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RESEARCH ARTICLE

Development and Quality Evaluation of Amaranth Flour Pasta

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Abstract:

Amaranth is well known short lived perennial plant, it posses dual characteristic of a cereal and legume. Present study was designed to the development and evaluation of amaranth flour pasta using standard procedures. Four different samples containing 10%, 20%, 30%, and 40% amaranth flour were prepared and sensory properties for cooked pasta were evaluated using the 9 point hedonic scale test. The sensory score for 20% pasta was found best with color, aroma, taste, texture and overall acceptability. On the basis of sensory qualities, result suggested that the significance of wheat with amaranth flour the formulation of pasta containing 20% amaranth flour resulted in better quality and nutritious pasta. All four sample chemically analysis indicates that's the amaranth flour increases the protein, fiber and sugar content of the pasta keeping the fat at optimum level, fortified pasta was highly acceptable with respect sensory attribute. Resultant pasta can be used as a nutritious food with higher content of protein and other nutritious elements in an increased market of pasta product where quality protein is an issue.

Key words: : Physicochemical properties, sensory properties, pasta, Amaranth flour, gruel loss.

INTRODUCTION:

Consumers attention in recent years has been directed towards nutritional and health aspects of foods. The application of new ingredients in the basic product formulation could result in products with higher nutritional value and improved sensory quality[1]. Pasta is a staple food in many countries. It is mainly used as an energy source due to its high content of carbohydrates. Pasta products, largely consumed all over the world were traditionally manufactured from durum wheat semolina, known to be the best raw material suitable for pasta production[2] .Utilization of durum wheat for snack and extruded foods has been well identified[3] . As wheat derived staple food, pasta is second to bread in world consumption[4]. Its worldwide acceptance is attributed due to its low cost, ease of preparation, versatility, sensory attributes and long shelf life.

Realizing the malnutrition problems of low-income group people and preschool children, the need of up gradation of nutrition is becoming a major concern. However, pasta products are high in starch but due to its commercial production using hard wheat flour which is deficient in essential amino acids such as lysine, pasta is a poor source of proteins and dietary fibers[5]. We believe that pasta could be an excellent vehicle for supplementation and applied as a functional food with minerals, proteins, and many other valuable healthy components if healthy components such as protein and other valuable health components incorporating into it during formulation.

Amaranth (Family: Amaranthaceae) is a pseudo-cereal having dual characteristics of a cereal and a leguminous seed[6-7]. The most studied nutritional aspect concerning the food value of grain amaranth is the identification of the limiting amino acids of the protein component. Amaranth has a significant amount of soluble and insoluble fiber content and a high protein concentration between 12.5% -19%, [8]. It is a highly nutritious grain containing a rich amount of nutritionally critical amino acids such as methionine and lysine (0.73 -0.84%) and high vitamin and mineral contents, such as riboflavin, niacin, ascorbic acid, calcium, and magnesium compared to other grains[9-11]. The health benefits attributed to bioactive constituents present in amaranth includes serum cholesterol level reducing activity[12], immunostimulant, antioxidant, [13] anticancer [14], antihyperglycemic [15], antihypertensive[16] activities. The aim of this study was the formulation and evaluation of amaranth flour pasta and its effect on quality and consumer acceptance.

MATERIAL AND METHODS

Procurement of raw materials and other materials

Refined wheat flour (*Triticum aestivum*) and amaranth flour were procured from the local market.

Evaluation of physicochemical and chemical composition of raw materials

Physicochemical (moisture content and ash value) and chemical composition (carbohydrate, protein, fiber and fat) of raw materials were evaluated according to standard Internationally Approved Methods (2000) described by Association of Analytical Chemists (AOAC) for the assessment of quality of raw materials[17]. Moisture content was evaluated as per AOAC-925.10 method; ash value was evaluated as per AOAC- 923.03 method; protein content was determined as per (IS:7219:1973) Kjeldhal method, final protein content was obtained by using the conversion factor of 6.25; Dietary fibre was measured gravimetrically as per IS:11062 and AOAC-991.43; fat content was determined by titrimetry as per AOAC 939.05.

Sample preparation

Five samples (C, C1, C2, C3 and C4) were prepared by using refined wheat flour and different proportions of amaranth flour. Sample C was prepared as control containing only refined wheat flour (100%), while sample C1 contains refined wheat flour 90% and amaranth flour 10%, sample C2 contain refined wheat flour 80% and amaranth flour 20%, sample C3 contain refined wheat flour 70% and amaranth flour 30%, sample C4 contain refined wheat flour 60% and amaranth flour 40% were prepared by changing the concentration of refined wheat flour and amaranth flour. All the samples were passed separately through 10 no. mesh sieve thrice to improve mixing. Prepared samples were stored in air tight polyethylene bags in cool and dry place for further study. Proximate composition and concentration of different raw materials was calculated.

