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Preparation and standardization of food product by soya chunks and oats as a substitute of meat products and nutraceuticals potential of soybean

Aisha Parveen, Alisha, Mohd Asim and Dr. Ritu Prakash Dubey

Abstract

Isoflavones, which are a subclass of flavonoids, are present in many different plants but the soybean is the only common consumed food to contain nutritionally relevant amount of these diphenolic molecules. The two primary soybean Isoflavones are genistein and daidzein. Isoflavones are referred to as phytoestrogens because they have a chemical structure similar to the hormone estrogen, bind to estrogen receptors (ER), and exert some estrogen like effects in cells. The present study was conducted "Preparation and standardization of food products by soya chunks and oats as substitute of meat products" Oats (*Avena sativa* L.) have received considerable attention for their high content of dietary fibres, phytochemicals and nutrition value. The prepared food product is seek kabab and served as treatments T1, T2, T3 and T4 at 20:70:10 percent, 40:50:10 percent, 60:30:10 percent and 80:10:10 percent of Soya chunks, Bengal gram and Oats respectively with some objectives To assess the organoleptic quality of prepared food products to determine the nutritional composition of prepared food products to calculate the cost of the prepared food products. Sensory evaluation was carried out using nine point Hedonic scale. Soybean has received the status as one of the most important edible plants known for its seed as a source of protein, oil and nutraceuticals. The content of the isoflavones and folic acid has made it a versatile crop for healthy food applications. The utility of soybean crop for food applications is described the soybean proteins are gaining importance as a vegetable source for protein based products, with abundance quantity of essential amino acids. Its content of quality fats and PUFA are also important from nutraceutical point of view. The fermented soybean meal is also a good source of nutritionally rich tofu.

Keywords: Soya bean. Isoflavones. Oats. Phytochemicals. Protein. Seek Kabab

1. Introduction

Potential mechanism by which soy protein and/or Isoflavones induce lowering of blood cholesterol concentrations include thyroid status, bile acid balance and the estrogenic effects of genistein and daidzein. In addition to the potential beneficial effects, the increased consumption of products containing soy protein may displace foods relatively high in saturated fat and cholesterol from the diet and hence have an indirect blood cholesterol-lowering effect. (Loviti *et al.*, 2000) [6]

A variety of health benefits, including protection against breast cancer, have been attributed to soy food consumption, primarily because of the soybean Isoflavones (genestein, daidzein, glycitein). If breast cancer patients enjoy the soy products, it seems reasonable for them to continue to use them. The estrogen like effects of Isoflavones in combination with work suggesting the synthetic Isoflavones ipriflavone exerted skeletal benefits led to initial speculation that soyfood help to maintain bone health and prevent osteoporosis. (Messina and Loprinzi 2001)

Proteins Raw soybeans primarily contain legume proteins belonging to the globulin family of seed storage proteins called legumins and vicillins, or in the case of soybeans, glycinin and beta-conglycinin. Soy protein is generally regarded as stored protein held in discrete particles called "protein bodies" estimated to contain at least 60% to 70% of the total protein within the soybean germinates, the protein will be digested and the released amino acids will be transported to locations of seedling growth. Soybean also contain biologically active or metabolic proteins, such as enzymes, trypsin inhibitors, hemagglutinins and cysteine proteases. Carbohydrate Soybeans are relatively low in carbohydrate (35%) and nearly all the carbohydrates in soy are fibres and oligosaccharides. The principal soluble carbohydrates of raw soybeans are the disaccharide sucrose, the trisaccharide raffinose, and the tetrasaccharide stachyose.

Phytoestrogen Soybeans contain different Isoflavones and coumestans and further contain plant lignans, which are the principal precursor to mammalian lignans. However the isoflavone content of soy is usually attracting the largest attention. Phytoestrogens are primarily interesting in relation to human intake because they have the ability to bind human estrogen receptors, and thus influence bodily actions normally governed by natural estrogen levels. (Anders 2013) ^[1]

(Anderson *et al.*, 1999) Soy beans are nutrient- dense, fibre rich and are high- quality sources of protein. Protective and therapeutic effects of both dry bean and soybean intake have been documented. Soybeans are unique source of the Isoflavones, genistein and diadzein, which have numerous biological functions. Soybeans and soyfoods potentially have multifaceted health- promoting effects, including cholesterol reduction, improved vascular health, preserved bone mineral density and reduction of menopausal symptoms. The availability of legume products and resources is increasing, incorporating dry beans and soy foods into the diet can be practical and enjoyable.

