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Development of Quality Characteristics of Dried Pasta Enriched with Soya Protein Isolate Powder

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Abstract: *Pasta is a most popular, nutritious and health conscious, global appeal as nutrition supplement. Fortifications of pasta with a variety of proteins increase the nutritional significance of pasta and improve the health condition of the immense majority of health conscious peoples. In present study we developed three samples (C, C1, C2,and C3) of pasta using refined wheat flour and proportions of soya protein isolate(SPI). Sample C was prepared as control containing only refined wheat flour (100%), while sample C1 (refined wheat flour 99% and soya protein isolate powder (SPI) 1%, C2 (refined wheat flour 97% and soya protein isolate powder (SPI) 3%. C3 (refined wheat flour 95% and soya protein isolate powder 5%) were prepared by changing the concentration of refined wheat flour and different soya protein isolate. All the three samples were evaluated for the physicochemical properties (moisture content, ash value and texture analysis) nutritional properties (carbohydrate, protein, fibre and fat), cooking time and sensory qualities. A soya protein isolate fortified pasta product was successfully produced and it was observed as the concentration of soya protein isolate was increased the cooking time also increased. On the basis of physicochemical & nutritional properties cooking time and sensory qualities, pasta containing refined wheat flour (97%) and soya protein isolate (SPI) 3% resulted in better quality having more nutritional elements and highest overall acceptability.*

Keywords: *Pasta, fortification, protein supplementation, nutrition, health conscious peoples*.

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I. Introduction

Under conditions of normal dietary intake, properly processed soy protein ingredients are good protein value for humans. Soya-bean proteins are used in human foods in a variety of forms, in-cluding infant formulas, flours, protein isolates and concentrates, and textured fibres. Soy foods include cheese, drinks, miso, tem-peh, tofu, salami, and vegetarian meat substitutes. Consumption of soy foods is increasing because of its beneficial effects on human nutrition and health. These effects include lowering of plasma cholesterol and prevention of cancer, diabetes, and obesity, as well as protection against bowel and kidney diseases. This is particularly true when soy products are utilized in combination with other protein sources, Such as meat, milk, and cereal grains. The nutritional adequacy of soy protein products has been clearly demonstrated in infant formulas, where protein requirements are most critical. The most refined forms of soybean proteins are the isolates, which contain 90% or more protein. They are prepared by removing the water-insoluble polysaccharides, as well as the oligosaccharides and other low-molecular-weight components that are separated in making protein concentrates. Defatted flakes or flours, which have received a minimum of moist heat treatment, are extracted with water plus alkali at a pH of 7 to 8.5. The in-soluble residue, containing the water-insoluble polysaccharides plus residual protein, is then separated. In the next steps, the clarified extract containing the bulk of the proteins plus the sugars is adjusted to about pH 4.5. This treatment precipitates the proteins, which are then removed by centrifugation or filtration. The precipitated proteins are then washed and dried to give the isoelectric protein. The protein is neutralized before drying. Isolates' may contain more than 95% protein but contain 2% to 5% ash and 3% to 4% of minor constituents. Soy concentrates and isolates provide highly concentrated proteins such as meat, milk, fish, and egg .Digestibility values for protein concentrates and isolates by humans fall in the range of 91% to 96%, which is comparable to values for milk. Proteins that are utilised in food processing are of various origins, and it can roughly be classified into animal proteins (gelatins), vegetable proteins (e.g. peanut protein, soy protein, wheat proteins, Almond protein, canola meal protein etc.), and animal derived protein (e.g. milk proteins). However, many vegetable proteins require processing to provide food material having acceptable functional properties such as emulsification, oil and water absorption, texture modifications, colour control and whipping properties, which are primarily attributed to the protein characteristics. Many plants have attracted a deal of interest as a source of low cost protein to supplement human diet, this include among others soybeans and peanut .

II. Material And Method

2.1. Procurements of raw material

Soya protein isolate powder basically (protein isolate) and wheat flour (*Triticum aestivam*) is used and procured from local market.

2.2. Evaluation of physicochemical properties of raw material

The content of protein was determined as per (IS: 7219:1973): Kjeldhal method, protein content was obtained by using the conversion factor of 6.25, crude fibre was determined by (IS: 11062) and carbohydrate content by difference method, ash and fat content were determined according to AOAC 2000 methods.

