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Development of Egg Nuggets with Addition of Pearl Millet

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ABSTRACT

Background: A study was conducted to develop egg nugget incorporated with pearl millet to improve its acceptability and nutritional value. Eggs being an ideal diet for humans for its high nutritional properties that also fulfils special dietary requirements. Egg nuggets are the novel convenience egg products to be developed to fulfil a number of objectives including preparation of delicious ready to eat egg products with positive health effects. The beneficial effect of egg may be improved with addition of fibre in the nugget with a greater acceptance among the consumers.

Methods: The egg nuggets were developed by using pearl millet flour at three different levels *viz.* T1(21.5%), T2 (19.5%) and T3 (17.5%). 19.5% level of pearl millet flour was selected on the basis of sensory attributes.

Result: The variant T2 (19.5% Pearl Millet) was awarded highest overall palatability score Flavour, juiciness and texture scores were also found to be significantly ($p<0.05$) higher. Therefore, from the present study it was concluded that egg nuggets with 19.5% pearl millet flour had a better sensory quality and acceptability.

Key words: Acceptability, Egg nugget, Pearl millet, Sensory quality.

INTRODUCTION

Indian poultry industry is highly vertically integrated industry and matches the efficiency levels of many developed countries. India ranks third in egg production and fifth in broilers in the world. The total annual egg production accounts to 103.32 billion (DAHD, 2019).

Eggs play an important role in human food and nutrition as an affordable nutrient-rich food commodity. It contains highly digestible proteins, lipids, minerals and vitamins. Eggs being an ideal diet for humans for its high nutritional properties that also fulfils special dietary requirements of all age groups. Apart from nutritional benefits, ease of preparation also favours the huge market demand for egg products. A change in traditional food habits and introduction of fast-food culture has shifted the preference of consumer, the egg product not being an exception (Pandey and Yadav, 2010). Along with the increasing consciousness among consumers about their nutrition and well being, there is also a growing concern over diseases caused due to irregular bowel movement in the gut. Therefore, an increase in dietary fibre inclusion in daily diet has been recommended (Mehta *et al*., 2015).

Pearl millet (*Pennisetum glaucum*) is an important staple food in semi-arid regions of India and Africa. Pearl millet (PM) costs much less than other conventional cereals and has better nutritional value. It has high dietary fiber (2.6-4.0%) and protein content (8.5-15.1%) and contains several essential minerals like calcium, magnesium, phosphorus, sodium, potassium, zinc, copper and iron (Abdalla *et al.,* 1998). Pearl millet flour had been incorporated in various meat and egg products (Yashoda *et al.,* 2008; Santhi and Kalaikannan, 2015). Yashoda *et al*. (2008) prepared Egg chips by using different millet flours as binders and changes in product quality during storage were studied, rancidity and microbial profiles which revealed that the fried chips were sensorily acceptable when packed in metalised polyester pouch with air or nitrogen stored at 27°C for 4 months.

Para and Ganguly (2015) studied the effect of bajra flour (Pearl millet) on different quality and sensory attributes of chicken nuggets and concluded that chicken nuggets of very good acceptability and nutritive value could be prepared by extension with bajra flour substituting lean chicken meat in formulation. The present study was envisaged to develop a novel egg product, egg nugget incorporated with pearl millet on the sensory attribute.

MATERIALS AND METHODS

The experiment was conducted in the session 2019-20 at the Department of Livestock Products Technology, College of Veterinary Science and Animal Husbandry, Anjora, Durg. Fresh chicken eggs free from any defect were procured from local market of Anjora, Durg. Other ingredients used in formulation like salt and pearl millet flour were of food grade and procured

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from the same source. The chemicals used in the study were of analytical grade and procured from Central Drug House (CDH), New Delhi. Low density polyethylene (LDPE) bags used for packaging of products were sourced from local market and sterilized by exposing to UV light for 30 minutes before use.

Methodology for preparation of egg nuggets

The egg nuggets were prepared by incorporation of Pearl millet (binder) and whole egg liquid along with other ingredients. After uniform mixing of the ingredients mentioned in Table 1, the batter thus obtained was poured in rectangular container greased with edible oil and steam cooked in pressure cooker for 20 minutes and then after cutting into pieces was subjected to sensory evaluation.

