 2016), biscuits (Mridula and Wanjari, 2006) were prepared. Sattu is common fast food in most of the part of India mainly U.P., Bihar, M.P. Maharashtra and few places of Rajasthan. It is a combination of roasted flour mixture of cereal, pulses and nuts used as ready to eat food. It is a convenient, less expensive, easily digestible and nutritional food. Because of its vital importance including good keeping quality, it is considered useful for nutritional enrichment especially in rural areas and malnourished communities. Moreover this product can be taken as a very nutritive food supplement at the border security areas where the food supply is troublesome. Therefore in present study a fortified soya sattu namely Nutrameal - Shakti Aahar has been formulated and introduced to supplement the diet of malnourished rural women.

Objectives :

– To assess the organoleptic qualities of Nutrameal - Shakti Aahar.

– To analyse nutritional and microbial content of Nutrameal - Shakti Aahar.

– To identify the effect of supplementation of Nutrameal - Shakti Aahar on malnourished rural women.

■ RESEARCH METHODS

It was a laboratory based trial which was conducted in 2015. In this study instead of bangle gram sattu, a new type of sattu Nutrameal - Shakti Aahar was prepared fortifying with soybean, black gram, groundnut, millet, wheat and sesame seed. Two type of Nutrameal - Shakti Aahar were prepared in this study (i) Nutrameal - Shakti Aahar with sugar and (ii) salted Nutrameal Shakti Aahar. Prepared products were stored in auto sealed sachets.

Sensory evaluation :

A trained panel of 4 judges was selected from Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan. Nine (9) point Hedonic Test (Jellinek, 1985) was used to study the overall acceptability and organoleptic qualities, *i.e.*, appearance, colour, taste and flavour of Nutrameal Shakti Aahar.

Nutrient analysis :

Moisture, protein, fat, calorie content, carbohydrate, calcium and iron of both sweet and salted Nutrameal - Shakti Aahar were analysed in Central Institute of Agriculture Engineering, Bhopal, Madhya Pradesh.

Microbiological analysis :

Microbial content such as total microbial count (total bacterial count and total fungal count) and total coliform count of Nutrameal - Shakti Aahar (per gram dry basis) was assessed in Central Institute of Agriculture Engineering, Bhopal, Madhya Pradesh.

Supplementation of Nutrameal Shakti Aahar :

The formulated Nutrameal - Shakti Aahar was introduced to 20 malnourished women of Hathikheda village, Kota (Rajasthan). The age group was 25 - 40 years. Sample was selected through purposive sampling. Nutritional and health status of rural women were assessed by the doctor and the women who were malnourished were selected for this study. Written informed consent was taken from the participants. Twenty gram of sweet Nutrameal - Shakti Aahar was supplemented daily to these women for 3 months. Parameters, *i.e.*, weight gain, level of fatigue and physical discomfort during menstrual cycle.

■ RESEARCH FINDINGS AND DISCUSSION

Since soybean contains very good quality protein in considerable quantity, it can very well replace the pulse component and can provide a better nutrition and balanced essential amino acid profile for protein utilization.

Table 1 revealed the sensory properties of the fresh Nutrameal – Shakti Aahar were assessed using Nine point Hedonic Scale. Both sweet and salted Nutrameal – Shakti Aahar got more than 7 score for their sensory properties indicating that experts liked these products. Overall acceptability of sweet Nutrameal – Shakti Aahar was liked very much as hedonic score was 8.0 by the panel members whereas overall acceptability of salted Nutrameal – Shakti Aahar was liked moderately. Scores of colour and taste of both products were same indicating that both products were tasty and appealing. Generally soybean has beany flavour but it was not detected in sweet product. It was assumed that combination of different ingredients along with sugar enhance the flavour of sweet Nutrameal – Shakti Aahar. Score of flavour of salted Nutrameal – Shakti Aahar was slightly lower than the sweet product and it was liked slightly by the experts.