Table 1: Composition of different samples prepared with refined wheat flour and Amaranth flour

Sample		Ingredients (g)	
		Refined Wheat Flour	Amaranth Flour
Control	C	1000	-
Blends	C1	900	100
	C2	800	200
	C3	700	300
	C4	600	400

Alveographic characteristics of prepared blends

The mean resistance (P) of the samples was calculated from the maximum height reached by the curve, the mean extensibility (L) of the samples was taken from the total length from the time it starts to blow up until the bubble breaks and the strength (W) was taken from the area under the alveograph (curve).

Rapid Visco Analyzer (RVA) characteristics of prepared blends

This test measures the flour starch properties. The RVA can also be used to determine the stirring number, which is related to sprout damage. Using RVA, starch slurry is cooked at 95ºC then cooled to 65ºC, and its viscosity was measured. The paste temperature of 65ºC is used to rapidly stabilize viscosity and minimize retro gradation.

Pasta Preparation

Prepared blends (refined wheat flour and amaranth flour) were mixed properly in the ratio of 100:00, 90:10, 80:20, 70:30, and 60:40 respectively. In each case an amount of 1000 g was taken. Required amount (30% by weight) of water was added in the mixing chamber of pasta making extruder (Le monferrina, Masoero Arturo, Italy) to distribute the water uniformly throughout the flour. Flour was mixed in the mixing chamber of pasta extruder for 10 minutes to distribute water uniformly throughout the flour particles. The flour was extruded through and adjustable die. The speed of the revolving sharp blade cutter in front of the die was adjusted so that the length of the pasta finished at 2 cm for each sample. The drying of pasta was carried out in hot air oven at 75ºC for 3 h[18]. The main objective of the drying was to reduce the moisture content of the sample below 10%. The optimum water absorption of flour for pasta making was determined based on appearance, shaping, and handling properties of dough during the process after conducting the trials. The dried product was packed in air tight polyethylene bags for further various chemical and sensory analysis.

Physicochemical and nutritional composition of prepared raw pasta samples

Physicochemical (moisture content and ash value) and nutritional composition (carbohydrate, protein, fiber and fat) of prepared pasta samples were analyzed according to standard internationally approved methods (2000) described by the Association of Analytical Chemists (AOAC).

Gruel loss of prepared raw pasta samples

The gruel loss of raw pasta samples were carried out in order to determine the amount of ingredients lost during the cooking of samples. Gruel loss is determine by using hot air oven by removing water from the gruel collected after coking of pasta at 100±2ºC.

Sensory evaluation of prepared cooked pasta samples

The sensory evaluation of cooked pasta samples was carried out in order to determine the various aspects of sensory of the amaranth flour incorporated pasta (10%, 20%, 30% and 40% amaranth flour) compared to the control pasta (100% refined wheat flour) through a panel of semi-trained judges. To cook the pasta samples for sensory evaluation 500 ml of water was brought to boil in a stainless steel pan. When the water started boiling, a 50 g amount of pasta was added. The cooking temperature (water temperature) was maintained at 98-100±0.5ºC throughout the cooking process. The cooking period began as soon as the pasta was added into the boiling water and was cooked for the time already determined. The pasta was then drained, cooled to room temperature and used for sensory evaluation. Semi trained panelists (n = 10) were given approximately 20 g each of the five cooked samples (0, 10, 20, 30, and 40% amaranth flour). Each of the sample was randomly numbered using a three-digit code. Pasta was evaluated for different sensory attributes viz. color, flavour, texture, taste and overall acceptability. Panelists were asked to indicate their preference on a 9-point Hedonic scale with degree of liking: 1 = extremely disliked to 9 = extremely liked.

RESULT AND DISCUSSION

Evaluation of physicochemical and chemical composition of raw materials

Physicochemical and chemical composition of raw materials were evaluated according to standard internationally approved methods (2000) described by the Association of Analytical Chemists (AOAC) for the assessment of physicochemical and chemical quality of raw materials. Results were shown in Table 2.

Table 2: Physicochemical and chemical composition of raw materials

Raw Material	Moisture	Ash	Carbohydrate	Protein	Fat	Fiber
Refined Wheat Flour	10.80±0.15	2.84±0.11	74.67±0.53	10.70±0.21	1.12±0.18	0.50±0.30
Amaranth Flour	10.50±0.17	2.32±0.13	66.25±0.61	13.56±0.27	7.02±0.32	6.70±0.08

All value were represented as Mean±SD (standard deviation) n=3; data were analyzed by Mean using SPSS 16.0 software.

