Effect of Incorporation of Bread Crumbs on the Physicochemical and Sensory Quality of Chicken Nuggets

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Abstract: The study was aimed at evaluating the effect of bread crumbs on the quality of chicken nuggets. Bread crumbs were incorporated in batter at 1% (T₁), 2% (T₂) and 3% (T₃) level and compared with the control (T₀) prepared without the incorporation of bread crumbs. The quality parameters studied included physico-chemical indices including moisture (%), protein (%), fat (%), emulsion stability, cooking yield (%), oil pick up (%); and sensory attributes. Moisture, protein, fat and oil pick up showed significant decrease whereas pH, emulsion stability and cooking yield (%) showed non-significant difference when compared with control. Among sensory attributes, texture and overall acceptability showed significant difference with higher scores at 2% level of incorporation. From the study, it was concluded that overall quality of nuggets prepared with incorporation of 2% bread crumbs was better than other treatments.

Key words: Chicken nugget; Bread crumbs; Physicochemical; Quality; Sensory.

1. Introduction

With advent of rapid industrialization, urbanization and change in life style, demand for convenience meat products has increased (Sofi et al 2010). Meat processing technology has led to the
development of variety of convenience and value added products. Among these, chicken nuggets occupy a predominant place worldwide due to their characteristics flavour and pronounced chewy texture. With increase in the cost of meat, certain alternatives in processing technologies have become a necessity. This can be done by incorporation of a range of non-meat ingredients to alter taste, flavor, appearance, colour, texture, water binding, counteracting fat separation and preservation besides reducing the cost and improving yield (Muthulakshmi, 2010). These non-meat ingredients could be in the form of extenders, binders or fillers (Muthulakshmi, 2010). Bread crumbs has been used as a filler/extender in convenience meat products due to their high carbohydrate and low protein contents (Muthulakshmi, 2010). It reduces the cost and adds to the volume besides acting as a binder (Kondiah, 2010). It increases the water binding for more juiciness and fat binding for improved texture (Muthulakshmi, 2010). Hence the current study was conducted with the objective of optimizing the incorporation levels of bread crumbs in chicken nuggets and accessing its quality.

2. Materials and Methods

2.1. Source of Raw Material

Broilers of 6 weeks age were purchased from the local market and dressed at local meat shop by halal method. Dressed chicken meat was packed in low density polyethylene pouches and kept in deep freezer at -18 ± 1 °C overnight, and subsequently used for product formulation. Fresh bread loaves, spices and condiments were also purchased from the local market.

2.2. Preparation of Chicken Nuggets

Chicken nuggets were prepared following the method of Nag (1994) with slight modifications. Deboned meat after thawing at room temperature was minced in a meat mincer. Salt, sodium nitrite and sodium tri-polyphosphate were added in minced meat and chopped in bowl chopper for desired duration with addition of vegetable oil, refined wheat flour, condiments and spice mix. Fresh bread loaves were dried in hot air oven, ground in a grinder and then added at 1, 2, and 3 percent levels during emulsion preparation. Emulsion was stuffed in steel box (14 x 7 x 3 cm) so as to get proper shape. Lid was closed in such a way so as to make it air tight. Moulds containing emulsion was kept in a steam cooker and cooked for 35 minutes without pressure in such a way so that the internal temperature of loaf recorded 75 ± 2 °C. Cooked loafs were cooled to room temperature and cut into 4 x 1.5 x 1.5 cm sized nuggets which were subsequently packed in polyethylene pouches.
2.3. Quality Evaluation

Samples were subjected to quality evaluation in terms of physico-chemical and sensory attributes. Moisture, protein, fat was estimated by following the method of AOAC, 1995. pH was estimated by the method of Trout et al. (1992). Emulsion stability was estimated by following the method of Townsend et al. (1968). Cooking yield percent was calculated by dividing the weight of cooked loaf with weight of emulsion used. Oil pick up was calculated by using the following formula.

\[
\text{Oil Pick} = \frac{\text{Initial wt. of oil taken before frying} \ - \ \text{Left over wt. of oil after frying}}{\text{Initial weight of oil taken before frying nuggets.}} \times 100
\]

Sensory quality was evaluated as per 8 point descriptive scale of Keeton (1983) modified and adopted by Division of LPT, IVRI (Sharma et al. 1997).

2.4. Statistical Analysis

Data obtained during the study were analyzed by following the procedure described by Snedecor and Cochran (1989). The ANOVA of group means was computed and significance of means was tested by using least significant difference test (LSD) at 5% level of significance.

3. Results and Discussion

The comparative physico-chemical qualities of chicken nuggets of different treatments are presented in Table 1 and 2. The pH, emulsion stability and cooking yield of chicken nuggets differed non-significantly between the treatments. The slight increase in pH of nuggets incorporated with bread crumbs from control (T0) might be due to change in net charge of proteins of nuggets upon cooking due to protein denaturation (Babu et al. 1994). The emulsion stability although did not differ significantly but there was a non-significant increase with the increasing levels of bread crumbs. This might be attributed to decrease in moisture content with addition of bread crumbs in chicken nuggets. Similar observations were made by Dushyanthan et al. (2008) who also observed higher emulsion stability in nuggets having low moisture content. Cooking yield followed similar trend as that of emulsion stability which is also in agreement with Dushyanthan et al. (2008) who reported that the emulsion stability of product is directly proportional to product yield. Our observations were also in agreement with the observations of Whiting and Jenkins (1981). One of the peculiar characteristics upon frying of chicken nuggets with or without bread crumbs is oil pick up, which differed significantly (P<0.05) from each other. In T0, the oil pick up was maximum which decreased significantly with increasing levels of bread crumbs. Moisture content is an important factor in determining the oil pick up upon frying. The product with bread crumbs being lower in moisture content created cavities or pores in between the meat particles. The cavities are well known as
capillary pores through which the oil penetrates during frying. The product with high moisture content normally resulted in high oil pick up during frying. Since the moisture was low in bread incorporated nuggets the oil pick up of these products reduced considerably. Ngadi et al. (2007) also reported similar relationship between moisture content and oil pick up of product.