The following abbreviations were used according to inclusion level of pearl millet, T1- egg nuggets with 21.5% pearl millet flour, T2- egg nugget with 19.5% pearl millet flour and T3- egg nugget with 17.5% pearl millet flour.

The formulation of processing Egg nuggets is described in Table 1.

Analytical procedures

Measurement of physico-chemical parameters

The weight of raw and cooked Egg nugget of each replicate was recorded before and after cooking and yield expressed as percentage. The pH of egg nugget was determined as per the method given by Trout *et al.* (1992). Moisture was determined by standard procedures of AOAC (1999). Fat content in egg nugget was estimated by ether extraction following AOAC (1999) method using Relitech Soxhlet apparatus (model - 16.580.0l, Pragati Laboratory Equipment, Ambala Cantt.). The protein content of egg nugget in the study was estimated as per method described in AOAC (1999) with suitable modifications using combined digestion and distillation unit (Relitech, 16.540.02, Pragati Laboratory Equipment, Ambala Cantt.). The ash content in the egg nugget was estimated as per AOAC (1999) method using muffle furnace. The fibre content of the sample was estimated as per AOAC (1999) method. Sensory evaluation (Keeton, 1983) was carried out in 6 replicates with each analysis done in duplicate.

Table 1: Formulation for processing pearl millet added egg nuggets.

Ingredients (%)	T1	T2	T3
Whole egg liquid	74	76	78
Pearl millet flour	21.5	19.5	17.5
Salt	1.4	1.4	1.4
Garlic powder	1	1	1
Maleic acid	0.05	0.05	0.05
Citric acid	0.05	0.05	0.05
Maltodextrin	2	2	2

Statistical analysis

The data obtained from various trials under each experiment was subjected to statistical analysis (Snedecor and Cochran, 1994) for one way analysis of variance. Duplicate samples were taken for each parameter and the experiment was repeated three times, total being six observations (n=6) were taken for consistency of results. The statistical significance was estimated at 5% level ($p<0.05$).

RESULTS AND DISCUSSION

The initial experiments for optimization of formulation on the basis of sensory evaluation indicted that 19.5% level of pearl millet as binder (T2) would result into better quality of the product with respect to appearance, flavour, juiciness, texture and overall palatability. The mean appearance, flavour, juiciness, texture, overall palatability scores of various treatments prepared by different level of pearl millet flour as depicted in Table 2. Inclusion of pearl millet has been successfully attempted in low fat chicken meat balls to enhance the fiber content and improve sensory attributes by Shanthi and Kalaikannan (2015).

The mean appearance, flavour, juiciness, texture, overall palatability scores of various treatments prepared by different level of pearl millet flour as depicted in Table 2.

The appearance scores for T1, T2 and T3 were 6.33±0.33, 6.66±0.33 and 6.16±0.16 respectively which implies that the appearance scores of T2 was numerically higher than T1 and T2. The overall treatment mean for appearance was 6.38±0.16.

There was non-significant ($p>0.05$) difference in appearance scores in egg nuggets at all the levels of incorporation of pearl millet flour. This is in agreement with the findings of Para and Ganguly (2015) who studied the effect of bajra flour (pearl millet) on chicken nuggets and Nandhini *et al*. (2018) also reported that the appearance scores did not alter significantly in chicken cutlets. It may be attributed to the similarity of colour of pearl millet flour to the colour of the finished product.

Table 2: Sensory attributes (Mean±SE) of egg nuggets incorporated with different levels of pearl millet flour.

Parameter	Treatment			Treatment mean
	T1	T2	T3	
Appearance	6.33±0.33	6.66±0.33	6.16±0.16	6.38±0.16
Flavour	6.00±0.36^{a}	6.83±0.16^{b}	5.50±0.22^{a}	6.11±0.19
Juiciness	5.83±0.30^{a}	6.66±0.21^{b}	5.50±0.22^{a}	6.00±0.18
Texture	5.66±0.21^{a}	6.66±0.21^{b}	5.66±0.33^{a}	6.00±0.18
Overall palatability	6.25±0.40^{ab}	7.00±0.25^{b}	5.50±0.34^{a}	6.25±0.23

*****Mean±SE with different superscripts row-wise (a,b) differ significantly ($p<0.05$) within a parameter.

Table 3: Physico-chemical and proximate parameters (Mean±SE) of egg nuggets treated with different level of antioxidants.