Alveographic characteristics of prepared blends

Alveographic characteristics of prepared blends for the formulation of pasta samples were shown in Table-3.

Table 3: Alveograph values of prepared blends

Sample	Resistance (P) mm	Extensibility(L) mm	Strength (W) 10 e-4J	P/L
Control	173	32	261	5.41
10%	163	30	216	5.43
20%	127	22	120	5.77
30%	118	13	61	9.08
40%	107	10	49	10.7

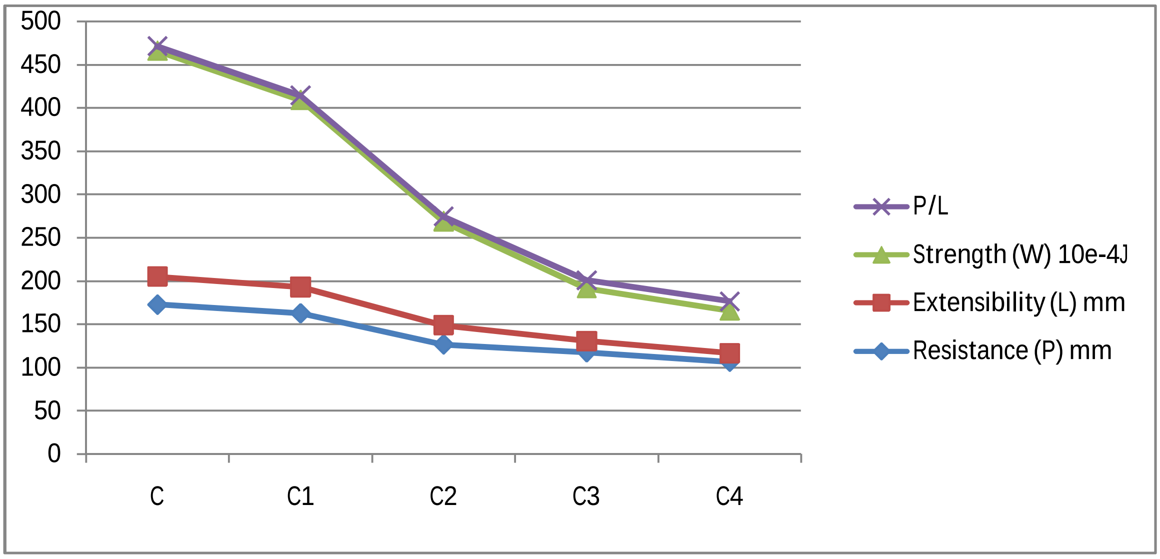

Figure 1: Alveographic characteristics of prepared blends

Where C, C1, C2, C3 and C4 Control, 10%, 20%, 30% and 40% respectively

Rapid Visco Analyzer characteristics of prepared blends:

RVA (Rapid Visco-analyzer) analyze Peak viscosity, Hold viscosity and Final viscosity of the product. It shows that the viscosity of starch decreases as we increase the amount of amaranth flour in pasta samples. Results are shown in table-4.

Table 4: RVA Results of Prepared blends

Sample	Peak Viscosity	Hold Viscosity	Final Viscosity
C	2849±2	1685±2	3010±1
C1	1389±1	1217±1	2897±3
C2	1058±2	992±2	2542±2
C3	907±3	863±3	1940±1
C4	703±2	697±2	1373±2

All values are represented as mean ±SD (Standard deviation) n=3;

