

EFFECTS OF CHICKEN SKIN AND WHEAT FIBER MIXTURE ON QUALITY PROPERTIES OF CHICKEN NUGGET

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Abstract – Chicken skin and wheat fiber mixture (SFM) were assessed as fat replacers in chicken nugget. The addition of SFM increased the moisture and protein content in the sausage because of the water binding capacity in wheat fiber and protein content in pig skin. The nugget sample containing 20% SFM had higher water and ash contents than those of the control ($p < 0.05$). The lightness value of before frying chicken nugget had higher than frying chicken nugget of all sample. For both before and after frying chicken nugget, the addition of SFM resulted in increased redness values yellowness values. High SFM content resulted in a higher hardness, gumminess, and chewiness. No significant differences were observed in color, flavor, tenderness, juiciness, flavor, and overall acceptability between the control and nugget sample with SFM by the sensory panel. Therefore, SFM could be used as fat replacers to obtain lower fat, and higher water, ash contents.

Key Words – Chicken skin, Wheat fiber, Nugget

I. INTRODUCTION

Fried chicken nuggets are very common and generally acceptable worldwide. Chicken nuggets cook rapidly and develop golden color, crisp texture and good flavor at the frying temperatures between 160 and 90 °C. In general, mass transfer during frying consists of moisture loss and oil absorption. Moisture loss during frying generally decreases exponentially with frying time. So, fried chicken nuggets contain high oil contents and calories. However, consumer demand for low-fat products has been increasing. Consumers increasingly prefer products with low-fat content while retaining good flavor and overall acceptability [1]. Consistent with this trend, manufacturers have reduced the fat content of nugget, typically by substituting dietary fiber and chicken skin for reduced fat.

Chicken skin, a by-product of fabrication operations, could be a potential water binder and texture-modifying agent for use in reduced-fat comminuted meat products. Improving the functionality (solubility) of chicken skin may increase its potential use in comminuted meat products as a less expensive water binder or texture-modifying agent [2-4].

Dietary fiber holds all the characteristics required to be considered as an important ingredient in the formulation of functional foods, because of its beneficial effects such as increasing the transit, cholesterol and glycaemia levels, chelating harmful substances (mutagenic and carcinogenic agents), and stimulating the proliferation of intestinal flora [5].

The aim of this study was to assess the effect of chicken skin and wheat fiber mixture (SFM) as fat replacers on the quality characteristics of chicken nugget.

II. MATERIALS AND METHODS

The chicken skin and fiber mixture (SFM) were manufactured based on the following formulation: 50% chicken skin, 20% wheat fiber, and 30% ice. The batch of chicken skin, wheat

Table 1. Chicken nugget formulation with various chicken skin and wheat fiber mixture

Ingredients		SFM ^A		
		CON	10%	20%
Main	Breast (%)	87	87	87
	Skin (%)	10	5	-
	SFM ^A	-	5	10
	Ice (%)	3	3	3
Additive	NaCl (%)	0.5	0.5	0.5
	Phosphate (%)	0.3	0.3	0.3

^ASFM: Chicken Skin and wheat fiber mixture.

fiber, and ice were emulsified using a silent cutter (Nr-963009, Scharfen, Witten, Germany). Chicken breast and skin were initially ground through an 8 mm plate. Three different nugget batters were produced and the experimental design and compositions are given in Table 1. 1.5% NaCl and 0.3% sodium tripolyphosphate was added to chicken breast and mixed for 1 min. The SFM was added after 3 min and the batters were homogenized for 6 min. The nuggets were fried for 5 min at 180 °C. The samples were allowed to cool to room temperature before further tests.

To determine physicochemical properties of proximate composition, pH, frying yield, color, texture profile analysis, and sensory evaluation were examined.

An analysis of variance was performed on all the variables measured using the general linear model (GLM) procedure of the SAS statistical package (SAS, 2010).

III. RESULTS AND DISCUSSION

The proximate composition value of nuggets formulated with various SFM levels (0%, 10%, and 20%) are given in Table 2. The differences in moisture, protein, fat and ash values of the various chicken nuggets were statistically significant ($p < 0.05$). The water and ash content increased ($p < 0.05$) as SFM level increased because these samples were contained wheat fiber which had higher water retention and improved emulsion stability and chicken skin which was absorbed during gel formation with added water. The addition of SFM significantly reduced the fat and

Table 2. Proximate composition of chicken nugget formulation with various chicken skin and wheat fiber mixture

Traits	SFM ^A		
	CON	10%	20%
Water (%)	61.95 ± 0.67 ^c	63.41 ± 0.48 ^b	64.26 ± 0.24 ^a
Protein (%)	27.36 ± 0.47 ^a	27.36 ± 0.32 ^a	25.44 ± 0.06 ^b
Fat (%)	11.61 ± 0.13 ^a	9.57 ± 0.12 ^b	7.61 ± 0.23 ^c
Ash (%)	1.82 ± 0.07 ^c	1.97 ± 0.04 ^b	2.06 ± 0.05 ^a

All values are mean ± standard deviation of three replicates.
^{a-c} Means within a row with different letters are significantly different ($p < 0.05$).

