DETERMINE NUTRITIONAL QUALITIES OF PASTA PREPARED FROM SOYABEAN AND SORGHUM FLOUR

MORADIYA, P. B.; *GOJIYA, D. K. AND VYAS, D. M.

**DEPTT.OF PROCESSING AND FOOD ENGINEERING,
COLLEGE OF AGRICULTURAL ENGINEERING AND TECHNOLOGY,
JUNAGADH AGRICULTURE UNIVERSITY, JUNAGADH - 362 001,
GUJARAT, INDIA**

EMAIL: dkgojiya@gmail.com

ABSTRACT

Pasta is extruded product with most ancient source of food with long shelf life, availability in numerous shapes and sizes, high digestibility, good nutrition and low cost. The principal object of pasta preparation was to prepare an improved pasta product enriched good nutritional components and sensory characteristics by blending soyabean flour, sorghum flour and semolina, which has also good texture, shape, taste and all the attributes of the best pasta products. Besides 15 per cent semolina, the pasta formulation was substituted with soyabean and sorghum flour at 30, 40, 50, 60 and 70 per cent of its dry weight. Pasta with different shapes was made from the prepared flour by mixing with 31 per cent water using the Lab scale pasta making machine. Then the pasta products were dried in shade followed by cooking. The optimization of the variable for the development of the best quality pasta product was done by statistical analysis. Regression models were developed for the dependent and independent variables. In this study, the independent parameters i.e. blend ratio of sorghum and soyabean flour (70:30, 60:40, 50:50, 40:60 and 30:70) have been optimized for proximate compositions moisture content, protein, ash, fat, crude fiber and carbohydrate. The results revealed that the protein, fat and ash content increased with the increase in percentage of soyabean flour, whereas moisture content, carbohydrate and crude fiber content increased as the percentage of sorghum flour increased. Considering the analysis of observations, the highest value of overall acceptability for cooked pasta with 30-70 per cent blend (soyabean to sorghum flour) for the shapes Spaghetti, Fusilli, Ziti Rigati and Shell type considered was found as 6.92, 7.06, 7.02 and 6.76, respectively.

KEY WORDS: Blending, blend ratio, extrusion, flour, pasta, semolina, sorghum, soybean

INTRODUCTION

The most widely consumed snacks are mixture of cereals based products. These are rich sources of carbohydrates and supply calories and other nutrients to the consumers. The majority of the Indian population thrives upon cereals and pulses as a source of calories and proteins. No single legume or cereal can provide adequate amount of all nutrients. It was recognized that mixing of legumes and cereals in the diet could improve overall nutrition. Moreover, the use of blends of wheat and non wheat flours, known as composite flour, became prevalent when wheat was scarce. The present and newly derived knowledge

in these areas makes it possible to blend, mix or fortify one food material with others so that the resulting fortified mix has not only better nutritional quality but also attributes for consumer acceptance.

Sorghum (*Sorghum bicolour* L.) is an important staple crop in semi-arid regions of Africa and India because of its drought tolerance. But low protein content and quality limits its widespread use. Sorghum ranks fourth after rice, corn and wheat in terms of importance for human nutrition (Lupien, 1995). Amongst important biochemical components of sorghum, are the levels of starch and starch depolymerising enzymes. Due to presence of high amount of starch (56-73%), sorghum could be the good commodity for preparing of expanded snacks (Shafiur, 2007).

Soyabean (*Glycine max* (L.) *Merrill*, family *Leguminosae*, sub-family *Papilionoidae*) originated in Eastern Asia. Soyabean is a rich source of protein content. It is found in varied sizes as well as seed coat colours, right from black, brown, blue and yellow. Soyabean contains all the macro-nutrients required for good nutritionally complete, protein, carbohydrate and fat as well as vitamins and minerals, including calcium, folic acid and iron. Soy based food extends health benefits for diabetic, cancer and heart patients.

The present and newly derived knowledge in these areas makes it possible to blend, mix or fortify one food material with others so that the resulting fortified mix has not only better nutritional quality but also attributes for consumer acceptance. The nutritional quality of sorghum and wheat, especially the former, is poor. Therefore, attempts have been made to fortify these cereals with legumes to make nutritionally superior and acceptable products.

Extrusion cooking is a processing method, which makes it possible to obtain, expanded products (crackers), pre-cooked (instant flour) or textured. It combines a heat treatment with a mechanical treatment at different pressure and shearing rate. These treatments are applied to the product for short time and short duration. The extruded products are mostly formulated from mixtures of cereals, legumes and oilseeds and are completely precooked for easy reconstitution and use. Considering all above aspects in mind a research was undertaken to develop and determine nutritional qualities of ready to eat pasta product by blending soyabean flour and sorghum flour.

