

## RESTRUCTURED AND BREADED (NUGGETS) CHICKEN PRODUCT WITH THE ADDITION OF *OAT FIBER*: CHEMICAL AND SENSORIAL CHARACTERIZATION

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**Abstract** – The aim of this work was to add Oat Fiber (OF) in a restructured and breaded chicken product and determine their chemical composition, dietary fiber and sensory analysis of formulations. It was observed for chemical composition of products in different concentrations of OF (3%, 4.5% and 6%) that an increase in addition of fiber resulted in a decrease in the protein and moisture, whereas the opposite was observed for lipids and ashes, presenting significant difference ( $p < 0.05$ ) in the analysis of moisture, ash and protein. The content of dietary fiber in product followed the percentage of OF added in the formulations of 3% and 4.5%, but 6% did not correspond to the added percentage. In the analysis of color significant difference was observed ( $p < 0.05$ ) among the samples for parameters  $L^*$  and  $b^*$ , however there was no significant difference ( $p > 0.05$ ) for the parameter  $a^*$ . Sensory analysis showed that the three formulations are similar to each other, with no significant difference ( $p > 0.05$ ) for the attributes studied, only for juiciness significant difference was observed ( $p < 0.05$ ). This work has proved to be possible the application of dietary fibers in restructured and breaded meat products with a good overall acceptability by consumers.

### I. INTRODUCTION

The industry have focused in producing food with high nutritional value by adding alternative ingredients. These ingredients need to satisfy this demand without interfering with two other important issues: product quality and consumer health, which is becoming more aware and critical of their food. Breaded and restructured meat products represent a category with great potential for application of functional ingredients with appeals of healthiness. This kind of products is very well accepted by the population, because its great convenience. Additional studies are always needed in searching of improvements of technological, sensory and functional effects

of the ingredients used in such products. This segment of functional products, with the addition of fibers, is considered the new frontier in the food industry and one of the alternatives to add value to ingredients considered by-products in the industry. The presence of fibers in food often results in the reduction of calories and contributes to the amount of daily intake, thereby providing a better diet. According to the resolution of ANVISA (Brazilian National Health Surveillance Agency), which provides for the technical regulation on supplementary nutrition, we can consider a product as "source of fiber" when presenting in its composition at least 3g of fiber per 100g of prepared dishes or at least 2.5g of fiber per serving. For designate a product as "high fiber content" must have at least 6g of fiber in cooked dishes or at least 5g of fiber per serving BRAZIL [1]. The addition of an ingredient processing and breaded products may directly influence the quality attributes such as color, aroma, flavor, juiciness and tenderness. Quality aspects of a new product will determine their success and pleasant aroma and flavor, desirable color and texture become prerequisites. Therefore, knowledge of their composition, structure, process conditions and how these factors will influence the sensory aspects, nutritional value, safety, the costs and marketing share when developing a new product are extremely required.

### II. MATERIALS AND METHODS

The process of elaboration of a restructured chicken meat product (nuggets) with the addition of OF was carried out in the laboratories of meat science of Federal Technological University - Paraná (UTFPR). The OF obtained by microgrinding was

provided by *SL Alimentos Company*. The covering system (*Predust, Breading and Batter*) was supplied by *Griffith Laboratories - GL*. Other condiments incorporated into the formulation were purchased in local shops.

The nuggets were processed by mixing the ingredients with the OF followed by molding and subsequent application of the cover layer (predust, batter and breading), pre frying at 200°C for 25 seconds and freezing at -18°C.

Three different formulations were prepared for analytical assays and shown below.

