

Sensory and nutritional quality evaluation of soy-bajra fortified sattu and ready to eat sattu products

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Life style changes in society have created altogether a new market for value added processed food products. Incorporation of soybean and bajra in popular traditional Indian foods is likely to help in acceptability of soy blended foods. Sattu is an Indian traditional ready to eat snack item. Therefore, the present study was carried out to investigate the nutritional and sensory quality characteristics of traditional sattu and soy-bajra fortified sattu made from puffed flours of barley and Bengal gram and puffed flours of soybean, bajra and Bengal gram, respectively. The results showed that soy and bajra flour could be well supplemented up to the level of 25 per cent with good palatability. Soy-bajra fortified sattu beverage was more acceptable (74.3%) as compared to traditional sattu beverage (72.4%). Overall per cent acceptability of soy-bajra fortified sattu paste was more (74.8%) as compared to traditional sattu paste (67.6%). Overall per cent acceptability of traditional sattu ladoo (81.2%) was more as compared to soy-bajra fortified sattu ladoo (78.0%). No significant difference was observed in all the quality attributes of ready to eat sattu products developed from traditional sattu and soy-bajra fortified sattu. This explains that sensory quality of the products remained unaffected with the use of soy-bajra fortified sattu. The developed sattu based products were also subjected to sensory evaluation using 9-point hedonic ranking scale to find out the consumer acceptability of the ready to eat sattu products sex-wise and residence-wise. Soy-bajra fortified sattu products were almost equally acceptable in rural and urban areas and in both the sex. Increase in protein, fat, energy, calcium and iron was noted in soy-bajra fortified sattu products. The net dietary protein cal% of traditional sattu was 6.89 and soy-bajra fortified sattu was 6.32 which is adequate to maintain health for adults and good to promote growth. The cost of soy-bajra fortified sattu was also affordable by lower economic class and thus this serves the dual purpose of convenience and ensuring nutritional security.

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INTRODUCTION

Good health is very essential for a successful life. People are becoming health conscious and thereby demand of specialty foods is increasing. Soybean has tremendous potential to be transformed into a number of such foods suiting to the requirement of people. Daily use of soybean in the diet would provide a balanced nutrition at a low cost and also the health benefits. Awareness on this aspect, among masses, is now spreading. Soy based products are nutritious, economical

and healthful.

Cereals and bengal gram flour can be fortified with full fat soy flour and can be used to prepare traditional food products. In India, sattu is traditionally prepared with the combination of roasted Bengal gram and roasted cereal of the particular region and used as ready to eat (RTE) food in most parts of India originally from north Indian villages (Deshpande *et al.*, 2004a). As soybean contains higher amount of protein and fat than bengal gram, it could be partially substituted to enrich the traditional sattu. Soybeans being referred many times as “golden bean” are a boon to solve the problem of energy protein malnutrition in India and many other developing countries (Gandhi *et al.*, 2008).

The protein digestibility of most soy products is generally

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excellent (Veena *et al.*, 2008). In fact, the digestibility of soy protein is comparable to milk and meat proteins and can reach 100 per cent. Sattu is excellent for growing kids. It is highly nutritious food, easy to make and long lasting (Deshpande *et al.*, 2004b). In areas where bajra is grown, sattu can be prepared by blending of bajra is more popular. The present study was carried out to investigate sensory and nutritional quality characteristics of sattu made from different proportion of puffed flours of soybean, bajra, bengal gram, and to study the consumer acceptability of ready to eat sattu products and to popularize the ready to eat sattu product amongst rural as well as urban population.

METHODOLOGY

Methodological aspects related to present study are discussed in four phases:

Phase I: Development and standardization of soy-bajra fortified sattu flour:

Cleaned whole grains of soybean (*Glycin max*), bajra (*Pennisetum typhoideum*), barley (*Hordeum vulgare*) and bengal gram (*Cicer arietinum*) were separately moisture conditioned and stored under refrigerated condition for 48 hours to facilitate moisture equilibrium. Each of these samples was then roasted in a hot sand bath followed by their dehulling. The dehulled samples were then mixed in following three proportions of soybean, bajra and Bengal gram 30:20:50, 25:25:50 and 20:30:50. Samples thus prepared were ground and powdered. Traditional sattu was prepared using barley and bengal gram in proportion of 50 :50 for use as a control sample. Developed soy-bajra fortified sattu flour was standardized to find out the best proportion of soy, bajra and Bengal gram.

