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COMPOSITIONAL PROFILING AND SENSORIAL ANALYSIS OF EXTRUDED PUFF PRODUCT USING CORN, RICE AND AMARANTH FLOUR

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Abstract

In present time consumers want snack that looking good, taste, smell and in addition, nutritionally and healthy. The demand for non-meat, high protein products is increasing day by day so that we used amaranth flour to enriched puffed product with high protein and the result of this study maximum in C3 (15% amaranth flour) sample with low moisture, revealed that the samples contain high protein content. We have prepared different samples of gluten-free extruded products using the different proportion of amaranth flour (0, 5, 10, 15, and 20%). Developed extruded products were evaluated for their different physicochemical, textural and along with their sensory evaluation using 9 points hedonic scale. We have also performed the stability studies of the developed extruded products. Findings of this study showed that extruded product prepared amaranth flour at a level of 15% show best sensory score in comparison to other proportion. Low moisture extruded products are shelf-stable and extended storage at room temperature. Sensory evaluation also showed that all the products were rated above the average. In this demonstration extruded product prepared from blends of corn, rice and 15% Amaranth flour was found most acceptable for consumers and an excellent source of complete protein.
***Keywords*:** Soy: Amaranth Flour, Hedonic scale, Sensory, Extrudates.

Introduction

Advancement in science and technology and has made India self-sufficient in food production and it has achieved food security. The health conscious consumers are no longer snacking for enjoyment. The demand snacks suitable for specific health benefits or needs such as essential nutrients, improving its physical and prevention of nutritional related *diseases*. The most consumed snacks are produced from corn flour, which is deficient in the essential amino acid, lysine and tryptophan, minerals, including zinc, iron. Amaranth has higher protein content (12-18%) than most of the cereals with a significant higher content of lysine and acceptable level of tryptophan and methionine, which are found in low concentration in cereal and legume Grains. Extrusion blends made with good quality of protein maize produces extruded flour for excellent physiochemical and sensory properties. The optimization of the processes involves several conditions and several response variables. The optimum combination of the process variable for producing optimized extruded quality protein maize flour for preparing tortillas with a single screw extruder (Jorge *et al*., 2006). *Amaranth caudatus Blanco* (Oscar Blanco CAC-43) can be extruded and used as a high quality protein snack food in place of corn-rice snacks (Chavez-jauregui *et al*., 2000). Increasing amount of amaranth grits in the extrusion blend causes increase of density and hardness of the extrudated products and decrease in expansion index. extrusion process partially damages starch granules, thus obtained gels of extrudated products have lower viscosity than the initial grits (Dokic *et al*., 2009). The addition of Amaranth leaf powder to the extruded provitamin A-biofortified maize snacks had a significant effect on their quality attributes. The nutrient content (including essential amino acids, pro-vitamin A and Fe) of the snacks was significantly improved by the addition of Amaranth leaf powder (Beswa *et al*., 2016) It is possible to produce corn flours with different physicochemical properties using germinated corn kernels. Functional changes are consequence of biochemical modifications and weakening of grain also. The modified flours may have different industrial and food uses, mainly when products with high solubility and low viscosity are desired (Grossmann *et al*., 1998).

Development of value added product with using dried cauliflower green leaves this study will help people to generate awareness for the supplementation of iron rich DCGLP in their daily diet to control anemia and increase nutritional status in a better way (Chauhan *et al*., 2015). Addition of soya bean flour significantly influenced the textural properties of the extrudates made from a soya bean/corn mixture (Si-quan et. al., 2005) The change in moisture and temperature affected all the responses to a greater extent than by screw speed (Pardhi *et al*., 2016) it was possible to prepare expanded gluten-free corn-based extrudates containing amaranth, quinoa and kañiwa flour (Diaz *et al*., 2013) The incorporation of amaranth, quinoa and kaniwa inevitably altered the physical and sensory characteristics of corn-based extruded snacks. Shows promising results, as crispiness and crunchiness were maintained at high and moderate levels for all grains (Diaz *et al*., 2013) Successful utilization of low value minor cereals with added functionality in snack food sector will definitely open up new dimensions to the food industries (Seth *et al*., 2013) Amaranth seed puffing at 290 ^{0}C allows obtaining a product characterized by better color, geometric and fat absorption characteristics, compared with raw material and seeds puffed at temperatures exceeding 300 ^{0}C (Zapotoczny *et al*., 2006).

