The Pharma Innovation Journal 2023; SP-12(8): 986-988

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(8): 986-988

www.thepharmajournal.com
Received: 19-05-2023
Accepted: 22-06-2023

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Effect of enrobing on sensory attributes of chicken nuggets

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Abstract
A study was conducted to assess the effect of enrobing of chicken nuggets with different types of flour individually and in combination. The flour used were gram flour and corn flour separately as 100% and also as its combination (gram flour and corn flour in 2:1 ratio) to observe the effect on its sensory attributes. Chicken nuggets were prepared as per standard methods. Three different types of enrobed chicken nuggets were prepared by using enrobing materials viz. 100% gram flour i.e. GF (T_2), 100% corn flour i.e. CF (T_3), gram flour(GF) : corn flour (CF) :: 2 : 1 (T_4) and subsequently deep fried till golden brown colour. All the treated samples were compared with control i.e. uncoated chicken nuggets and were subjected for sensory evaluation. Upon statistical analysis of sensory parameters, Colour and juiciness were found to be highest for T_2 group, while coating character, flavour, crispiness and overall acceptability were found to be highest for T_4 group.

Keywords: Chicken, enrobing, flours, nuggets, sensory

Introduction
Chicken nugget is an emulsion based ready to eat fried meat product and being a potential source for profitable utilization of spent hen meat. It can be prepared by simple low cost technology. Development of value added products such as chicken nuggets has been best way to popularize poultry meat products and its consumption (Yogesh *et al*., 2013) [18] Today chicken nuggets are common menu items at all fast food non-vegetarian restaurant chains and served primarily as snacks or starter. However calorie conscious people used it in limited quantity because of high absorption of fat due to deep frying, however coating of nuggets prior to frying may reduce fat absorption. Azahrani *et al*., (2019) [3] and Ananey-obiri, *et al*. (2020) [2] revealed that the application of edible coating by protein recovered from fish and chicken by-products showed significant reduction in fat absorption in deep fat fried products. Falowo *et al*., (2014) [7] reported that fat absorbed by fried foods can be significantly reduced by the application of edible coatings, which is a major contributory factor to the deterioration in meat quality due to oxidation and low shelf-life of products. Adrah *et al*., (2021) [1] developed an edible coating from chicken protein Isolate and Quercetin to improve oxidative stability of deep fat fried chicken. Jairath and Chatli (2013) [9] reported that enrobing not only improves the sensory attributes such as general appearance, colour, flavour and juiciness of the product but also help in maintenance of these attributes during storage in air permissible films due to its protective cover. Wu *et al*. (2000) [17] reported that enrobed pork chops and beef patties were juicier than uncoated frozen stored samples and found that colour values of coated products decreased with storage due to release of moisture from the coating. So, the study was planned to enrobe the chicken nuggets with different types of flour based batter mix. separately and in combination for its influence of sensory attributes.

Materials and Methods
Chicken nuggets were prepared in the laboratory of Livestock Products Technology Dept, Bihar Veterinary College, Patna by procuring spent hen from local market of Patna. After slaughter of spent hen as per standard method, their deboned meat were used for preparation and cooking of nuggets as per standard procedure. The cooked nuggets were then separated into four different groups equally after cutting into 2x1x1 cm size and rectangular shape. The first group (T_1) was remain as such and were fried without enrobing at medium gas burner flame in refined sunflower oil heated to 170 °C for 6 minutes by turning equally all sides time to time within this period. Other three groups were dipped in enrobing batter before frying at same temperature and time.

