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Effect of Bengal Gram Flour and Corn Flour Enrobing on Quality of Chicken Nuggets

Sushma Kumari[1*], J.N. Singh[1] and Sanjay Kumar[2]

[1]Department of Livestock Products Technology, [2]Department of Livestock Production and Management, Bihar Animal Sciences University, Patna, India

**Corresponding author*

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A B S T R A C T

Chicken nugget is an emulsion based meat product prepared from spent hen meat by simple low cost technology and can gain popularity in fast food sector if further improvement can be done in its appearance, texture, flavor and nutritional value by enrobing. When coating of chicken nuggets were done through enrobing batter gram flour or corn flour alone or its combination in the ratio 2:1 respectively, it further improved the sensory quality and overall acceptability of chicken nuggets.

Introduction

Poultry farming is now recognized as organized sector and potential tool for employment generation through improving product processing. Chicken nugget is one such emulsion based product prepared from spent hen meat, which could find increasing popularity in fast food industry. Anandh and Villi (2018) reported that spent hen meat can be successfully used for value addition in the preparation of comminuted meat products by using emulsion as well as ground spent hen meat batter. Kumar R. (2014) assess the comparative quality of nuggets prepared from different combination of spent duck and spent hen meats in terms of physico-chemical and sensory attributes. Enrobing of chicken nuggets with edible coating materials may also be done to improve its appearance and crispiness besides maintaining its nutritional quality. Para *et al.*, (2016) stated that Enrobing of chicken nuggets with black bean flour at 25% (w/w) concentration used in the batter mix was found optimum and had better efficacy in terms of some physico-chemical and sensory attributes.

Materials and Methods

Spent white leg horn hens of above 72 weeks of age were procured from Govt. poultry farm in the LPT Dept., BVC and were hygienically and scientifically slaughtered and dressed as per standard method. After deboning, the meat was packed in polyethylene bag and kept at -10^0 C for 24 hrs. The frozen meat block thus obtained was used for preparing minced meat and further for preparation of emulsion. Meat emulsions for nuggets were prepared in bowl chopper by addition of salt, STPP, spices, condiments, ice flakes and 20% minced soya nuggets. Thus prepared emulsion was filled tightly in stainless steel nugget boxes and was steamed cooked for 40 minutes and then allowed to cool for 15 minutes without opening the lid. Then lids were opened and meat blocks thus obtained were cooled in refrigerator at 4 $\pm$1 ^{0}C and cut into 2x1x1 cm size for rectangular shape of nuggets.

For enrobing of nuggets, three types of batter were prepared by mixing gram flour, corn flour separately with salt and black pepper and also in their combination of 2:1 respectively. Care was taken at the time of adding water to avoid clumping. Water was added slowly with intermittent whipping of batter mix. Batter was mixed continuously till assured for complete hydration of desired consistency.

Results and Discussion

Effect of flours on physico-chemical properties of enrobed chicken nuggets

Enrobing material pick-up (%)

Results showed that nuggets enrobed with only gram flour had higher while only corn flour based batter had significantly ($p<0.01$) lower pick up % than other two formulations. The lower pick-up % in nuggets enrobed with corn flour based batter might be due to interaction between flour and other ingredients in batter mix, which led to its lower viscosity. Johnson and Hutchinson (1983) reported that corn flour in batter mix settled rapidly, which reduces thickening property of batter mix and resulting in uneven enrobing material pick-up. Gram flour, a leguminous flour, high in mucilage and protein content, which might be responsible for further improvement in viscosity and adhesiveness of batter system (Revin and Zyas, 1992). The above characteristics of gram flour might have contributed to better adhesion and higher enrobing material pick-up% of batters containing GF alone or combination of GF+ CF in the ratio 2:1 than only CF based batter.

Coating thickness(mm)- Results showed that Gram flour based batter (T_2) had significantly higher coating thickness while corn flour based batter (T_3) had significantly ($p<0.01$) lower coating thickness as compared to other treatment. In the enrobed products, coating thickness increased due to increase in enrobing material pick-up (Hanson and Fletcher, 1963).

Shear force value- The shear force values were significantly affected by formulation treatments. Table 1 showed that shear force value of uncoated nuggets (control) had significantly ($p<0.05$) higher values than enrobed nuggets. The lower shear force value in enrobed nuggets might be due to incorporation of flour and other ingredients, which reduced the proportion of muscle fibre and connective tissue (Biswas, 2002). The lowest shear force value as recorded in nuggets enrobed with gram flour based batter might be due to higher expansion ratio and higher moisture percentage in gram flour coated nuggets than other treatments. It was in accordance with the report of Park *et al.,*

(1993a), who advocated that lower shear force value normally indicates lower bulk density, higher expansion ratio and higher moisture absorption by the products.

pH- Results showed that pH decreased significantly ($p<0.01$) due to enrobing with corn flour based batter, while there were no significant ($p<0.05$) differences in pH of nuggets either without enrobing or enrobed nuggets. The results were in accordance to Meghawal (2002).