MATERIAL AND METHODS

The Dolly pasta machine manufactured by "La Monferrina" di A. Mascero and C. Snc. Manufacturing company (Italy) was used for extrusion of pasta of sorghum and soyabean flour with five different blend ratios. Soyabean and Sorghum were floured and sieved through 28 mesh while Maida through 48 mesh sieve. All the three flours were mixed together to prepare five different samples. However, 15 per cent (by weight) Maida was added rationally in all the five samples. While remaining 85 per cent (by weight) of sample was prepared by taking different ratios of sorghum and soyabean flour as shown below:

The ratios were,

a. 70% sorghum + 30% soyabean flour + Maida
b. 30% sorghum + 70% soyabean flour + Maida
c. 40% sorghum + 60% soyabean flour + Maida
d. 60% sorghum + 40% soyabean flour + Maida

e. 50% sorghum + 50% soyabean flour + Maida

For the preparation of raw pasta, the mixing tank was filled with basic ingredients followed by addition of 31 per cent (Garg, 2005) pure water in the flour and then safety cover was closed. The machine was started with kneading position. After kneading the material for about 15 minutes to get the homogeneous mix, the machine was set from previous kneading position to the extruding position. The material was extruded in four different shapes using the four types of dies. Subsequently, pasta was allowed to dry in shed from moisture content approximately 30 to 9 ± 1% (w.b). The boiled pasta was prepared by placing the dried raw pasta into the boiling water. The cooking time was recorded when the centering of the pasta became cooked.

Analysis of observations

The average value of three replications are reported and considered for evaluation. The results obtained from the proximate analysis and sensory evaluation were analyzed using curve fitting (statistical) tools to predict the variables values. The results were drawn from statistically obtained parameters value (using CRD design) as well as from the sensory analysis outcome.

RESULTS AND DISCUSSION

The content of moisture, protein, ash, fat, crude fiber and carbohydrates were obtained for raw (dried) pasta prepared by different blend ratios and presented in Table 2.

Moisture content

The moisture content in the extruded pasta products ranged from 7.95 per cent (w.b.) prepared with 70 % soyabean and 30 % sorghum flour ratio to 9.30 % (w.b.) in 30 % soyabean and 70 % sorghum (Table 2). The graph (Figure 1) showed the effect of blend ratio on the moisture content of extruded pasta products. From the graph (Figure 1), it was observed that as the per cent sorghum flour in the blend ratio increased, the moisture content of the pasta also increased, mainly because of the higher initial moisture content of sorghum flour as compared to soyabean flour. The mathematical model for the actual value of moisture content (MC) was best fitted in following polynomial equation.

$$MC = 9.8 - 0.7071x + 0.2554x^2 - 0.0375x^3$$

Where, x = blend ratio

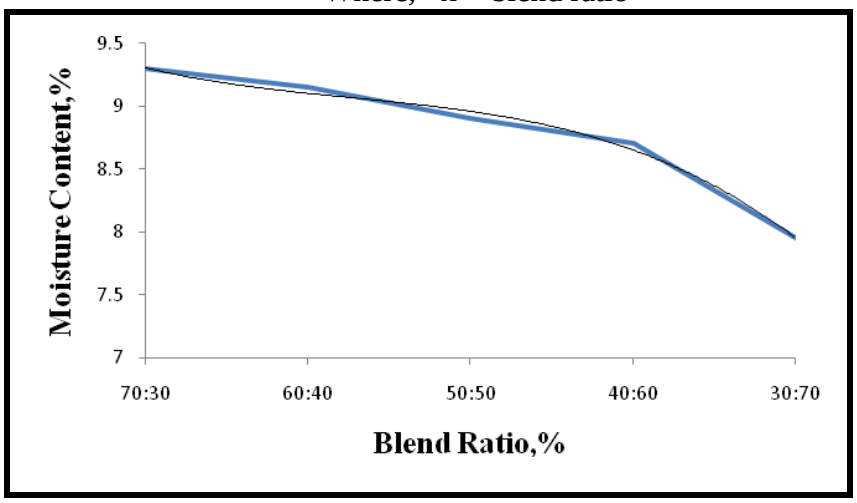

Fig. 1: Effect of blend ratio on moisture content of pasta products.