Oat protein Oat is considered to be a potential source of low cost protein with good nutritional value. Oat has a unique protein composition along with high protein content of 11-15%. Cereal protein have been classified into four types according to their solubility as follows: albumins (water soluble), globulins (salt water soluble), prolamines (soluble in dilute alcohol solution) and glutelins (soluble in acid or bases). Oat protein not only differs in the structural properties but also differs in distribution of protein fraction in comparison to other cereal grains. (Klose *et al.*, 2009) ^[5]

Choy *et al.*, (2006) reported that soybeans are relatively low in carbohydrates (35%), and nearly all the carbohydrates in soy are fibers and oligosaccharides. The principal soluble carbohydrates of raw soybeans are the disaccharide sucrose, the trisaccharide raffinose, and the tetrasaccharide stachyose. The oligosaccharides raffinose and stachyose are not digestible sugars in humans, and contribute to flatulence and abdominal discomfort, as undigested oligosaccharides are broken down in the intestine by native microbes, producing gases such as carbon dioxide, hydrogen, and methane. The insoluble carbohydrates in soybeans consist of the complex polysaccharides cellulose, hemicelluloses, and pectin. The majority of the insoluble soybean carbohydrates can be classed as belonging to dietary fibers.

Dietary fibres promote beneficial physiological effects including laxation and/or blood cholesterol attenuation and/or blood glucose attenuation (AACC 2001). It is also known to reduce blood cholesterol level (Ripsin *et al.*, 1992). Dietary fibres particularly oat beta-glucan has potential anti-cancerous property, as they reduce compounds which are causative agents of colon cancer (Sadiq Butt *et al.*, 2008).

A. Lipids

Oat is a good source of lipids. It contains much higher levels of lipids than other cereals which are excellent sources of energy and unsaturated fatty acids. The majority of lipids of oats are in the endosperms. The fat content of oat ranges from 5.0 to 9.0% of the total lipid content. The lipid content in an intact kernel of oat stored for one year at room temperature was found to be stable (Keying *et al.*, 2009), due to the protection from endogenous antioxidants such as tocopherols, L- ascorbic acid, thiols, phenolic amino acids and other phenolic compounds. Along with lipids, oat contains considerable amount of lipases, which are capable of acting under low moisture condition. If not controlled, these lipases

causes rancidity and short shelf life processed products of oat (Lehtinen *et al.*, 2003) ^[7].

B. Vitamin E

Antioxidants such as vitamin E are known to protect the body from damaging radicals and play an important role in prevention of diseases such as cancer, arthritis, atherosclerosis, and cataract. Oat germ has high level of tocopherols (a and c isomers), whereas tocotrienols are mainly concentrated in endosperm but are absent in germ the primary tocopherol of oat is alpha-tocotrienol but small amount of tocopherols and their beta- homologs are also present.

C. Avenanthramides (AVAs)

Oats are known for a unique group of antioxidants reported among cereals known as avenanthramide (AVA) (Dimberg *et al.*, 1993; Meydani 2009) ^[9]. There are abundant AVAs in oat, namely 2c, 2p and 2f, number 2 indicates 5-hydroxyanthranilic acid and letter c, p and f indicates the kind of hydroxycinnamic acids as p-coumaric, caffeic and ferulic acid, respectively.

(Dimberg *et al.*, 1993) reported that AVAs have an antioxidant activity of 10-30 times greater than that of other phenolic antioxidants such as vanillin and caffeic acid. Preliminary studies indicate that the AVAs might possess anti-inflammatory and antiatherogenic properties, since they inhibit monocyte adhesion to human aortic endothelial cells and are presumed to inhibit release of pro-inflammatory compounds from macrophages (Liu *et al.*, 2004) ^[8]. They are also involved in controlling the blood pressure, as they produce nitric oxide which dilates the blood vessels (Nie *et al.*, 2006) ^[10].