Table 1. Effect of Bread crump incorporation levels on Physico-chemical quality of chicken nuggets

<table>
<thead>
<tr>
<th>Treatment</th>
<th>pH</th>
<th>Emulsion stability (%)</th>
<th>Cooking yield (%)</th>
<th>Oil pickup (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₀ (Control)</td>
<td>6.23±0.07</td>
<td>92.56±0.42</td>
<td>93.02±0.45</td>
<td>5.27±0.34</td>
</tr>
<tr>
<td>T₁ (1%)</td>
<td>6.25±0.08</td>
<td>92.68±0.44</td>
<td>93.36±0.46</td>
<td>4.36±0.30</td>
</tr>
<tr>
<td>T₂ (2%)</td>
<td>6.26±0.08</td>
<td>92.69±0.46</td>
<td>93.40±0.45</td>
<td>3.90±0.30</td>
</tr>
<tr>
<td>T₃ (3%)</td>
<td>6.26±0.08</td>
<td>92.72±0.45</td>
<td>93.48±0.45</td>
<td>2.06±0.30</td>
</tr>
</tbody>
</table>

Row wise means with different superscripts in a row differ significantly (P<0.05)

Table 2. Effect of Bread crump incorporation levels on Proximate composition of chicken nuggets

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Moisture (%)</th>
<th>Protein (%)</th>
<th>Fat (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₀ (Control)</td>
<td>59.34ᵃ±0.47</td>
<td>18.50ᵃ±0.45</td>
<td>13.44ᵃ±0.45</td>
</tr>
<tr>
<td>T₁ (1%)</td>
<td>57.68ᵇ±0.44</td>
<td>16.90ᵇ±0.45</td>
<td>11.93ᵇ±0.44</td>
</tr>
<tr>
<td>T₂ (2%)</td>
<td>56.65ᵇ±0.44</td>
<td>16.82ᵇ±0.45</td>
<td>11.67ᵇ±0.45</td>
</tr>
<tr>
<td>T₃ (3%)</td>
<td>56.53ᵇ±0.45</td>
<td>16.81ᵇ±0.45</td>
<td>11.57ᵇ±0.44</td>
</tr>
</tbody>
</table>

Row wise means with different superscripts in a row differ significantly (P<0.05)

The moisture, protein and fat content of chicken nuggets made without the incorporation of bread crumbs (T₀) was significantly higher (P<0.05) than T₁, T₂ and T₃. However non-significant difference was observed among T₁, T₂ and T₃. It was observed that with increased level of incorporation of bread crumbs, the percentages of moisture, protein and fat showed decreasing trend. Our observations were in agreement with Dushyanthan et al. (2008) who also reported decrease in moisture with increasing use of maida in buffalo meat nuggets. The decrease in protein and fat content of nuggets incorporated with bread crumbs may be attributed to low content of protein and fat as compared to that of lean meat which was proportionately replaced by bread crumbs.

The sensory quality of chicken nuggets prepared with or without incorporation of bread crumbs is delineated in Table 3. The scores for sensory attributes viz., texture and overall palatability of chicken nuggets differed significantly (P<0.05) between the treatments while non-significant differences were observed with respect to appearance, flavor and juiciness scores. The texture and overall palatability scores were observed to be significantly higher in nuggets with 2% incorporation of bread crumbs (T₂) as compared T₀ to T₁ and T₃. The findings of present investigation are in close
agreement with those reported by Rao et al. (1997) and Dushyanthan et al. (2008) who also observed variations in sensory attributes of chicken nuggets made by using refined wheat flour.

Table 3. Effect of Bread crump incorporation levels on sensory quality of chicken nuggets

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Sensory attributes</th>
<th>Overall palatability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Appearance</td>
<td>Flavour</td>
</tr>
<tr>
<td>T_0 (Control)</td>
<td>5.86±0.15</td>
<td>6.00±0.20</td>
</tr>
<tr>
<td>T_1 (1%)</td>
<td>6.00±0.20</td>
<td>6.66±0.25</td>
</tr>
<tr>
<td>T_2 (2%)</td>
<td>6.13±0.22</td>
<td>6.86±0.39</td>
</tr>
<tr>
<td>T_3 (3%)</td>
<td>6.27±0.33</td>
<td>6.80±0.41</td>
</tr>
</tbody>
</table>

Row wise means with different superscripts in a row differ significantly (P<0.05)

4. Conclusions

From the study, it was concluded that overall quality of nuggets prepared with incorporation of 2% bread crumps was better than other treatments.

Potential Conflicts of Interest

The authors declare no conflict of interest.

References