2.3. Sample preparation

Four Samples (C, C1, C2, and C3) were prepared using sample C as control containing only refined wheat flour (100%), while sample C1, C2 and C3 were prepared using different concentration of refined wheat flour and ginger powder. Proximate composition and concentration of different raw materials taken in the preparation of control (C) and other samples (C1-C3) is shown in Table 1. All the samples were passed separately through sieve no. 10 thrice to improve the mixing. Prepared samples were stored in an air tight polyethylene bag in cool and dry place for further study.

Table.1 Chemical composition of raw materials

Ingredient	**Sample**			
	C	C1	C2	C3
Refind wheat flour	1000	990	970	950
Soya protein isolate	-	10	30	50

2.4. Pasta Preparation

Different samples of pasta (C, C1, C2 and C3) is prepared using different concentrations of refined wheat flour and soya protein isolate powder in the ratio of 100:00; 99:01; 97:03, 95:05 respectively. In each case, an amount of 1000 g of the respective composition was taken for the preparation of pasta. Refined wheat flour and soya protein isolate powder is mixed with optimum amount of water in the mixing chamber of pasta extruder (Le Monferrina Masoreo Arturo and C.S.N.C., Italy) for 10 minute to distribute the water uniformly. The moist flour aggregate was extruded through pasta extruder fitted with an adjustable die. The speed of revolving sharp blade cutter in the front of the die was adjusted so that the length of the pasta finished at 2 cm for each sample. Drying of final pasta sample was carried out in hot air oven at 75ºC for 3 h. The dried product was packed in polyethylene bags. The main objective of the drying was to reduce the moisture content of the sample to about 8-10%. Final dried products of various samples were packed in high density polyethylene bags. The resultant dried products were then used for further study such as cooking time, chemical composition, viscosity, texture and sensory analysis.

2.5 Evaluation and optimization of pasta samples

The developed pasta products were analyzed for their different quality parameters. The cooking quality of samples was determined by the minimum cooking time as per AACC 2000. Rapid visco analyzer (RVA) was used to determine the pasting properties of raw material of pasta products. The texture of the product was determined with the help of stable micro system texture analyzer TA-XT2i. It was used in cutting mode to record the required force to cut the pasta sample. Sensory evaluation was carried out as per 9 point hedonic scale with the degree of liking: 1 = extremely dislike, to 9 = extremely like. Each pasta sample was cooked separately in a stainless steel pan, in the each case 100 g pasta sample was taken and cooked in 500 ml of water. The pasta was added in to the boiling water and was boiled for the time already determined. Boiled pasta was then drained, fried in a pre standardized method by using oil, mustard, onion and tomato with salt and used for sensory evaluation. A ten member panel of panellists evaluated the cooked samples of pasta and marked their observations in the sensory card. Each of the samples was randomly numbered using a three-digit code. Pasta was evaluated for colour, texture, aroma, taste and overall acceptability.

2.6 .Statistical analysis.

The results are expressed as Mean ± SD (standard deviation). The statistical significance was analyzed using One-way Analysis of Variance (ANOVA) followed by Dunnett Multiple Comparisons Test by employing statistical software, Graph Pad, Instate 3. Differences between groups were considered significant at $P<0.05$ level.

III. Results And Discussions

3.1. Evaluation of chemical composition of raw material

The composition of the raw material is depicted in Table 2

Table.2.Chemical composition of raw materials

Raw material	Carbohydrate	Protein	Fat	Fibre	Ash
Refined wheat flour	72.65±0.02	10.68±0.10	1.18±0.08	0.51±0.15	3.61±0.03
SPI powder	18.70±0.01	5.05±0.12	0.31±0.02	2.41±0.02	1.28±0.01

3.2. Nutritional composition of prepared pasta samples

The protein content of C, C1, C2 and C3 pasta samples were found to be 9.72±0.28, 4.52±0.90, 9.42±0.90, and 9.28±0.90 respectively. Fortification of pasta with different level of soya protein isolate powder lightly decreases the carbohydrate, protein, fat and ash content of the final products. While fibre content of prepared soya protein isolate pasta increases in comparison to control pasta, the result agreed with other researchers. The nutritional composition of prepared pasta samples is shown in Table 3.