Taylor and Jones (2006) studied that the inclusion of oats in the gluten-free diet for patients with celiac disease to assess whether oats can be recommended. Celiac disease is an immunologically mediated enteropathy resulting from the ingestion of gluten in genetically predisposed people. Patients classically present with chronic diarrhoea, fatigue, weight loss, failure to thrive, etc. However, many present atypically. The spectrum of celiac disease has been shown to be broader than first believed.

Oil: Soybean contains roughly ~19% oil, of which the triglycerides are the major component. Soy oil is characterized by relatively large amounts of the polyunsaturated fatty acids (PUFA), i.e., ~51% linoleic acid and ~8% α -linolenic acid, stearic acid ~4, palmitic acid ~10, oleic acid ~23 of total fatty acids (Messina, 1997). Soybean oil contains essential fatty acids linoleic acid and α -linolenic acid belonging to the ω -6 and ω -3 family, which plays an important role in the regulation.

2. Materials and Methods

The present study titled "Preparation and standardization of food products by soya chunks and oats as substitute of meat products" was conducted in the Nutritional Research Laboratory, Department of Food, Nutrition and Public Health, Ethelind College of Home Science, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad. U.P. The details of materials, experiments, procedure and techniques followed during the course of the present investigation have been elaborated in this chapter under the following heads:

A. Procurement of Raw Material

The raw material for the product development was purchased from the market nearby Sam Higgin bottom University of Agriculture, Technology and Sciences, Allahabad.

B. Experimental Site

The present investigation was carried out in the Nutritional Research Laboratory of the Department of Food, Nutrition and Public Health, Ethelind College of Home Science, Sam Higginbottom University of Agriculture Technology and Sciences Allahabad.

C. Development of Products

Three products were used i.e. soya chunks, gram flour and oats. Different ratios of these products combination were tried several times and evaluated by sensory evaluation t method to obtain the best ratios. The three combination respectively were then used as treatment (T1, T2, T3 and T4).

D. Treatments and Replications of Products

1) Detail of treatment of product (Seek kabab)

Table 1: Detail of treatment of product (Seek kabab)

Products	Treatments				Replication
	T ₁	T ₂	T ₃	T ₄	
1. seekh kabab					
Soya chunks	20%	40%	60%	80%	3
Gram flour	70%	50%	30%	20%	
Oats	10%	10%	10%	10%	

2) Details of treatments

Preparation of seekh kabab by using soya chunks and oats
Preparation and Standardization of Food Products by Soya Chunks and Oats as a Substitute of Meat Products (IJSRD/Vol. 5/Issue 05/2017/441)

- T1: the product was prepared using 20g soya chunks, 70g gram flour and 10g oats.
- T2: the product was prepared using 40g soya chunks, 50g gram flour and 10g oats.
- T3: the product was prepared using 60g soya chunks, 30g gram flour and 10g oats.
- T4: the product was prepared using, 80g soya chunks, 10g gram flour and 10g oats.

Table 4.1: The average sensory scores of treated sample of seekh kabab.

Treatments	Colour and Appearance	Body and Texture	Taste and flavor	Overall Acceptability
T ₁	7.8	7.8	7.9	7.7
T ₂	8.83	8.1	8.1	8.1
T ₃	8.86	8.8	8.9	8.9
T ₄	6.1	5.9	7.2	6.1
F-test	S	S	S	S
C.D	0.215	0.117	0.152	0.117

Colour and Appearance

F= 492(4.76), Significant, $P \leq 0.05$ CD=0.21

- Body and Texture

F= 1616.6(4.76), Significant, $P \leq 0.05$ CD=0.11

- Taste and Flavour

F= 314(4.76), Significant, $P \leq 0.05$ CD=0.15

- Overall acceptability

F= 1430(4.76), Significant, $P \leq 0.05$ CD=0.11

The data illustrated in the above table pertaining to the average sensory scores of different parameters in treated

E. Organoleptic Evaluation

The organoleptic evaluation of prepared products was done by a panel of 5 judges from the Department of Food, Nutrition and Public Health to assess the acceptability of the products based on the various sensory attributes like colour, appearance, texture, flavour and taste. The evaluation was done on the 9 point hedonic scale based on score card (Srilakshmi, 2010)

F. Statistical Analysis

The data was statistically analyzed by using analysis of variance (two way classification) and critical difference technique. A significant difference between the treatments was determined by using CD (critical difference) test (Appendix C). (Chandel, 2006).