Protein

The pasta produced from 30 % sorghum and 70 % soyabean flour had the highest protein content of 24.88 % and the pasta produced from 70 % sorghum and 30 % soyabean flour had the lowest protein content of 16.18 % (Table 2). The protein content was observed to be increased with progressive increase in proportion of soyabean flour, indicating that supplementation of soyabean flour with sorghum flour would greatly improve the protein nutritional quality of pasta products (Figure 2). This could obviously be due to the significant quantity of protein in soyabean flour. The mathematical model for the actual value of protein content was fitted in the polynomial equation as,

Protein $=14.98+ 0.854x + 0.349x^2 - 0.025x^3$ Where, x = Blend ratio

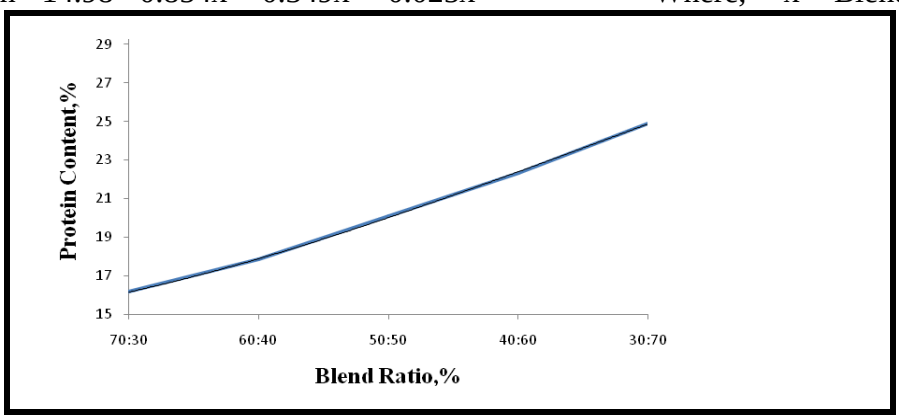

Fig. 2: Effect of blend ratio on protein content of pasta products.

Ash

The pasta produced from 70 % soyabean and 30 % sorghum had the highest ash content of 4.91 % and the pasta produced from 30% soyabean and 70 % sorghum flour had the lowest ash content of 3.56 % (Table 2). The ash content was observed to be decreased with the increased in proportion of sorghum flour in the semolina (Figure3). This was due to the lower ash content in sorghum flour as compare to the soyabean flour. The mathematical model for the actual value of ash content was fitted in the polynomial equation as,

Ash $= 2.37+ 1.605x - 0.465x^2+ 0.049x^3$ Where, x = blend ratio

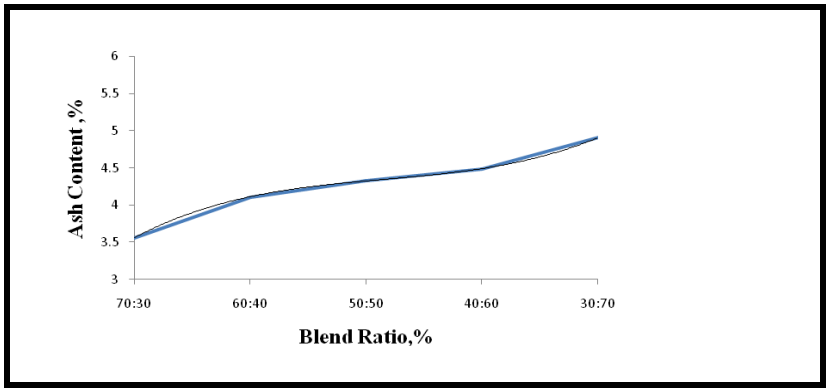

Fig. 3: Effect of blend ratio on ash content of pasta products.

Fat

The pasta produced from 70 % soyabean flour and 30 % sorghum flour had the highest fat content of 14.05 % and the pasta produced from 30 % soyabean flour and 70 % sorghum flour had the lowest fat content of 9.70 % (Table 2). The fat content was observed to be increased with the increased in proportion of soyabean flour in the semolina (Figure 4). As the soyabean flour contained 20.80 % fat which was higher than that of sorghum flour, the resultant fat content was increased with the blend ratio. The mathematical model for the actual value of fat content was best fitted in the polynomial equation as,