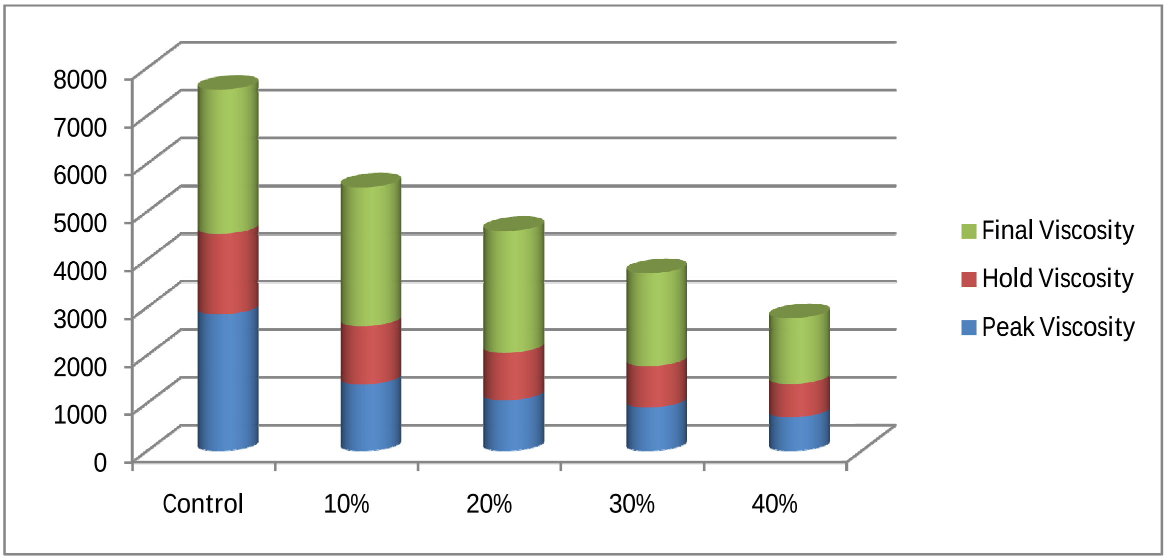

Figure 2: Viscosity of different blends

Nutritional composition of prepared pasta samples

Nutritional characteristics of final products were analyzed according to standard internationally approved methods (2000) described by the Association of Analytical Chemists (AOAC).

Fortification of pasta resulted in increased protein, fat, and fiber content, while as carbohydrate content decreased, as compared to control. The results agreed with other research workers, [19-21]. Who reported the incorporation of plant proteins, oyster, oak mushroom. Pulses increased the protein content, fibre content, sugar content and fat content of the final product. The results showed a significant difference as the fortification was increased in table 5.

Table 5: Chemical composition of prepared raw pasta samples (in gram)

Sample	Moisture	Ash	Carbohydrate	Protein	Fat	Fiber
C	8.13±0.34	2.84±0.27	74.26±0.63	10.20±0.41	1.06±0.19	0.45±0.21
C1	7.74±0.32	2.22±0.16	73.83±0.40	10.99±0.47	1.71±0.23	1.12±0.09
C2	7.53±0.46	2.35±0.09	72.99±0.32	11.27±0.38	2.30±0.12	1.74±0.33
C3	7.32±0.23	2.41±0.07	72.15±0.49	11.56±0.65	2.89±0.46	2.36±0.17
C4	7.12±0.38	2.46±0.11	71.30±0.28	11.85±0.71	3.48±0.11	2.98±0.14

All value are represented as Mean ± SD (standard deviation) n=3; data were analyzed by Mean using SPSS 16.0 software.

Gruel loss of prepared raw pasta samples:

Pasta with ideal physical and sensory quality is characterized by strength and elasticity in the dough form, high tensile strength in the dried form, minimal cooking losses, minimum stickiness and reasonable firmness after cooking. In the Present study the cooking loss of control, 10, 20, 30 and 40% samples are 6.33, 8.01, 8.05, 9.17 and 9.59 respectively. This shows that the gruel loss is increasing with increase in the concentration of amaranth flour.

Sensory characteristics of prepared cooked pasta samples:

Sensory evaluation was carried out as per 9 point hedonic scale by a ten member panel and results of the evaluation are presented in table 6. Among the four fortified samples (C1, C2, C3 and C4), the second sample (C2) had highest overall acceptability as compared to other fortified samples. This shows that after 30 percent amaranth flour incorporation the acceptability is decreasing. So the 20 percent sample was finalized.

Table 6: Sensory scores of prepared cooked pasta samples

Samples	Sensory Parameters				Overall acceptability
	Color	Texture	Aroma	Taste	
Control	8.50±0.53	8.25±0.63	8.30±0.67	8.00±0.82	8.50±0.53
10%	7.50±1.84	6.8±1.69	7.3±1.50	7.3±1.16	7.22±1.40
20%	7.6±1.17	7.2±1.32	7.5±1.43	7.1±1.10	7.35±0.95
30%	6.3±0.82	7.3±1.34	6.3±0.95	6.4±0.97	6.57±0.86
40%	6.0±0.82	7.1±1.29	6.4±1.17	6.7±1.16	6.55±0.71

All value are represented as Mean±SD (standard deviation) n=3; data were analyzed by Mean using SPSS 16.0 software.

CONCLUSION

Wholegrain wheat pasta supplemented with 10%, 20%, 30% and 40% Amaranth flour demonstrated good quality. Chemical analysis indicates that the amaranth flour increased the protein, fiber and sugar content of the pasta keeping the fat at optimum level. Fortified pasta was highly acceptable with respect to sensory attributes. On the basis of sensory quality, pasta when fortified with 20% Amaranth flour resulted in better quality and nutritious pasta (carbohydrate content 72.99 g, protein content 11.27 g, fat content 2.30 g, and fiber content 1.74 g). It was found that the peak viscosity, hold viscosity and final viscosity were decreasing with increase in the amaranth flour. Resultant pasta can be used as a nutritious food with higher content of protein and other nutrients in an increasing market of pasta products where quality protein is an issue.

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