Table.3. Nutritional composition of prepared pasta samples

sample	Carbohydrate	Protein	Fat	Fibre	Ash
C	75±0.51	9.72±0.28	1.14±0.01	0.45±0.01	3.52±0.05
C1	75±0.46	4.52±0.90	1.15±0.03	0.52±0.06	3.38±0.08
C2	74±0.32	9.42±0.90	1.10±0.05	0.52±0.02	3.05±0.03
C3	74±0.36	9.28±0.90	1.07±0.02	0.54±0.07	2.89±0.08

Note: All value are represented as Mean ± S.E.M. (standard error mean), n=6; data were analyzed by one-way ANOVA (Analysis of variance) employing Dunnett Multiple Comparisons Test using Graph Pad, Instate 3 software. Where C= Control sample, C1= 1% soya protein isolate powder sample, C2= 3% soya protein isolate powder sample, C3= 5% soya protein isolate powder sample.

3.3. Cooking time. Cooking time of pasta sample was significantly decreased as compare to the control sample, in each case 50g of each sample was taken and cooked separately for the evaluation of cooking time. The result is shown in Table 4.

Table.4.Cooking time of prepared pasta sample

sample	Cooking time (minute)
C	5.12±0.01
C1	5.10±0.06
C2	4.72±0.08
C3	4.35±0.12

Note: All value are represented as Mean ± S.E.M. (standard error mean), n=6; data were analyzed by one-way ANOVA (Analysis of variance) employing Dunnett Multiple Comparisons Test using Graph Pad, Instate 3 software, *P<0.05.

3.4. Rapid Visco Analyser (RVA) : Rapid visco analyzer (RVA, Starch Master of Perten, Sweden) was used to determine the pasting properties of raw material of pasta products. The peak viscosity (maximum viscosity of the sample during the heating and holding phase of the procedure) as well as the final viscosity (viscosity reading at the end of the test profile) was recorded for all samples. Sample is cooked at 95ºC then cooled to 65ºC, and its viscosity measured, using a RVA. The paste temperature of 65ºC is used to rapidly stabilize viscosity and minimize retro gradation.

Table.5.Viscosity Value of Different Samples

Sample	Peak viscosity	Hold viscosity	Final viscosity
C	2642±4.42	1942±2.48	3432±1.48
C1	2538±3.40	1862±2.14	3381±1.35
C2	22.65±2.58	1762±2.25	3320±1.58
C3	2148±0.75	1378±3.36	2692±1.12

It was found that there was significant difference in the peak viscosity and hold viscosity among different samples (P<0.05).

Note: All value are represented as Mean ± S.E.M. (standard error mean), n=6; data were analyzed by one-way ANOVA (Analysis of variance) employing Dunnett Multiple Comparisons Test using Graph Pad, Instate 3 software, *P<0.01

3.5. Texture analysis : The texture of the samples was analyzed and it was found that the force (in g) required cutting the pasta sample was decreasing with increasing amount of soya protein isolate powder. The results of the analysis are presented in the table No 6. The cutting force of C, C1, C2 and C3 were 2512.10±0.38, 2389.00±1.06, 2128.86±1.56 and 1842.00±0.85 respectively. The increase in the percentage of soya protein isolate powder is resulting in the softer texture of the product.

Table.6.Cutting force of the pasta samples

Sample	(SPI) powder
C	2512.10±0.38
C1	2389.00±1.06
C2	2128.86±1.56
C3	1842.00±0.85

Note: All value are represented as Mean ± S.E.M. (standard error mean), n=6; data were analyzed by one-way ANOVA (Analysis of variance) employing Dunnett Multiple Comparisons Test using Graph Pad, Instate 3 software, *P<0.01.