Three different types of batter for enrobing chicken nuggets were prepared by taking gram flour 100% (T_2), corn flour 100% (T_3) and their combination in the ratio 2:1 (T_4) separately, along mixing with other ingredients viz. spices, condiments and salt in equal proportions to all three treatment groups. Water was added slowly with intermittent whipping of batter mix. and accordingly, batter was mixed continuously till assured for complete hydration of desired consistency. Care was taken at the time of adding water (w/v) to avoid clumping. Chicken nuggets were dipped individually in coating batter for 15 secs, drained for 10 secs and then deeply fried at 170 °C in refined sunflower oil for 6 minutes till having golden brown colour. After proper frying, all four types of nugget samples were subjected for sensory evaluation to semi- trained panellists of about 12 persons in three different groups. The sensory score card was based on 8-point hedonic scale (Keeton, 1983) [10] consisting of parameters coating characteristics, colour, flavour, crispiness, juiciness and overall acceptability. In that score card, 8-point depicted was for excellent and 1- point was for extremely poor quality. Clean potable water was provided to rinse mouth between samples testing. The panellists were explained about the nature of the experiment and to fill the score card separately and confidentially. The data obtained for various parameters from the score card of panellists were subjected to statistical analysis as per Snedecor and Cochran (1989) [14]. Mean values of different treatments were compared by applying Duncan's multiple range test (Duncan, 1955) [4].

Results and Discussion

The average mean value of scores for various parameters of sensory attributes are depicted in Table 1.

The scores for coating character of enrobed chicken nuggets varied from 6.90 to 7.12 among all treatment groups. The mean values recorded were 7.10, 6.90 and 7.12 in nuggets enrobed with GF (T_2), CF (T_3) and combination of GF + CF (2:1) based batter, respectively. Here, T_3 differed significantly (p<0.01) from T_2 and T_4, however both T_2 and T_4 treatment groups didn't differ significantly (p<0.01) from each other. The variation of coating character between different treatment groups might be due to interaction of flours and viscosity building effect of coating materials, which ultimately affect coating character. Wall and Beckwith (1969) [15] & Krull and Inglett (1971) [11] stated that elastic and cohesive character of gluten improves the adhesibility of batter on meat products and it is due to disulphide bonds of sulphur containing amino acids linked with polypeptide chain interaction.

The values for appearance and colour of chicken nuggets were rated from good to very good' and scores ranged from 6.70 to 7.28. The mean values recorded were 6.70, 7.26, 6.88 and 7.28 in uncoated nuggets, enrobed with GF, CF and GF+ CF based batter, respectively. The result revealed that significant (p<0.01) effect was found by enrobing with different flours on appearance and colour scores of finished product. Uncoated nuggets and CF coated nuggets differed significantly (p<0.01) from other formulations and also differed significantly (p<0.01) from each other and also from other treatment groups, however, GF coated and combination of GF + CF coated nuggets didn't differ significantly (p<0.05) from each other. The higher appearance and colour values in enrobed nuggets in this investigation might be due to composition as well as consistency of enrobing materials. Appearance and colour might also be contributed by cooking method, its temperature- time combination, interaction between cooking medium and batter mix. Colour differences among different coating might be due to difference of flours having different colour producing capability. Gram flour produces deep yellowish brown colour while corn flour produces very light brown colour upon frying. Hanson and Fletcher (1963) [8] stated that yellow corn produced a greenish yellow colour, waxy corn starch and corn starch mixture produced a very light brown colour and waxy com flour mixture produced glossy brown coatings upon frying of enrobed products.

The scores for flavour were rated between 'good to very good' and the values varied from 6.78 to 7.45. The mean values recorded were 6.78, 7.42, 7.30 and 7.45 in uncoated nuggets, enrobed with GF, CF and GF + CF based batter respectively. Enrobed nuggets had significantly (p<0.01) higher flavour scores than uncoated nuggets. However, T_2 and T_3 groups showed resemblance with T_4 group. Improved flavour in enrobed products were also reported by many research workers (Zabik and Dawson, 1963; Zwiercan, 1974; Elston, 1975) [19, 20, 5].