Phase II: Product development using traditional sattu and soy-bajra fortified sattu :

Three types of products namely sattu beverage, sattu paste and sattu laddoo were developed. Sattu beverage and paste was prepared using sattu and water. Sattu beverage and paste was used as a nutritional supplementation for infants and children. Sattu laddoo was liked by people of all age groups.

Phase III: Sensory evaluation:

The developed beverage, paste and laddoo using traditional sattu and soy fortified sattu flour were standardized using sensory evaluation with the help of semi trained panel members using composite scoring technique (Swaminathan, 1987). Specific characteristics of a product were rated separately and the most important characteristics will account for a large part of the total score. Developed ready to eat soy-bajra fortified sattu products were also subjected to sensory evaluation using 9 point hedonic scale to find out the consumer acceptability sex-wise and residence-wise.

Phase IV: Comparison of nutritive value and cost of traditional and soy-bajra fortified sattu :

The products developed were analyzed for the nutritive composition using nutritive value of Indian foods (Gopalan *et al.*, 2000). Protein quality in traditional sattu and soy-bajra fortified sattu was assessed using net dietary protein calorie per cent (NDP Cal%) and the cost of products were also calculated.

Statistical analysis:

All values have been presented as mean \pm SD and statistical significance was analysed by Student's t-test and F-Test.

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as well as relevant discussion have been presented under following heads :

Sensory evaluation:

Soy-bajra fortified based ready to eat mix sattu was prepared using roasted and dehulled ingredients *viz.*, soybean, bajra and bengal gram. Three product formulations were prepared using quantities of ingredient in different proportions *e.g.* soybean: 20-30 per cent and bajra 20-30 per cent and bengal gram 50 per cent. Soy-bajra fortified sattu was evaluated for its acceptability by a panel of judges. Results revealed that soybean, bajra and bengal gram in the ratio of 25:25:50 was found highly acceptable. The mean scores for all the quality characters and general acceptability were more in the samples of sattu fortified up to 25 per cent soybean and 25 per cent bajra. Soy-bajra based sattu was devoid of off flavour and possessed acceptable characteristics. Acceptable ratio of soy-bajra fortified sattu was used to develop ready to eat sattu products beverage, paste and laddoo.

The results of mean acceptability scores for taste, consistency, appearance and colour of sattu beverage revealed that beverage prepared from soy-bajra fortified sattu scored slightly more as compared to traditional sattu (Table 1). Results of per cent acceptability (Fig.1) revealed that overall

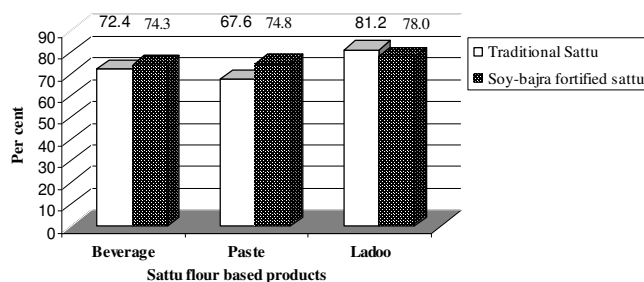


Fig. 1. Overall acceptability of sattu products developed using traditional sattu and soy-bajra fortified sattu

Table 1. Mean and per cent organoleptic acceptability of sattu beverage developed from traditional and soy-bajra fortified sattu

Quality attributes (composite scores)	Traditional sattu beverage			Soy-bajra fortified sattu beverage		
	Mean	S.D	%	Mean	S.D	%
Taste (40)	28.0	±5.65	70	30.4	±7.35	76
Consistency (20)	14.0	±3.39	76	14.8	±1.96	75
Appearance (20)	13.6	±3.86	68	14.8	±2.69	74
Colour (20)	13.2	±2.69	66	14.4	±2.82	72

Values are mean ± SD of ten panelist

Table 2. Mean and per cent organoleptic acceptability of sattu paste developed from traditional and soy-bajra fortified sattu

Quality attributes (composite scores)	Traditional sattu paste			Soy-bajra fortified sattu paste		
	Mean	S.D	%	Mean	S.D	%
Taste (40)	28.8	±6.74	72	30.4	±6.31	76
Consistency (20)	12.4	±2.95	62	14	±2.10	70
Appearance (20)	13.2	±2.69	66	15.2	±1.68	76
Colour (20)	13.2	±3.79	66	14	±2.10	70

Values are mean ± SD of ten panelists

Table 3. Mean and per cent organoleptic acceptability of sattu ladoo developed from traditional and soy bajra fortified sattu