$$Fat = 9.896 - 0.9662x + 0.854x^2 - 0.0992x^3$$ Where, x = blend ratio

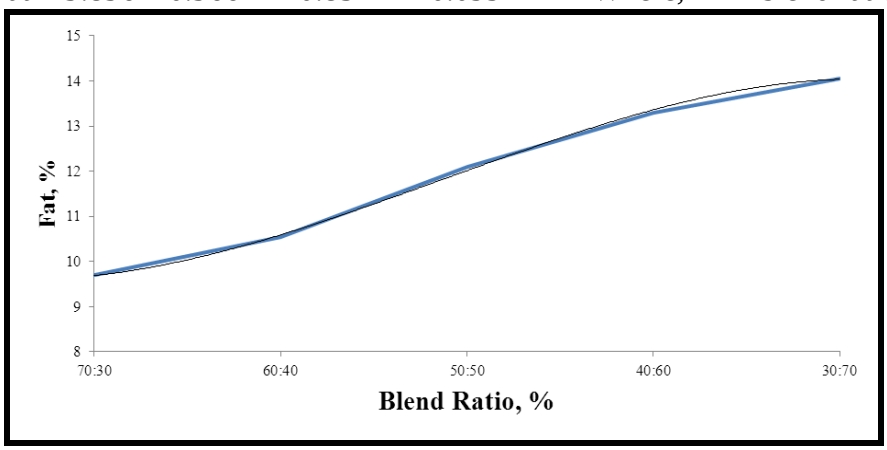

Fig. 4: Effect of blend ratio on fat content of pasta products

Crude fiber

The pasta produced from 30 % soyabean flour and 70 % sorghum flour had the highest crude fiber content of 8.97 % and the pasta produced from 70 % soyabean flour and 30 % sorghum flour had the lowest crude fiber content of 5.76 % (Table 2). The crude fiber content was increased with the increased in proportion of sorghum flour in the semolina (Figure 5). It could be due to higher amount of fiber content in sorghum flour. The mathematical model for the actual value of crude fiber was fitted in the following second order model.

$$Crude\ Fiber = 10.66 - 1.859x + 0.163x^2 + 0.002x^3$$ Where, x= blend ratio

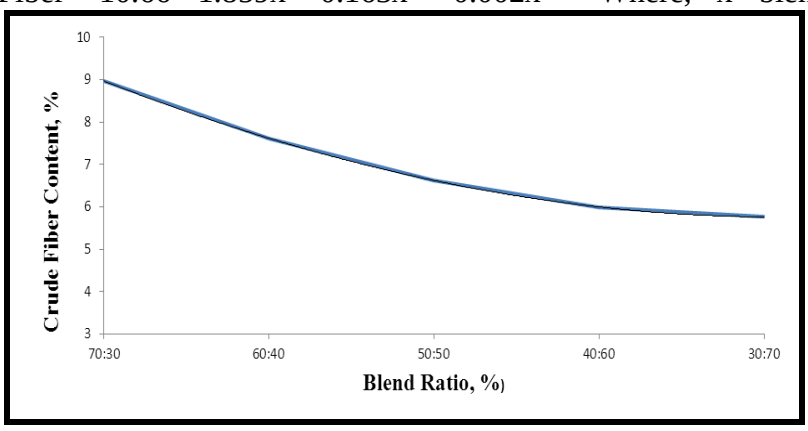

Fig. 5: Effect of blend ratio on crude fiber of pasta products.

Carbohydrates (CHO)

The pasta produced from 70 % sorghum flour and 30 % soyabean flour had the highest carbohydrates of 55.17 % and the pasta produced from 30 % sorghum flour and 70 % soyabean flour had the lowest carbohydrates of 35.94 % (Table 2). The carbohydrate was decreases with the increased in proportion of soyabean flour in the semolina (Figure 6). It may be due to lower amount of starch in soyabean as compared to sorghum. As the carbohydrate was estimated by difference and therefore, the increased in fat content induced the decreased in the carbohydrate content. The mathematical model for the actual value of carbohydrates was best fitted in the following polynomial equation.

$CHO = 82.99 - 38.57x + 11.86x^2 - 1.207x^3$ Where x = blend ratio

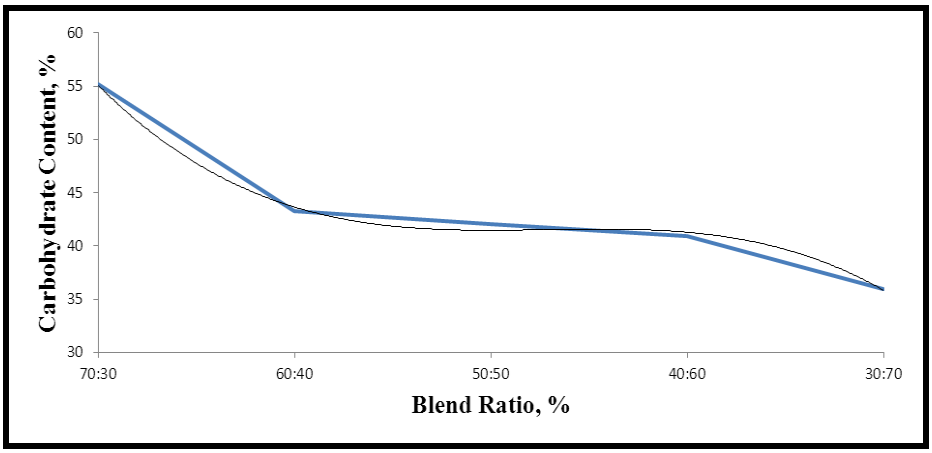

Fig. 6:Effect of blend ratio on carbohydrates of pasta products.