Material and Method

Corn (*Zia maize*), Rice (*Oryza sativa*) and amaranth flour (*Amaranthus caudatus L.*) were procured from local market of Jhansi.

Evaluation of physicochemical and chemical composition of raw materials

Physicochemical (moisture content, ash value) and chemical composition (carbohydrate, protein, 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. 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, and fat content was determined by Soxhlet extraction.

Extrusion

BTPL lab model twin screw extruder (Basic technology Pvt. Ltd. Kolkata Model No-002-13-14) was used for extrusion of puff product. Use high moisture in between each sample due to simply differentiated. After completion of extrusion open the dye use inching, switch off the feeder, cutter, and heater. Let extruder torque to come down to 3 and when it becomes stable press stop extruder button. Open cutter cover and remove the dye (Dye will be very hot) change extruder mode to inching position (green light with start). Puss inching button (extruder button in the extruder machine) and remove all waste and paste material in the extruder and mostly dye section. All prepared sample fill the air tide polyethylene bag.

Sample preparation

The corn, rice and amaranth flour *(Amaranthus caudatus L.)* were blended at four different compositions with one control sample 0, 5%, 10%, 15% and 20%. amaranth flour blends samples compare with control sample. Five samples were prepared using one as control sample (C) containing corn flour 60% rice flour 40%, sample two (C1) contain corn 57.50%, rice 37.50% and amaranth flour 5%, sample three (C2) contain corn flour 55%, rice flour 35% and amaranth flour 10% , sample four (C3) contain corn flour 52.5%, rice flour 32.5% and amaranth flour 15%, sample four (C4) contain corn flour 50%, rice flour 30% and amaranth flour 20% Each sample mixed properly with 3.5 gm salt and 40 ml of water (8% of total sample). Than all sample passed through 40 mesh size sieve twice, for improve mixing and better result.

Table 1 : The prepared samples in different proportion of Amaranth flour (gm).

Ingredients	Blends of the Samples				
	C	**C1**	**C2**	**C3**	**C4**
Corn flour (gm)	350	287.5	275	262.5	250
Rice flour (gm)	150	187.5	175	162.5	150
Amaranth flour (gm)	-	25	50	75	100
Salt (gm)	3.5	3.5	3.5	3.5	3.5
Water (ml)	40	40	40	40	40

Total quantity of each sample prepared was 500gm (C=Control, C1=5%, C2=10%, C3=15%, C4=20% sample)

(Fig.1 A-Twin screw extruder)

(Fig. 1 B–Control Panel of twin screw extruder)

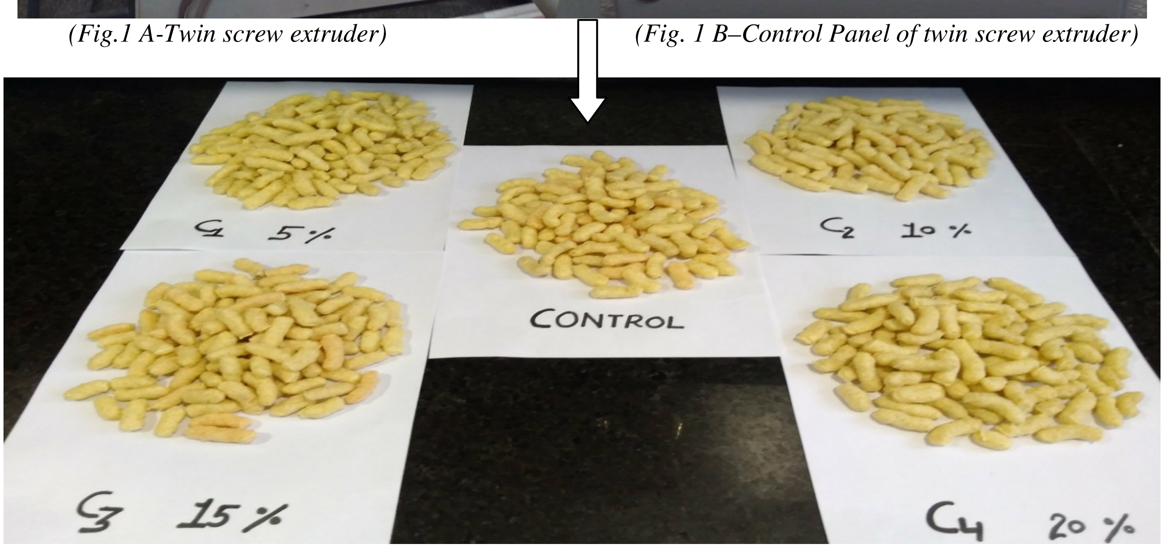


Fig. 2 : Extruded puff products, (C=Control, C1=5%, C2=10%, C3=15%, C4=20% Amaranth blended samples