G. Calculation of Nutritive Value of Prepared Products

The nutritive value obtained by the chemical analysis of the soya chunks was computed, as well as food composition tables by (Gopalan *et al.* 2015) was used to determine the nutritive value of the prepared products. Nutrients such as energy, protein, carbohydrate, fat, calcium, iron, and fiber, were calculated

1) Formula

$$\text{Nutrient/ 100g of product} = \frac{\text{Ingredient used (g)} \times \text{Nutritive value of Ingredient}}{100}$$

3. Results and Discussion

Finding of the present study entitled “Preparation and standardization of food products by soya chunks and oats as substitute of meat products” are presented and discussed in this chapter. The data collected on different aspects as per the methodology have been tabulated and analyzed statistically. The findings are also illustrated. The results obtained from the analysis are presented and discussed in the following sequence.

- Organoleptic characteristics of the developed food products.
- Nutritional composition of the products.
- Cost of the prepared food products.
- Organoleptic characteristics of the Seekh kabab

samples of seekh kabab clearly indicates that in terms of taste and flavour T3(8.9) had the highest score followed by T2, T1 and T4, and. T3 had the highest score in other parameters i.e. body and texture, colour and appearance and overall acceptability making it quite obvious that seekh kabab made of incorporation of 60 percent soya chunks, 30 percent gram flour and 10 percent oats enhanced all parameters and acceptability.

Table 3: Analysis of Variance data for colour and appearance of seekh kabab

Sources of variation	d. f	S.S.	M.S.S.	F. cal.	F. tab.	Result
Due to treatment	3	14.78	4.92	492	4.76	S
Due to replication	2	0.01	0.005			
Due to error	6	0.06	0.01			
Total	11	14.85	4.935			

S = Significant ($p \leq 0.05$)

The ANOVA table is evident that calculated value of F (492) due to treatments is greater than the tabulated value of F (4.76) on 3, 6 degree of freedom at 5% probability level. It indicates that there was significant difference between the four treatments regarding the colour and appearance of Seekh kabab and it can concluded that incorporation of soya chunks, gram flour and oats in the seekh kabab improved colour and appearance of the product.

Table 4: Comparison between the colour and appearance of the treatment of seekh kabab against C.D. CD= 0.21

Treatment Mean value	T ₁ (7.8)	T ₂ (8.83)	T ₃ (8.86)	T ₄ (6.1)
T ₁ (7.8)	0	-1.03	-1.06	1.7
T ₂ (8.83)		0	-0.03	2.73
T ₃ (8.86)			0	2.76
T ₄ (6.1)				0

On comparing the average scores for colour and appearance of seekh kabab against critical difference in the table 4.1.2, the variation in scores for colour and appearance of seekh kabab can be seen as follows. The difference in the mean value of (T₁, T₄), (T₂, T₄), (T₃, T₄) was greater than C.D, (0.21) therefore the difference was significant while the difference in the mean value of (T₁, T₂), (T₁, T₃), (T₂, T₃) is less than C.D., therefore the difference was non-significant.

Table 7: Analysis of Variance data for taste and flavour of seekh kabab

Sources of Variation	d.f.	S.S.	M.S.S.	F.cal.	F.tab. (%)	Result
Due to treatment	3	4.73	1.57	314	4.76	S
Due to replication	2	0.03	0.01			
Due to error	6	0.03	0.005			
Total	11	4.79	1.585			

S = Significant ($p \leq 0.05$)

The ANOVA table is evident that calculated value of F is greater than the tabulated value on 3, 6 degree of freedom at 5% probability level. It indicates that there was significant difference between the four treatments regarding the taste and flavour of seekh kabab and it can concluded that soya chunks

Table 5: Analysis of Variance data for body and texture of Seekh kabab.

Sources of variations	d.f	S.S.	M.S.S.	F.cal.	F.tab.	Result
Due to treatment	3	14.75	4.85	1616.6	4.76	
Due to replication	2	0.03	0.01	3.33		
Due to error	6	0.02	0.003			
Total	11	14.8	4.863			

S = Significant ($p \leq 0.05$)

The ANOVA table is evident that calculated value of F is greater than the tabulated value on 3, 6 degree of freedom at 5% probability level. It indicates that there was significant difference between the four treatments regarding the body and texture of seekh kabab and it can concluded that soya chunks and oats improved body and texture of the products.