Parameter	Control	19% Pearl millet egg nuggets
pH	6.59±0.12[a]	6.08±0.06[b]
Cooking yield%	94.05±0.05[a]	93.65±0.19[b]
Moisture%	57.38±0.12	57.07±0.14
Fat%	16.65±0.04	16.47±0.04
Protein%	12.33±0.10	12.13±0.03
Ash%	4.84±0.12[a]	5.16±0.21[b]
Crude fiber%	0.11±0.01[a]	0.53±0.03[b]

*****Mean±SE with different superscripts row-wise (a,b) differ significantly (p<0.05) within a parameter.

The mean flavour scores for T1, T2 and T3 were 6.00±0.36, 6.83±0.16 and 5.50±0.22 respectively. The overall treatment mean for flavour was 6.11±0.19. The analysis of variance indicated significant (p<0.05) difference in mean flavour scores between treatments. T2 is found to have marked variation from T1 and T3. Similar trends were recorded in juiciness, texture and overall palatability scores of the products.

The juiciness scores for T1, T2 and T3 were 5.83±0.30, 6.66±0.21 and 5.50±0.22 respectively. The overall treatment mean for juiciness was 6.00±0.18.

Physico-chemical properties and proximate composition

The pH of egg nugget prepared with 19.5% levels of pearl millet flour incorporation was found significantly lower than that of control. Gamit *et al.* (2020) and Naveena *et al*. (2006) also reported significant decrease (p<0.05) in pH of chicken nuggets incorporated with finger millet flour, quality characteristics of chicken meat cutlets incorporated with finger millet (*Eleusine coracana*) flour respectively, in contrary to this study.

The cooking yield per cent of egg nuggets recorded control and treatment (19.5% pearl millet added egg nuggets) 94.05±0.05 and 93.65±0.19 per cent (Table 3). The treatment recorded the highest yield while that of control recorded the lowest. This might be due to high fiber content in pearl millet flour 2.6-4.0% (Abdalla *et al.,* 1998). However, the per cent yield recorded in the study was somewhat higher than those reported by Deepthi *et al*. (2011) who had prepared EAP by incorporating WF and rice flour (RF). The observations are in agreement with those of Das *et al*. (2015) who reported significantly higher cooking yield in chicken patties formulated with finger millet flour. Increase in cooking yield in chicken nuggets and meat balls respectively. Pawar *et al.* (2012) however reported 97% cooking yield after steam cooking in egg crunchy bites.

Moisture percentage of egg nuggets with 19.5% pearl millet flour was non-significantly lower than control. The decrease in moisture percentage may be attributed to less moisture content in finger millet flour as compared to that in chicken meat. The observations are in accordance with those of earlier workers, who prepared different types of meat products with addition of different flours (Gupta *et al*., 2015, Gamit *et al*., 2020)

Protein and fat percentage at 19.5% levels of pearl millet flour incorporation was vary non-significant. The reduction in protein and fat percentage of egg nuggets may be attributed to lower protein and fat content of pearl millet flour as compared to control. The findings are in accordance with Chatli *et al*. (2015) who also reported significant decrease (p<0.05) in the protein and fat content of emu meat nuggets formulated with finger millet flour incorporation. Gamit *et al*. (2020) who also observed decrease in the protein and fat content in Quality Characteristics of chicken meat cutlets incorporated with finger millet (*Eleusine coracana*) flour.

Ash and crude fiber of egg nuggets prepared with pearl millet flour was significantly (p<0.05) higher than control. It might be due to higher mineral and crude fiber content in pearl millet flour than chicken meat. This result is in accordance with those of Das *et al*. (2013) who also reported significance difference in ash content of chicken patties. Gamit *et al*. (2020) who also observed increase in the ash and crude fiber content in quality characteristics of chicken meat cutlets incorporated with finger millet (*Eleusine coracana*) flour.

CONCLUSION

Sensory evaluation indicted that 19.5% level of pearl millet as binder would result into better quality of the product with respect to appearance, flavour, juiciness, texture and overall palatability. pH cooking yield ash and crude fiber. The pH of egg nugget prepared with 19% levels of pearl millet flour incorporation was found significantly lower than that of control. Pearl millet added egg nuggets recorded the highest yield while that of control recorded the lowest. Overall egg nuggets added with 19.5% pearl millets have better acceptability over control.

Conflict of interest: None.

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