Result and Discussion

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 are shown in table,

Table 2 : Nutritional composition of different raw Blends

Sample	Constituents				
	Carbohydrate (%)	**Protein (%)**	**Fat (%)**	**Ash (%)**	**Moisture (%)**
C	73.31± 0.11	09.44±0.77	04.10± 0.07	01.19±0.07	11.22±0.05
C1	72.23±0.12	09.62±0.14	03.72±0.14	01.10±0.02	10.43± 0.08
C2	72.12±0.10	10.16±0.04	03.32±0.12	01.16±0.04	9.8±0.12
C3	71.27±0.12	10.46±0.07	03.24±0.29	01.12±0.06	9.6±0.26
C4	71.16±0.68	11.26±0.06	03.12±0.55	01.6±0.05	9.5±0.18

Total quantity of each sample prepared was 500gm (C=Control, C1=5%, C2=10%, C3=15%, C4=20% sample)

Note: All values are represented as Mean±SD (Standard deviation) n=3; data were analyzed by one-way ANOVA (Analysis of variance) using SPSS 16.00 software.

Table 3 : Nutritional composition of different extruded puff products.

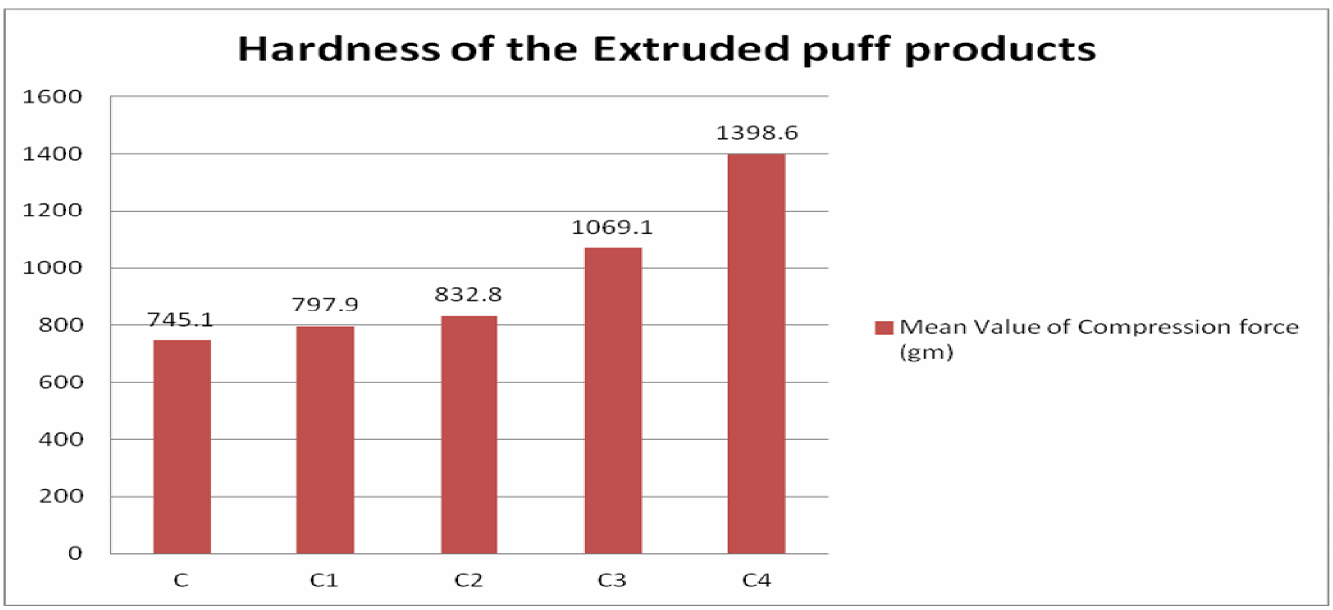
Sample	Constituents				
	Carbohydrate (%)	**Protein (%)**	**Fat (%)**	**Ash (%)**	**Moisture (%)**
C	71.21±0.60	06.48±0.06	03.14±0.08	01.18±0.01	7.16.±0.03
C1	70.18±0.54	08.53±0.04	02.32±0.07	01.19±1.02	07.9±0.06
C2	69.26±0.31	10.24±0.52	02.18±0.03	01.18±1.04	07.8±0.01
C3	68.34±0.21	12.32±0.42	02.15±0.01	01.21±0.04	07.5±0.32
C4	68.22±0.12	12.48±0.21	02.14±0.31	01.23±0.21	07.40±0.12

