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Development and Quality Evaluation of Corn Based Extruded Snacks Incorporating Goat Offal Meat Powder

Brighton Jabez^{1*} and V. Nithyalakshmi²

¹College of Food and Dairy Technology, Tamilnadu Veterinary and Animal Sciences University, Koduvelli, Chennai – 600 052, India

²Department of Food Process Engineering, College of Food and Dairy Technology, Tamilnadu veterinary and Animal Sciences University, Koduvelli, Chennai – 600 052, India

*Corresponding author

ABSTRACT

Keywords

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Ready-to-Eat (RTE) snackfood was developed using corn (*Zea mays*), rice (*Oryza sativa*), Bengal gram dal (*Cicer arietinum*) and Goat offal meat powder with a laboratory model twin screw extruder. The extrudates were developed by conducting various blends (corn + rice+ bengal gram dal flour) in the ratio of T₁ (40:40:20), T₂ (50:40:10), T₃ (60:30:10), T₄ (50:30:20), T₅ (40:50:10) and incorporating Goat offal meat powder viz., (1, 3, 5 & 7%) levels. Among the different blends studied, T₃ has been standardized base on the sensory evaluation scores. The incorporation level 3% of Goat offal meat powder has been standardized based on the proximate composition and acceptability studies by untrained panellists using a 9-point hedonic scale.

Introduction

Goat offal meat is a good source of various macro and micro nutrients with higher biological values. As health is concerned, for the various metabolic and physiologic activity of body, body needs macro and micro nutrients like protein, fat, fibre, vitamins such as Vitamin B₁₂, minerals such as zinc, cobalt, calcium, etc. The incorporation or addition of offal meat as a nutrient source will improve the nutrition content of the food products. Incorporating goat offal meat in the corn

based snack food will be a better selection so that the nutrients of offal meat will reach most of the snack food consumers.

Extruded RTE snack foods are mostly of cereal based with a limitation of poor content of protein, since cereals are predominant source of carbohydrates (Iqbal *et al.*, 2006). Incorporation of protein source into cereal based extruded snacks would not only rectify its nutritional inadequacies, but also provides a variety of food and food products. Many attempts have been made in the food science

field in developing a protein rich RTE snacks with incorporation of fish powder (*Catla catla*, *Sardinella longiceps* and *Saurida tumbil*), foxtail millet, shrimp powder (*Parapenaeopsis stylifera*). (Kuna, 2013; Ganesan *et al.*, 2017; (Geeta, 2016; Shaviklo, 2015).

There are various reports on extruded products made from blends of meat and cereal ingredients (Lee *et al.*, 2003; Mittal and Lawrie, 1984). Rhee *et al.*, (1999) studied mixtures of maize flour and minced meat from hen, mutton, lamb and beef using a single-screw extruder. However, extrusion of starch rich ingredients blended with animal proteins is problematic due to the unstable thermal characteristics of the formulation (Yurjew *et al.*, 1989). The suitability of selected meat for snack food manufactured by indirect extrusion cooking has been evaluated. The results indicated that lean meat showed better extrusion characteristics than that of fatty meat while fresh meat being superior to frozen meat. Washing of the animal meat was found to enhance meat utility in extrusion cooking (Wianecki, 2007). The incorporation of animal proteins to starch-rich ingredients such as rice flour significantly reduced expansion and increased hardness. This could be the reason why attempts to develop expanded snack food products from blends of meat powder and starchy ingredients using extruder have met with limited success (Choudhury and Gautam, 2003).

The extrusion of puffed snacks is very sensitive to variations in feed composition, extrusion temperature, barrel screw speed and extruder type. Although the addition of meat protein to blends intended for extrusion is limited by technological constraints, it is highly desirable to develop such products from a nutritional point of view (Wianecki, 2007). The present study was carried out to develop an extruded puffed snack from goat

offal meat, to optimize the offal meat content of the puffed snack based on the sensory and protein characteristics of the developed snack.