Quality attributes (composite scores)	Traditional sattu ladoo			Soy-bajra fortified sattu ladoo		
	Mean	S.D	%	Mean	S.D	%
Taste (40)	33.6	±6.31	84	32.8	±5.90	82
Consistency (20)	16.4	±2.27	82	14.4	±2.79	72
Appearance (20)	16.4	±2.95	82	15.6	±2.27	78
Colour (20)	14.8	±3.29	74	15.2	±1.68	76

Values are mean ± SD of ten panelist

Table 4. Level of significance in sensory characteristics of traditional and soy-bajra fortified ready to eat sattu products

Quality attributes	Sattu beverage t value	Sattu paste t value	Sattu ladoo t value	f-value
Taste	-0.81 NS	-0.54 NS	0.29 NS	0.103 NS
Appearance	-0.66 NS	-1.3 NS	1.75 NS	
Consistency	-0.80 NS	-1.9 NS	0.68 NS	
Color	-0.97 NS	-0.58 NS	-0.34 NS	

NS= Non-significant

acceptability of soy-bajra sattu beverage was more (74.3%) as compared to traditional sattu beverage (72.4%).

The results of mean acceptability scores for taste, consistency, appearance and colour of sattu paste revealed that beverage prepared from soy-bajra fortified sattu scored more as compared to traditional sattu (Table 2). Results of per cent acceptability revealed that overall acceptability of soy-bajra sattu paste was more (74.8%) as compared to traditional sattu paste (67.6%).

The results of mean acceptability scores for taste, consistency and appearance of sattu ladoo revealed that ladoo prepared from traditional sattu scored more as compared to soy-bajra fortified sattu (Table 3). Colour of soy-bajra fortified sattu was more acceptable. Results of per cent acceptability

revealed that overall acceptability of traditional sattu ladoo (81.2%) was more as compared to soy-bajra fortified sattu ladoo (78.0%). Out of the three ready to eat sattu products acceptability of sattu ladoo was highest. Sattu beverage and paste was found to be almost equally acceptable (Fig. 1).

In all the quality attributes of sattu products developed from traditional and soy-bajra fortified sattu no significant difference was observed (Table 4). This explains that sensory quality of the products remained unaffected with the use of soy-bajra fortified sattu.

The developed ready to eat sattu products were also subjected to sensory evaluation to find out the consumer acceptability of the products sex-wise and residence-wise using 9-point hedonic ranking scale (Swaminathan, 1987).

The results revealed that Soy-bajra fortified laddoo were equally acceptable among rural (8.1) and urban population (8.1) in both the sex (Fig. 2). Hence liked very much by the sample population. Soy-bajra fortified beverage was more acceptable in urban population (8.4) as compared to rural population (7.6). Soy-bajra fortified paste was almost equally acceptable among rural and urban population. Female showed slightly more acceptance for paste as compared to male. The mean score for general acceptability of soy-bajra fortified sattu was more than the minimum acceptable score of 5 up to 25 per cent soy-bajra fortification. The results thus indicated that soy-

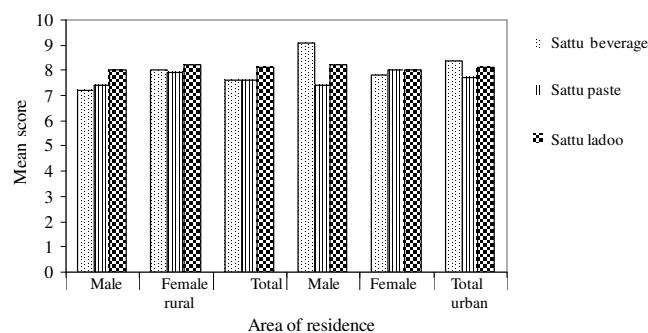


Fig. 2. Mean acceptability score of soy-bajra fortified ready to eat sattu products as per hedonic ranking scale

bajra fortified ready to eat sattu products were well accepted by sex-wise and residence-wise. These products were devoid of off flavour and possessed acceptable characteristics.

Nutrient calculation:

Nutrient calculation was done as per values given in the nutritive value of Indian foods by ICMR (Gopalan *et al.*, 2007). Increase in protein, fat, energy, calcium and iron was noted in soy-bajra fortified sattu (Table 5). Total increase of 46.76 per cent was noted in protein of soy-bajra fortified sattu. Protein quality of traditional and soy-bajra fortified sattu was assessed using NDPCal%. It relates protein quality to the energy intake. The net dietary protein value is the utilizable protein content of the diet. Chemical score method was used for calculating the NDPCal% as it is the indicator of the protein value. The calculated value of NDPCal% of traditional sattu was 6.89 (Table 6,7) and soy-bajra fortified sattu was 6.32 (Table 8,9) which is adequate to maintain health for adults and also good to promote growth in children and adolescents.