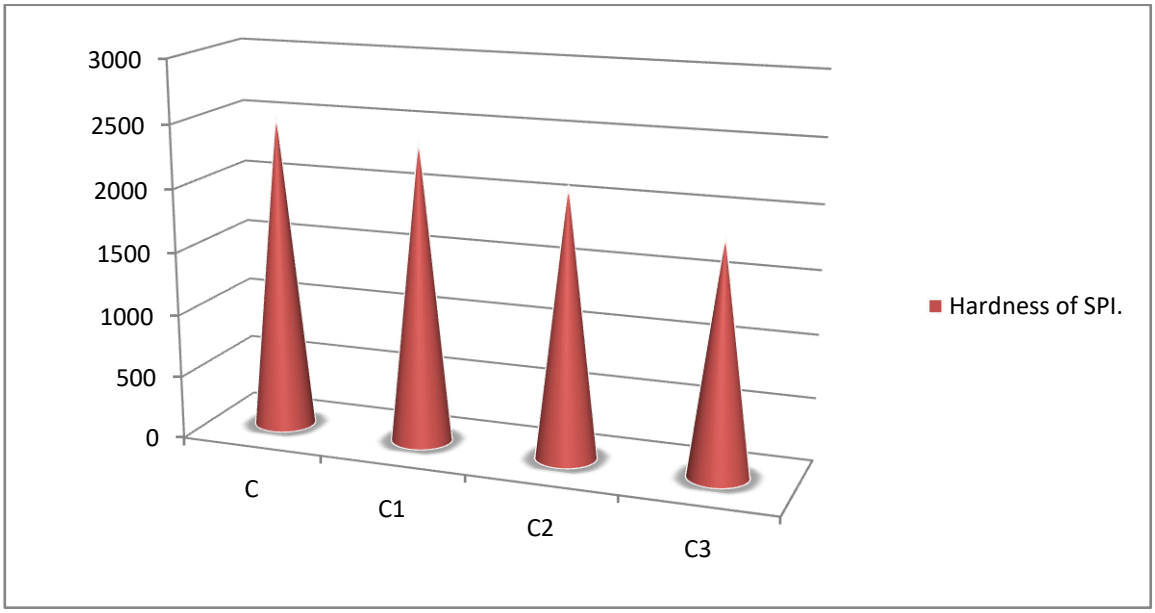

Fig 1 : Graphical Representation of Hardness of different (SPI) Pasta Samples

3.6. Sensory characteristics

Sensory evaluation of the products was carried out by using 9 point hedonic scale sensory test. The colour score of C, C1, C2 and C3 samples was,7.20±0.6.50,±0.97,8.30±.82 and 7.80±1.03 respectively. It was observed that the colour of C2 was found best among all samples. The flavour score of C, C1, C2 and C3 samples was7.20±0.78,7.20±7.78,7.80±0.91 and 7.90±1.19 respectively. The score of C2 was found best in sensory evaluation. The texture, taste and overall acceptability score of C2 was 7.90±0.99, 8.20±0.91 and 8.05±0.91 , respectively. There was improvement in colour and texture of the product. The taste might have some change with increasing concentration of soya protein isolate pasta. The product with 3 percent soya protein isolate pasta was found better in comparison to other combinations.

Sample C1

Sample C

Sample C2

Sample C3

Table 7. Sensory scores of prepared pasta samples

Samples	Sensory Parameter				
	Color	**Flavor**	**Texture**	**Taste**	**Over all Acceptability**
Control	7.20±0.63	7.20±0.78	7.50±0.52	7.10±0.73	7.25±0.31
C1	6.50±0.97	7.20±0.78	7.50±1.26	7.70±1.25	7.22±0.60
C2	8.30±0.82	7.80±0.91	7.90±0.99	8.20±0.91	8.05±0.49
C3	7.80±1.03	7.90±1.19	8.00±0.66	7.70±1.05	7.06±0.60

Note: All value are represented as Mean ± S.E.M. (standard error mean), n=6; data were analyzed by one-way ANOVA (Analysis of variance) employing Dunnett Multiple Comparisons Test using Graph Pad, InStat 3 software, *P<0.01, **P<0.05.

It was observed that with the addition of soya protein isolate for making pasta, cooking time of soya protein isolate pasta consistently decrease because SPI is having mucilaginous characteristics. Therefore the texture of pasta showing consistently decreasing hardness as the SPI was giving smoothness to the product. RVA (Rapid Visco Analyzer) measure pasting properties of the flour, high peak viscosity C2 sample with compare to the control (C), it's preferred to the pasta production due to gives better texture of pasta. Over all on the basis of, physic-chemical, nutritional, cooking time, viscosity (pasting properties), and sensory quality of pasta certain sample C2 resulted in better quality having high overall acceptability.

IV. Conclusion

The pasta was prepared with different proportions of soya protein isolate powder. The results showed that with increase in soya protein isolate concentration the fibre content increased and the cooking time decreased and the softness of pasta increased more than the control sample. It was found that the final viscosity of the sample was increasing with increase of soya protein isolate powder. Fortified pasta was highly acceptable with respect to sensory attribute and cooking time. On the basis of physico-chemical and nutritional properties, cooking time analysis of viscosity and sensory qualities pasta certain 97% refine wheat flour and 3% soya protein isolate powder (sample C2) resulted in better quality having more and high overall acceptability. Soya protein isolate powder (SPI) prevents different diseases (diabetes, asthma, arthritis and heart diseases etc.). If we include soya protein isolate powder pasta in daily life style, it's preventing many diseases.

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