Table 6: Comparison between the body and texture of the treatment of Seekh kabab against C.D.

Treatment mean value	T ₁ (7.8)	T ₂ (8.1)	T ₃ (8.8)	T ₄ (5.9)
T ₁ (7.8)	0	-0.3	-1	1.9
T ₂ (8.1)		0	-0.7	2.2
T ₃ (8.8)			0	2.9
T ₄ (5.9)				0

CD= 0.11

On comparing the average scores for body and texture of seekh kabab against critical difference in the above table, the variation in scores for body and texture of seekh kabab can be seen as follows. The difference in the mean value of (T₃, T₄), (T₁, T₄) and (T₂, T₄) was greater than C.D, (0.11) therefore the difference is significant while the difference in the mean value of (T₁, T₂), (T₁, T₃), (T₂, T₃) is less than C.D., therefore the difference is non-significant.

Table 7: Analysis of Variance data for taste and flavour of seekh kabab

Sources of Variation	d.f.	S.S.	M.S.S.	F.cal.	F.tab. (%)	Result
Due to treatment	3	4.73	1.57	314	4.76	S
Due to replication	2	0.03	0.01			
Due to error	6	0.03	0.005			
Total	11	4.79	1.585			

S = Significant ($p \leq 0.05$)

The ANOVA table is evident that calculated value of F is greater than the tabulated value on 3, 6 degree of freedom at 5% probability level. It indicates that there was significant difference between the four treatments regarding the taste and flavour of seekh kabab and it can concluded that soya chunks

with oats and gram flour improved taste and flavour of the products.

Mahapatra (2008) studied that the variety of kababs, popular convenience and nutritious comminute meat products made either from mince or chunks of meat and other ingredients vary in appearance and flavour.

Table 8: Comparison between the taste and flavour of the treatment of seekh kabab against C.D

Treatment Mean value	T ₁ (7.9)	T ₂ (8.1)	T ₃ (8.9)	T ₄ (7.2)
T ₁ (7.9)	0	-0.2	-1	0.7
T ₂ (8.1)		0	-0.8	0.9
T ₃ (8.9)			0	1.7
T ₄ (7.2)				0

CD= 0.152

On comparing the average scores for taste and flavour of seekh kabab against critical difference in the above table, the variation in scores for taste and flavour of seekh kabab can be seen as follows. The difference in the mean value of (T₁, T₄), (T₂, T₄), (T₃, T₄) was greater than C.D, (0.15) therefore the difference is significant while the difference in the mean

value of (T₁, T₂), (T₁, T₃), (T₂, T₃) was less than C.D., therefore the difference is non-significant.

Table 9: Analysis of Variance data for overall acceptability of seekh kabab

Sources of Variation	d.f.	S.S.	M.S.S.	F.cal.	F.tab. (%)	Result
Due to treatment	3	12.89	4.29	1430	4.76	S
Due to replication	2	0.06	0.03	10		S
Due to error	6	0.02	0.003			
Total	11	12.97	4.323			

S = Significant ($p \leq 0.05$)

The ANOVA table is evident that calculated value of F (22.3) due to treatments was greater than the tabulated value of F (4.76) on 3, 6 degree of freedom at 5% probability level. It indicates that there was significant difference between the four treatments regarding the overall acceptability of seekh kabab and it can be concluded that incorporation of soya chunks, oats and gram flour in seekh kabab improved overall acceptability of the product.

Table 10: Comparison between the overall acceptability of the treatment of Seekh kabab against C.D CD= 0.11

Treatment Mean value	T ₁ (7.7)	T ₂ (8.1)	T ₃ (8.9)	T ₄ (6.1)
T ₁ (7.7)	0	-0.4	-1.2	1.6
T ₂ (8.1)		0	-0.8	2
T ₃ (8.9)			0	2.8
T ₄ (6.1)				0

On comparing the average scores for overall acceptability of seekh kabab against critical difference in the above table, the variation in scores for overall acceptability of seekh kabab can be seen as follows. The difference in the mean value of (T₁, T₄), (T₂, T₄), (T₃, T₄) was greater than C.D, (0.11) therefore the difference is significant while the difference in the mean value of (T₁, T₂), (T₁, T₃) and (T₂, T₃) was less than C.D., therefore the difference was non-significant.