Sensory evaluation

Sensory evaluation of pasta products in terms of colour, appearance, visual surface properties (smothness, and uniformity in diameter), taste and overall acceptability was done using hedonic scale through a panel of judges by allotting marks out of 10 to find out the most acceptable treatment. Results of the sensory acceptability are presented in Table 3. The score for the 10-point scale (where, 9-10 = excellent, 8-8.9 = good, 6.6-8.8 = satisfactory, 5-6.5 = fair and <5 = poor) for the sensory overall acceptability of the prepared pasta products are shown in table 3 for all shapes. The overall acceptability of the pasta products prepared from 30:70 blend ratios was lowest while the same was highest of the pasta prepared from 70:30 blend ratios. In respect of frying oil temperature the overall acceptability of all the three types of pasta products prepared with 30 % sorghum flour and 70 % soyabean flour was found lowest, while that was highest for the pasta prepared with 70 % sorghum flour and 30 % soyabean flour for all shapes. The highest value of overall acceptability for raw pasta with 70 - 30% blend (sorghum to soyabean flour) for shape 1, 2, 3 and 4 was found as 6.61, 7.01, 6.76 and 6.70, respectively, while in case of cooked pasta, the overall acceptability with 70 - 30% blend (sorghum to soyabean flour) for shape 1, 2, 3 and 4 was found as 6.92, 7.06, 7.02 and 6.76, respectively. For fried pasta, the overall acceptability with 70 - 30% blend (sorghum to soyabean flour) for shape 1, 2, 3 and 4 was found as 6.79, 6.81, 6.70 and 6.64, respectively. The

smoothness, taste and colour of pasta products were decreasing as the percentage of soyabean flour increased in the blend.

CONCLUSION

It was observed that as the percent sorghum flour in the blend ratio increased, the moisture content of the pasta also increased, mainly because of the higher initial moisture content of sorghum flour as compared to soyabean flour. The protein content was increased with progressive increase in proportion of soyabean flour, indicating that supplementation of soyabean flour with sorghum flour would greatly improve the protein nutritional quality of pasta products. The ash content was decreased with the increased in proportion of sorghum flour. The fat content was increased with the increase in proportion of soyabean flour. The crude fiber content was increasing with the increased in proportion of sorghum flour in the blend. The carbohydrate was decreased with the increased in proportion of soyabean flour.

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Table 1: Biochemical composition of Soyabean flour, Maida and Sorghum (amount per 100 grams) [@].

Content	Soyabean Flour	Maida	Sorghum Flour
Protein(g)	36.00	12.68	07.87
Fat(g)	20.00	01.05	03.29
Ash(g)	04.90	01.15	01.60
Crude fibre(g)	09.00	03.90	06.60
Carbohydrate(g)	00.30	72.83	77.47

[@] (Anonymous, 2013)

Table 2: Influence of the blend ratio of Sorghum and Soyabean Flour on proximate composition of raw pasta.

Sr. No	Blend Ratio (%)	MC (%) (w.b.)	Protein (%)	Ash (%)	Fat (%)	CF (%)	CHO (%)
1	70:30	9.30	16.18	3.56	9.70	8.97	55.17
2	60:40	9.15	17.84	4.11	10.53	7.61	43.27
3	50:50	8.90	20.10	4.33	12.10	6.63	42.03
4	40:60	8.70	22.34	4.49	13.30	5.99	40.90
5	30:70	7.95	24.88	4.91	14.05	5.76	35.94

Table 3: Overall acceptability of the different pasta products prepared with different blend ratio of sorghum and soybean flour.

Sr. No.	Blend Ratio (%)	Overall Acceptability			
		Shape 1	Shape 2	Shape 3	Shape 4
1	70:30	6.92^{a}	7.06^{a}	7.02^{a}	6.76^{a}
2	60:40	6.73^{a}	7.03^{a}	6.79^{a}	6.61^{a}
3	50:50	6.41^{b}	6.67^{a}	6.48^{b}	6.38^{b}
4	40:60	6.34^{b}	6.45^{b}	6.37^{b}	6.39^{b}
5	30:70	6.04^{b}	6.06^{b}	6.11^{b}	6.04^{b}

[a] = Satisfactory, [b] = Fair, [c] = Poor

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