Materials and Methods

Materials

The goat offal meat was procured from local goat meat market in Chennai. Corn flour, rice flour, gram flour and salt were purchased from local market in Chennai. All the reagents used for the chemical analysis of the products were of analytical grade.

Methods

Preparation of offal meat powder (OMP)

Goat offal meat was prepared as powder for the preparation of offal meat powder extruded snacks. Goat offal such as omasum, abomasums, rumen and rectum of sound quality was purchased from the local butcher and brought to the processing hall for further processing. The cleaned goat offal meat was cooked by using cookware 15-20 minutes. The cooked meat were placed in food grade SS trays and dried in a tray drier at 65°C for 20hrs. The dried offal meat was powdered in a domestic mixer grinder at the rate of 100 g/ 2 minutes.

Formulation and Extrusion processing

Ingredients such as corn flour, rice flour, gram flour, pepper and salt of good quality were procured from the local market for the conduct of experiment. About 5 numbers of trials (T₁, T₂, T₃, T₄, T₅) were conducted to standardize the base of the product with various combinations of the ingredients (Table 1). The base ingredients were standardized with the trials conducted and Trial (T₃) combination is found to be highly acceptable and optimum for effective processing.

Incorporation level of OMP has been standardized, by conducting trials of various levels (1%, 3%, 5% and 7%) of OMP with the following proportions of flour mix (T₃) as described in Table 1 with the addition of pepper (2%) as seasoning. The extrudates obtained with all the four levels of incorporation of OMP is compared with the control for the physico-chemical parameters and sensory evaluations.

Extrusion cooking

The twin-screw extruder of 15kg/h capacity was used for the preparation of OMP based extruded snacks. The extruder was turned on and the heating sections Heater 1 & 2 were set at 65°C and 120°C respectively. Once the necessary temperature has reached, the pre-conditioned flour mixture was fed into feed hopper equipped with screw augers to load materials into the barrel at a uniform rate (10 kg/h).

The barrel screw speed was kept constant at 350 rpm respectively. The plasticized mass was passed through 3mm die and exposed to the atmosphere, which led to the expansion of the extruded product. As the material was extruded, it was cut into pieces of the desired length by adjusting the rotating speed of cutter blade.

The OMP incorporation level 3% has been standardized based on the physico-chemical and sensory evaluation results (Table 2 and 3). The processing flow chart is given in (Fig. 1).

Proximate composition

The proximate composition was determined according to (AOAC, 1995) methods. Crude protein content was determined using the Kjeldahl method. Ether extract was determined by the Soxhlet method. Ash content was determined by heating samples

overnight (24hrs) at 550°C. Moisture content was determined by drying samples for 4h at 105°C until constant weight was achieved. Carbohydrate content was calculated by difference method.

Sensory evaluation

Sensory evaluation of control and OMP based extruded snacks were made by untrained panellists at College of Food and Dairy Technology, Chennai.

The sensory data (Table 3) to describe the intensity of each attribute for the given samples was prepared by the panel. Average scores of the judges were calculated for each sample assessed and the reported values were the average of duplicate samples.

Results and Discussion

The incorporation of OMP improves the nutritional content of the snack product (Table 3). When compared with control sample (13.18±0.14), 1% OMP enrichment shows (14.21±0.18), 3% OMP enrichment shows (15.13±0.17), 5% OMP enrichment shows (16.57±0.11) and 7% enrichment contributes (19.19±0.16) in the protein levels.

Therefore addition of OMP increases the protein content of end product. Protein, fat, ash values are increasing significantly (P<0.01) due to the proportion of addition of offal meat powder.

Ether extract values contribute (0.36±0.04, 0.47±0.03, 0.55±0.04, 0.58±0.06, 0.62±0.04) for control and 1, 3, 5, 7% of OMP level enriched snacks. There will be small levels of elevation in the crude fibre levels in all the control and OMP enriched samples. The carbohydrate levels were considerably decreased in all the subsequent levels of OMP enriched snacks.