- Nutritional composition of the products

Table 11: Average percentage of nutrients in treated samples of Seekh kabab per 100g

Nutrients	Treatments			
	T ₁	T ₂	T ₃	T ₄
ENERGY(kcal)	275.4	292.2	309.6	282.8
Protein(g)	25.56	29.92	35.52	32.2
Fat(g)	4.20	2.99	4.47	3.50
Carbohydrate(g)	12.96	14.34	18.14	16.93
Calcium(mg)	32.2	33.1	35.6	34.6
Phosphorus(mg)	210.1	215.3	230.5	220.3
Fibre(g)	0.2	0.4	1.14	0.9
Iron (mg)	1.06	1.57	2.35	2.01
Magnesium(mg)	61	65	82	72
Sodium(mg)	73.12	74.31	76.10	78.12
Potassium(mg)	280	288	300	300

The table 11 shows the average nutritional composition of Seekh kabab with incorporation of soya chunks and oats. Results show that the nutrients content i.e. energy, protein, fat, carbohydrate, iron and fiber increased with the addition of, soya chunks, gram flour and oats. T₃ has maximum iron, fiber, energy, protein and fat content and carbohydrate content. Sodium, potassium, phosphorus, calcium and magnesium contents increase with the incorporation of soya chunks, oats and gram flour.

- Cost of the prepared food products.

Table 12: Cost of the prepared products namely Seekh kabab

Ingredients	Actual rate/kg (Rs)	T ₁		T ₂		T ₃		T ₄	
		Amt. (g)	Cost (Rs)						
Soya chunks	120	20	2.40	40	4.80	60	7.20	80	9.60
Gram flour	180	70	12.60	50	9.0	30	5.40	10	1.80
Oats	170	10	1.70	10	1.70	10	1.70	10	1.70
Onion	20	20	0.4	20	0.4	20	0.4	20	0.4
Refined oil	100	10	1	10	1	10	1	10	1
Carrot	40	20	0.80	20	0.80	20	0.80	20	0.80
Green Peas	40	10	0.4	10	0.4	10	0.4	10	0.4
Green chilies	50	5	0.25	5	0.25	5	0.25	5g	0.25
Total amount (Rs.)			19.55		18.35		17.15		15.95

Table 12 shows that the total cost of Seekh kabab per 100g of dry ingredients at the prevailing cost of the raw materials for treatment T₁ is Rs.19.55, T₂ is Rs.18.35, T₃ is Rs.17.15 and T₄ is Rs. 15.95. It is therefore concluded that the T₁ has the highest cost followed by T₂, T₃ and T₄ because of the variations in the treatments and ingredients used in seekh kabab which lowers the cost at every level.

4. Conclusion

From the result, it is concluded that Soya chunks (Glycine max), Bengal gram or garbanzo (Cicerarietinum) and oats (Avena sativa) can be suitably incorporated in "seekhkabab". The prepared products were well accepted with regard to sensory characteristics. Treatment (T₃) containing Soya chunks, Bengal gram and oats in the ratio of 60:30:10

respectively in the seekhkabab, was most acceptable in all the prepared food products. The amount of fibre and fat not increased much while the energy, carbohydrate, protein, iron, sodium, potassium, calcium and magnesium increased in the recipe. Potassium, sodium, magnesium and protein content increases with the incorporation of soya chunks and gram flour. The cost of best treatment (T₃) prepared food products per 100g of raw ingredients ranged from 17.15 Rs for seekhkabab. Thus soybean has a great potential as a source of important nutrients and nutraceuticals of implication to human health. Therefore the innovations that is taking place has in the development of processes and products of soybean will provide further boost to the aspect of utilization of soybean beyond the usage as oil seed crop.

5. Recommendations

Incorporation of soya chunks, gram flour and oats in (seekh kabab) can be recommended to preschool, adolescents and individuals of other age group in order to improve their nutrient intake, particularly protein, calcium, phosphorus, sodium, potassium, carbohydrate and iron. These three value added products can also be recommended for those who are vegetarian and for people with diseases like CVD, obesity and in protein deficiencies etc.

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