Effect of flours on proximate composition of enrobed chicken nuggets

Moisture (%)- The results showed a significantly lower moisture % in uncoated nuggets (control) as compared to enrobed nuggets. Among enrobed nuggets, coating with gram flour reflected significantly ($P<0.01$) higher moisture % than enrobing with corn flour or the combination. The higher moisture content in enrobed nuggets with gram flour (T_2) might be due to development of thick coating by the gram flour (a legume) during enrobing, there by retaining more moisture % in the product and so loss of moisture during cooking might be minimum. While corn flour (a cereal) formed thin layer of coating during enrobing .so the moisture loss was more in corn flour enrobed nuggets, however, it contained more moisture as compared to control. Love and Goodwin (1974) also reported that food coatings could act as moisture barriers and reduced the nutrient losses often caused by moisture losses and cooking temperatures.

Protein%:-Results showed that protein percentage of nuggets with or without enrobing didn't differ significantly ($p<0.05$). However the mean value of protein% recorded was highest for gram flour coated and lowest for control, this may be due to enrobing flour containing higher protein content. More protein in enrobed meat than in uncoated was also reported by Procter and Cunningham (1983) (Table 2).

Table.1 Effect of gram flour and corn flour on physico-chemical properties of enrobed chicken nuggets

Treatments	Enrobing material pick-up (%)	Coating thickness (mm)	Shear force value (kg/cm^2)	pH
Uncoated nuggets (Control) T_1	0.0	0.0	$0.66^{c} \pm 0.05$	$6.50^{b} \pm 0.02$
Enrobed with Gram flour batter (T_2)	$16.32^{c} \pm 0.19$	$1.39^{b} \pm 0.01$	$0.45^{a} \pm 0.03$	$6.49^{b} \pm 0.01$
Enrobed with Corn flour batter (T_3)	$13.81^{a} \pm 0.12$	$1.29^{a} \pm 0.01$	$0.58^{bc} \pm 0.02$	$6.46^{a} \pm 0.13$
Enrobed with combination of gram flour and corn flour (2:1) batter (T_4)	$15.74^{b} \pm 0.18$	$1.36^{b} \pm 0.02$	$0.52^{ab} \pm 0.03$	$6.48^{ab} \pm 0.01$

Means in column having same superscript(s) are not significantly ($p<0.05$) different.

Table.2 Effect of gram flour and corn flour on proximate composition of enrobed chicken nuggets

Treatments	Moisture (%)	Protein (%)	Fat (%)
Uncoated nuggets (Control) T_1	$57.54^{a} \pm 0.41$	24.86 ± 0.05	$11.20^{b} \pm 0.05$
Enrobed with Gram flour batter (T_2)	$60.35^{c} \pm 0.10$	24.98 ± 0.06	$10.75^{a} \pm 0.10$
Enrobed with Corn flour batter (T_3)	$59.67^{b} \pm 0.28$	24.92 ± 0.05	$11.09^{b} \pm 0.05$
Enrobed with combination of gram flour and corn flour (2:1) batter (T_4)	$59.98^{b} \pm 0.07$	24.96 ± 0.04	$11.06^{b} \pm 0.04$

Means in column having same or no superscript(s) are not significantly ($p<0.05$) different.

Fat% -Enrobed meat reflected a significantly ($p<0.01$) decrease in fat% as compared to control. The lower fat% in enrobed nuggets might be due to low absorption of oil because of enrobing. Mukprasirt *et al.*, (2001) reported that rice flour based batter coating resulted in a healthier enrobed product due to lower fat absorption during cooking.

Effect of flours on sensory attributes of enrobed chicken nuggets

Results revealed that gram flour based batter showed good coating character followed by combination and corn flour based batter alone. The variation of coating character between different formulations might be due to interaction of flours and viscosity building effect of coating materials, which ultimately affect coating character. Enrobed nuggets showed significantly ($p<0.01$) higher scores for appearance and flavor than uncoated nuggets (control). Combination batter showed good texture and crispiness over other formulations and control. Improvement in texture of meat products by enrobing was also reported by Elston (1975). Gram flour coated nuggets showed higher juiciness scores over other formulations. Combination flour coated nuggets showed better overall acceptability than other enrobed formulations and control.

In conclusion, enrobed chicken nuggets prepared from enrobing with batter of gram flour and corn flour in the ratio 2:1 was found to be superior in overall qualities over other enrobed products and control,

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