^ASFM: Chicken Skin and wheat fiber mixture.

protein content by increasing the water content.

Table 3 shows the pH, lightness (L^*), redness (a^*), and yellowness (b^*) values of before and after frying nugget formulated with CSFM levels (0%, 10%, and 20%). The pH of before frying nugget ranged from 6.36 to 6.38, and that of after frying nugget ranged from 6.4 to 6.51. the pH of the meat batter has been shown to increase in response to heat because imidazolium, the basic R group of the amino acid histidine, was exposed during heating [6]. The lightness value of before frying chicken nugget had higher than frying chicken nugget of all sample. For both before and after frying chicken nugget, the addition of SFM resulted in increased redness values yellowness values. These results agree with those of Ngadi, Yunsheng, and Oluka [7] who found that the redness and yellowness value significantly increased significantly with frying time and with the degree of oil hydrogenation.

The effects of replacement of chicken skin with chicken skin and wheat fiber mixture on the textural properties of chicken nugget are given in Table 4. The hardness of CON was lower than samples containing SFM. Springiness in chicken nuggets supplemented with SFM was ranged from 0.85 to 0.91. Hardness, gumminess, and chewiness

Table 3. pH value and color value of chicken nugget formulation with various chicken skin and wheat fiber mixture

Traits		SFM ^A		
		CON	10%	20%
Uncooked	pH	6.36 ± 0.02 ^a	6.37 ± 0.02 ^a	6.38 ± 0.03 ^a
	L^*	78.52 ± 1.05 ^a	74.65 ± 1.06 ^b	73.98 ± 0.78 ^{bc}
	a^*	4.11 ± 0.41	4.07 ± 0.33	4.15 ± 0.33
	b^*	15.10 ± 1.47	15.14 ± 0.83	16.00 ± 0.29
Cooked	pH	6.51 ± 0.03	6.47 ± 0.02	6.48 ± 0.02
	L^*	73.87 ± 0.83 ^a	71.91 ± 1.02 ^b	70.75 ± 1.89 ^{bc}
	a^*	4.50 ± 0.84 ^{ab}	4.75 ± 0.59 ^{ab}	5.68 ± 0.88 ^a
	b^*	35.48 ± 1.02 ^b	36.04 ± 1.33 ^b	37.61 ± 2.28 ^a

All values are mean ± standard deviation of three replicates.

^{a-c} Means within a row with different letters are significantly different ($p < 0.05$).

^ASFM: Chicken Skin and wheat fiber mixture.

Table 4. Texture properties of chicken nugget formulation with various chicken skin and wheat fiber mixture

Traits	SFM ^A		
	CON	10%	20%
Hardness(N)	149.18 ± 12.18 ^{bc}	157.53 ± 9.21 ^b	204.03 ± 19.26 ^a
Cohesiveness	0.41 ± 0.07 ^a	0.43 ± 0.03 ^a	0.40 ± 0.02 ^{ab}
Gumminess(N)	61.19 ± 6.77 ^{bc}	67.57 ± 6.78 ^b	81.73 ± 8.31 ^a
Springiness	0.91 ± 0.06 ^a	0.89 ± 0.05 ^{ab}	0.85 ± 0.05 ^b
Chewiness(N)	55.59 ± 8.55 ^{bc}	59.88 ± 6.86 ^b	69.79 ± 7.50 ^a

All values are mean ± standard deviation of three replicates.

^{a-c} Means within a row with different letters are significantly different ($p < 0.05$).

^ASFM: Chicken Skin and wheat fiber mixture.

were the highest for sample containing 20% SFM. The sensory evaluation results are shown in Table 5. Color, flavor, tenderness, juiciness, overall acceptability scores of control had slight higher others sample, but there were on significant differences among all the treatment containing SFM.

IV. CONCLUSION

The results suggest that the addition of SFM as fat substitute improved the quality characteristics and sensory properties of low fat chicken nugget. Further, the incorporation of SFM into chicken nugget resulted in lower fat, and higher water contents ($p < 0.05$) than in control samples. The lightness value of before frying chicken nugget had higher than frying chicken nugget of all sample. For both before and after frying chicken nugget, the addition of SFM resulted in increased redness values yellowness values. The addition of SFM had a positive effect on all texture parameters. Although samples containing SFM were low in fat, no significant differences in the sensory properties were observed ($p > 0.05$). In conclusion, the incorporation of SFM improved the quality characteristics of low-fat chicken nuggets.

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Table 5. Sensory evaluation of chicken nugget formulation with various chicken skin and wheat fiber mixture

Traits	SFM ^A		
	CON	10%	20%
Color	9.25 ± 0.46	9.13 ± 0.35	9.25 ± 0.46
Flavor	9.00 ± 0.53	9.13 ± 0.35	9.13 ± 0.35
Tenderness	8.38 ± 0.52	8.00 ± 0.53	7.75 ± 1.04
Juiciness	8.25 ± 0.71	8.00 ± 0.53	7.75 ± 1.04
Overall acceptability	8.44 ± 1.12	8.25 ± 0.46	7.94 ± 0.94

All values are mean ± standard deviation of three replicates.

^ASFM: Chicken Skin and wheat fiber mixture.

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