As Table 2 (i) indicates nutrient composition analysis by the SPU (Soya Processing Unit), CIAE, Bhopal. Moisture content of both sweet and salted Nutrameal – Shakti Aahar was similar. Protein content was higher in salted Nutrameal – Shakti Aahar (25-28%) whereas carbohydrate content was higher in sweet Nutrameal – Shakti Aahar (50-60%) due to addition of sugar in sweet Nutrameal – Shakti Aahar. Calcium content was higher (0.45 to 0.50%) in salted Nutrameal – Shakti Aahar than sweet Nutrameal – Shakti Aahar (0.20 to 0.25%). Soyabean is not a rich source of iron, therefore iron content of both sweet and salted Nutrameal – Shakti Aahar was very low (0.01 to 0.05%). Both type of Nutrameal – Shakti Aahar were nutritionally adequate and rich source of protein, fat and calorie, hence, regular intake of these products can enhance the nutritional status of the individuals.

According to Table 2 (ii) the presence of total microbial load in this product denotes total bacterial count, total fungal count and total coliform count through microbial contamination in raw materials, handling practices and sanitary control exercised during the production, processing, transportation and storage. In this investigation, care was taken to maintain environmental and personal hygiene to reduce the contamination during the preparation and storage of Nutrameal Shakti Aahar. According to SPU, CIAE, Bhopal, the permissible limit for total microbial count is $5.0x10^3$ per gram (dry basis). Microbial content of both products was lower than this permissible limit, hence, these samples are safe for consumption.

After the laboratory analysis, the sweet Nutrameal - Shakti Aahar was supplemented to rural women of

Table 1 : Sensory qualities of the soya product "Nutrameal – Shakti Aahar"

Parameter	Sweet	Salted
Appearance	8.0	7.0
Colour	7.0	7.0
Taste	7.0	7.0
Flavour	7.0	6.0
Overall acceptability	8.0	7.0

Table 2 (i) : Nutritional analysis of the soya product "Nutrameal – Shakti Aahar"

Nutrient composition (%)	Sweet	Salted
Moisture	2.5-3.0	3.0-4.0
Calorie	450-480	468-472
Protein	15-20	25-28
Carbohydrate	50–60	35-45
Fat	15-20	20-25
Calcium	0.20-0.25	0.45-0.50
Iron	0.01-0.05	0.01-0.03

Table 2 (ii) : Microbiological analysis of the soya product "Nutrameal – Shakti Aahar"

Counts	Sweet	Salted
Total bacterial counts	$3.33x10^3$	$5.95x10^2$
Total fungal counts	$1.22x10^2$	53.33
Total coliforms	Nil	Nil

Table 3 : Effect of supplementation of Nutrameal - Shakti Aahar on nutritional status of rural women (n=20)

Sr. No.	Aspects	Yes	No
1.	Weight gain	15 (75%)	5 (25%)
2.	Improvement in functional level	17 (85%)	3 (15%)
3.	Relief in physical discomfort during menstrual cycle	13 (65%)	7 (35%)

Hathikheda village. After 3 months of supplementation, it was found that their nutritional status was enhanced with its regular intake. Table 3 indicates that weight gain was seen in 75% women. Fatigue level of these women was also decreased as 85% of them indicated that they found themselves more active and energized after its regular consumption. It was also indicated that intake of Nutrameal - Shakti Aahar relieves physical discomfort as 65% women indicated that intake of Nutrameal - Shakti Aahar was also helpful in alleviating abdominal pain, cramps and physical discomfort during their menstrual cycle. Sweet Nutrameal - Shakti Aahar was liked by these women. They said the product was tasty and healthy and they want to consume it regularly as a part of their regular daily diet.

Conclusion :

Nutrameal - Shakti Aahar not only contained the added advantage of soybean but due to addition of different pulses, millets and oil seeds, they also have both macronutrients and essential micronutrients. Prepared products were tasty and were acceptabl by experts as well as by the rural women. These products were nutritionally adequate and were rich source of protein. Due to absence of coliform and minimal microbial these products were safe to consume. Supplementation effects of sweet Nutrameal - Shakti Aahar was very visible as weight gain was observed and fatigue level was diminished. It has been found out that people have accepted it as wholesome food and are willing to include it in their regular diet.

Authors' affiliations:
KHUSHBOO GUPTA AND GUNJAN SANADYA, Krishi Vigyan Kendra, Agriculture University, KOTA (RAJASTHAN) INDIA (Email : banasalkhushi.star@yahoo.com; gunjankvk1982@gmail.com)

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