The mean values for texture and crispness of nuggets were recorded as 6.55, 6.94, 7.04 and 7.10 in uncoated nuggets, enrobed with GF, CF and GF + CF (2:1) based batter, respectively. Table-1 revealed that the values were significantly (p<0.01) lower in uncoated nuggets over enrobed nuggets. Texture property for uncoated nuggets and gram flour coated nuggets differed significantly (p<0.01) from all other treatment groups, however CF coated nuggets and combination of GF+ CF coated nuggets didn't differ significantly (p<0.05) from each other. Mohamed *et al*. (1998) [12] found that corn starch produced tough, glossy and hard coating and dried quickly from the surface and make product more crispy. Improvement in texture of meat products by enrobing was also reported by Elston, 1975 [5].

The sensory scores for juiciness of chicken nuggets varied from 6.49 to 6.87. The mean values recorded were 6.49, 6.87, 6.75 and 6.84 in uncoated nuggets, enrobed with GF, CF and GF+ CF based batter respectively. The juiciness score for uncoated nuggets was lower and differed significantly (p<0.01) from enrobed nuggets, however enrobed nuggets didn't differ significantly (p<0.05) among themselves. GF coated nuggets had numerically higher juiciness score compared to other formulations, might be due to controlled moisture barrier and fat absorption properties of GF, because it formed thick coating. Mohamed *et al*. (1998) [12] observed that CF based batter produced hard and thin coating and absorbed more fat due to porous nature.

The scores for overall acceptability of chicken nuggets rated from 'good to very good' and the values ranged from 6.90 to 7.50. The mean values recorded were 6.90, 7.30, 7.23 and 7.50 in uncoated nuggets, enrobed with GF, CF and GF+ CF based batter respectively, revealed that overall acceptability of uncoated nuggets (T_1) and enrobed with GF+ CF (T_4) based batter differed significantly (p<0.01) from other formulations and also from each other, however the values for GF (T_2) and CF (T_3) coated nuggets didn't differ significantly (p<0.05) from each other. Uncoated nuggets had significantly (p<0.01) lower overall acceptability than enrobed nuggets, while GF+ CF coated nuggets had significantly (p<0.01) higher overall acceptability among all formulations. Wanstedt *et al*. (1981) [16] reported that alginate-coated pork-patties had higher overall acceptability and were more desirable than control. Eyas (2001) [6] found that enrobed buffalo meat cutlet had higher sensory scores and overall acceptability than that of

control (uncoated cutlet). Para *et al*., (2015) [13] used GGF (green gram flour) at two different levels in the batter mix viz. 25% (w/w) and 35% (w/w) separately and revealed non-significant (p>0.05) changes in sensory parameters of enrobed chicken nuggets viz. colour and appearance, juiciness and flavour, however, a significant (p<0.05) decrease was noted in the scores of texture and overall acceptability with increase in the level of green gram flour in the batter mix.

It may be concluded that enrobed chicken nuggets with different types had better sensory acceptability than uncoated chicken nuggets. Among the enrobed products, chicken nuggets, GF+CF (2:1) combination based enrobed chicken nuggets had better acceptability over individual flours.

Table 1: Effect of enrobing on sensory attributes of chicken nuggets.

Treatments	T_1 (Control)	T_2 (Enrobing with GF)	T_3 (Enrobing with CF)	T_4 (Enrobing with GF+CF) 2:1
Coating character	-	7.10^b	6.90^a	7.12^b
Appearance	6.70^a	7.26^c	6.88^b	7.28^c
Flavour	6.78^a	7.42^c	7.30^b	7.45^c
Crispiness	6.55^a	6.94^b	7.04^c	7.10^c
Juiciness	6.49^a	6.87^b	6.75^b	6.84^b
Overall acceptability	6.90^a	7.30^b	7.23^b	7.50^c

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

GF= Gram flour, CF= Corn flour, GF+CF= Gram flour + Corn flour (2:1).

Conclusion

Enrobed chicken nuggets had better sensory attributes than un enrobed nuggets (control), while among enrobed nuggets, T4 prepared with mixed flour combination in 2:1 ratio of GF:CF respectively had better overall acceptability than other treatment groups T3 and T2.

Conflict of Interest: The author declares no conflict of interest if any.

Funding Agency: No specific funding agency involved in grant.

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