Total quantity of each sample prepared was 500gm (C=Control, C1=5%, C2=10%, C3=15%, C4=20% sample)

Note: All values are represented as Mean±SD (Standard deviation) n=3; data were analyzed by one-way ANOVA (Analysis of variance) using SPSS 16.00 software.

Texture Analysis

The texture analysis was done with the help of stable micro system texture analysis TA-XT2i. It was used to compression mode to record to require force to break extruded puff products. The extruded sample was placed on the plate form transversely over a metal sheet support and operated in the compression mode with a probe P75. The probe (P75) distance fixed 3mm and run a test. The probe down and break the extrudates and get the force as graphical representation. It was found that the cutting strength of the extruded product was increasing means extruded puff products become harder with increase of amaranth flour.



C=Control, C1=5%, C2=10%, C3=15%, C4=20% Amaranth flout samples)

Fig. 3 : Texture analysis of prepared extruded puff products-

Graphical representation of texture analysis

Sensory characteristics of prepared Extruded puff product samples

Sensory evaluation was carried out as per 9 point hedonic scale. The values are the mean of ten readings. Among the four fortified samples with one control sample (C, C1, C2, C3 and C4), the fourth sample (C3) had highest overall acceptability as compared to the control Physical analysis of extruded puff product samples revealed the increasing the level of amaranth flour resproduct with increasing hardness, decreasing expansion ratio and C3 sample is improve taste and texture and bright in color.

Table 4 : Sensory scores of prepared pasta samples

Sample	Sensory properties				Overall acceptability
	Colour	Flavor	Texture	Taste	
C	7.5±1.06	7.0±0.06	8.5±1.03	7.9±0.04	7.12±0.08
C1	7.4±0.08	7.5±0.05	8.2±0.63	6.9±0.03	7.30±0.53
C2	8.0±1.05	8.2±0.04	8.6±0.51	7.6±0.03	8.24±1.08
C3	8.5±0.07	8.15±0.45	8.25±0.90	8.35±0.52	8.55±1.09
C4	7.5±1.05	8.7±0.26	8.4±0.74	8.32±0.64	8.28±0.06

Total quantity of each sample prepared was 500gm (C=Control, C1=5%, C2=10%, C3=15%, C4=20% sample)

Note: All values are represented as Mean ± SD (Standard deviation) n=3; data were analyzed by one-way ANOVA (Analysis of variance) using SPSS 16.00 software.

Conclusion

The incorporation of amaranth flour definitely altered the physical, chemical, texture and sensory characteristics of corn-rice based extruded puff products. The most observable effect of adding amaranth flour was the disruption of internal structure leading to smaller pores (low expansion ratio) thereby increasing the observed hardness and reducing crispiness and crunchiness. Crunchiness and roughness are generally considered positive and negative texture analysis and allow a deeper scientific understanding to textural properties and some of them linked to distinct sensory properties. Extruded puff product supplemented with 15% (C3) amaranth flour demonstrated well quality; physiochemical properties indicate that amaranth flour increased protein and decrease fat, moisture concentrate at optimum level, on the basis of sensory quality extruded puff product fortified with 15% (C3) amaranth flour resulted in better quality and nutritious puff product, C3 sample show better sensory properties (overall acceptability 8.55) on the basis of 9 point hedonic scale. Resulted extruded puff product can based as nutritious food with higher content of protein and other nutrients, in an increasing market puff product, where quality protein is an issue. In this study work demonstrated that amaranth flour can be used as a development of high quality protein puff product.

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