Table.1 Formulation of control sample with various combinations of ingredients

Ingredients (%)	T ₁	T ₂	T ₃	T ₄	T ₅
Corn	40	50	60	50	40
Rice	40	40	30	30	50
Bengal gram flour	20	10	10	20	10
Moisture (ml)	10	10	10	10	10
Salt	3	3	3	3	3

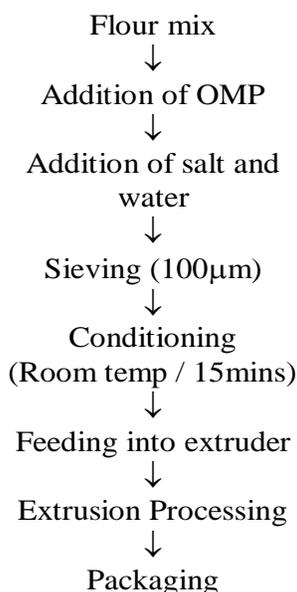
Table.2 Physico-chemical properties of the OMP incorporated extruded snacks

Parameters	Control	1%OMP	3%OMP	5%OMP	7%OMP	F value
Protein	13.18 ^a ±0.14	14.21 ^b ±0.18	15.13 ^c ±0.17	16.57 ^d ±0.11	19.19 ^e ±0.16	858.070**
Ether extract	0.36 ^a ±0.04	0.47 ^b ±0.03	0.55 ^c ±0.04	0.58 ^c ±0.06	0.62 ^d ±0.04	458.87**
Crude Fibre	0.64 ^d ±0.004	0.60 ^c ±0.005	0.51 ^b ±0.004	0.48 ^a ±0.003	0.47 ^a ±0.004	284.91**
Ash	1.20 ^a ±0.05	1.44 ^b ±0.09	1.67 ^c ±0.05	1.88 ^d ±0.04	1.89 ^d ±0.07	178.86**
Moisture	5.23 ^a ±0.06	4.10 ^b ±0.03	4.19 ^c ±0.06	4.24 ^d ±0.07	4.18 ^c ±0.03	1191.36**
Carbohydrate	79.39 ^d ±0.12	79.18 ^d ±0.14	77.95 ^c ±0.11	76.25 ^b ±0.17	73.65 ^a ±0.15	327.23**

Table.3 Sensory properties of the OMP incorporated extruded snacks

Parameters	Control	1%	3%	5%	7%	F value
Color	8.17±0.30	8.23±0.30	8.50±0.22	7.83±0.30	6.83±0.30	4.5
Appearance	8.43±0.30	8.17±0.30	8.00±0.25	7.17±0.30	7.17±0.30	2.5
Flavor	8.67±0.21	8.67±0.21	8.30±0.22	6.83±0.30	6.17±0.47	15.1**
Crispiness	8.33±0.21	8.43±0.21	8.40±0.22	7.83±0.30	6.50±0.22	11.9**
Texture	8.47±0.30	8.17±0.30	8.00±0.25	6.83±0.30	6.17±0.47	7.2**
Overall acceptability	8.35±0.30	8.09±0.33	8.30±0.25	7.83±0.30	6.83±0.30	3.7*

Fig.1 Flow chart of extrusion processing of goat offal meat enriched snack



The sensory property (Table 3) concludes that the product with 1% and 3% enrichment of OMP in snacks attains good overall acceptability than the 5% and 7% enrichment levels. Thus compared with 1% level of OMP enrichment, the snack product incorporated with 3% OMP attains the maximum sensory score with a higher protein enrichment levels when compared with the control sample. Therefore 3% OMP enrichment level is optimum for the preparation of offal meat powder enriched extrude snacks.

Optimum incorporation of 3% OMP was standardized in the study. Incorporation of OMP in the corn based extruded snacks shall deprive the protein malnutrition among the consumers. Protein supplement through snack foods could reach the children since now-a-days children are more attractive towards corn based extruded snacks.

The incorporation of OMP also imparts meat flavour which gives the consumer consuming a meat meal. Hence the objective of protein enrichment in corn based snack foods could be achieved by the incorporation of 3% of offal meat powder.

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