Cost calculation:

The cost of traditional and soy-bajra fortified sattu (Table 10) was also affordable by lower economic class and thus this serves the dual purpose of convenience and ensuring nutritional

Table 5: Nutritive value of traditional and soy-bajra fortified sattu (per 100 gm)

Nutrients	Traditional sattu	Soy-bajra fortified sattu	Per cent increase in nutrient
Energy (Kcal)	352.50	382.75	8.58
Protein (g)	17.00	24.95	46.76
Fat (g)	3.25	8.72	168.30
Iron (mg)	5.58	9.35	67.56
Calcium (mg)	42.00	99.5	136.90

(ICMR, 2007)

Table 6. Energy, Protein, nitrogen and amino acid content of traditional sattu

Food stuff	Amount (g)	Energy (Kcal)	Protein (g)	N ₂ (g)	Lysine (mg)	Sulphur containing amino acid (mg)	Threonine (mg)	Trptophan (mg)
Barley	50	168.00	5.75	0.92	115.00	100.00	100.00	50.00
Bengal gram	50	184.50	11.25	1.37	220.00	80.00	110.00	25.00
Total	100	352.50	17.00	2.29	335.00	180.00	210.00	75.00

Table 7. Net dietary protein calorie per cent of traditional sattu

NDPCal%	Amino acid content of traditional sattu				
	N ₂ (gm)	Lysine (mg)	Sulphur containing amino acid (mg)	Threonine (mg)	Trptophan (mg)
Amount present in soy-bajra fortified sattu	2.29	335.00	180.00	210.00	75.00
AA content mg/g N ₂ of soy-bajra fortified sattu	1	146.29	78.60	91.70	32.75
Provisional amino acid pattern(PAAP) mg/g N ₂		340	220	250	60
Chemical score using PAAP		43.01	35.73	36.68	32.75

NDPCal% of traditional sattu is 6.89

Table 8. Energy, Protein, nitrogen and amino acid content of soy-bajra fortified sattu

Food stuff	Amount (gm)	Energy (Kcal)	Protein (gm)	N ₂	Lysine (mg)	Sulphur containing Amino Acid (mg)	Threonine (mg)	Trptophan (mg)
Soybean	25	108.00	10.8	1.73	100.00	45.00	60.00	20.00
Bajra	25	90.25	2.9	0.46	47.50	65.00	60.00	27.50
Bengal gram	50	184.50	11.25	1.37	220.00	80.00	110.00	25.00
Total	100	382.75	24.95	3.56	367.50	190.00	230.00	72.50

Table 9. Net dietary protein calorie per cent of soy-bajra fortified sattu

NDPCal%	Amino acid content of soy-bajra fortified sattu				
	N ₂ (gm)	Lysine (mg)	Sulphur containing Amino Acid (mg)	Threonine (mg)	Trptophan (mg)
Amount present in soy-bajra fortified sattu	3.56	367.50	190.00	230.00	72.50
AA content mg/g N ₂ of soy-bajra fortified sattu	1	103.23	53.37	64.61	20.36
Provisional amino acid pattern(PAAP) mg/gm N ₂		340	220	250	60
Chemical score using PAAP		30.36	24.25	25.84	33.93

NDPCal% of soy-bajra fortified sattu is 6.32

Table 10. Cost of traditional and soy-bajra fortified sattu

Sattu	Costs (Rs) per 100g
Traditional sattu	3.00
Soy-bajra fortified sattu	3.50

security (Singh *et al.*,2008). Soy foods provide good quality nutrition and health promoting phytochemicals at an affordable price. 65 to 70 per cent of Indian population is vegetarian and majority of them suffer from energy protein malnutrition as they cannot afford high cost traditional pulses and or animal product like milk. Even the majority of non-vegetarian segment of population can not afford regular eating of animal protein because of its very high cost. In such a situation, soy-bajra fortified sattu is an effective alternative as it provides quality and quantity protein at low cost and conducive to good health.

Conclusion:

Consumers in general are becoming more interested in nutritional and healthy foods. Sensory quality of the products remained unaffected with the use of soy-bajra fortified sattu. . Increase in protein, fat ,energy, calcium and iron was noted in soy-bajra fortified sattu. The NDPCal% of traditional sattu was 6.89 and soy-bajra fortified sattu is 6.32 which is adequate to maintain health for adults and good to promote growth. The cost of soy-bajra fortified sattu was also affordable by lower economic class and thus this serves the dual purpose of convenience and ensuring nutritional security (ICMR, 2007).

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