<b>Formulation 1:</b> Standard (no OF added);
<b>Formulation 2:</b> 3% of Oat Fiber added
<b>Formulation 3:</b> 4.5% of Oat Fiber added
<b>Formulation 4:</b> 6% of Oat Fiber added

To determine the chemical composition of the formulations, methodologies recommended by the AOAC [2] were used. For dietary fiber, moisture, ash, lipids and proteins, were used the methods described in topics 941.43, 950.46, 920 153, 991.36 and 992.15, respectively. To the color analysis, were used the Minolta CR400 colorimeter, calibrated and expressed in the CIELAB system according Soares [3]. All the analysis were carried out in triplicate and for each treatment, e.g. concentration of OF, 20 samples were taken. To perform the sensory analysis was used Multiple Comparison Method [4] with 65 untrained panelists using a structured scale to scores from 1 to 5. All data were submitted to analysis of variance (ANOVA) and Tukey test at 5% using the Portable Software Statistica 8.

### III. RESULTS AND DISCUSSION

The chemical composition of chicken nuggets prepared with different concentrations of OF are shown in Table 1.

It was observed that the addition of OF altered the chemical composition of the product, causing a decrease in protein and moisture content. However, for lipid and ash content the opposite happened. The amount of protein decreased the extent that the fiber is added, resulting in a significant difference ( $p < 0.05$ ) between the standard and the samples added with 4.5% and 6% OF. Fact caused due to the substitution of chicken for OF. The larger the added fiber, lowest was protein concentration found in samples of breaded chicken, being in

accordance with the Technical Rules of Identity and Quality of Breaded [5], which states that the breaded meat products must have at least 10% protein and a maximum of 30% carbohydrates. The table below shows the results of total dietary fiber in samples of breaded chicken with the addition of OF.

Table 1 Chemical composition of chicken nuggets added with different concentrations of Oat Fiber

	<i>Std</i>	<i>3%</i>	<i>4.5%</i>	<i>6%</i>
<b>Moisture</b>	56.68 ± 0.51 <sup>a</sup>	52.59 ± 0.99 <sup>b</sup>	54.06 ± 1.26 <sup>b</sup>	52.13 ± 1.00 <sup>b</sup>
<b>Ashes</b>	2.20 ± 0.08 <sup>b</sup>	2.42 ± 0.37 <sup>a,b</sup>	2.31 ± 0.04 <sup>a,b</sup>	2.67 ± 0.20 <sup>a</sup>
<b>Lipids</b>	6.71 ± 0.46 <sup>a</sup>	7.37 ± 0.19 <sup>a</sup>	7.19 ± 0.04 <sup>a</sup>	7.45 ± 0.73 <sup>a</sup>
<b>Protein</b>	17.25 ± 1.64 <sup>a</sup>	15.99 ± 0.74 <sup>a,b</sup>	14.04 ± 0.74 <sup>b</sup>	13.18 ± 1.48 <sup>b</sup>
<b>Carbs*</b>	16.99	21.63	22.40	24.57

Values in the same line with different letters indicate significant difference ( $p < 0.05$ ).

\* Carbohydrates were calculated by difference.

Std - Standard

Table 2 Content of dietary fiber found in the formulations of breaded chicken with addition of OF.

<i>Samples</i>	<i>Dietary Fiber (g/100g)</i>
<b>Std*</b>	<0,50
<b>3%</b>	3,09
<b>4,5%</b>	4,22
<b>6%</b>	4,54

\*Std – Standard

It is observed that dietary fiber content analyzed followed OF percentage in formulations added with 3% and 4.5%. However, the formulation with 6% OF did not match the added percentage, but remained with the highest dietary fiber level.

The samples attended the Technical Regulation on Nutritional Supplement, containing at least 3% of dietary fiber per 100g, the labeling could receive the "source of fiber" attribute.

From Table 3, we observe a significant difference between the samples analyzed for parameters L\* and b\*.

However there was no significant difference for the parameter a\*, which indicates that the higher the value, the color of the sample will tend to red. The higher the luminosity value (L\*), the clearer the sample. The parameter b\* denotes the amount of yellow color which in meats and their derivatives is related to brown.

For the parameter  $L^*$ , a standard sample differed from the others ( $p > 0.05$ ), however, no significant difference for samples with addition of different concentrations of OF. Contributing to the increase in  $L^*$  value in samples with fiber because the color of the OF (beige).

TABLE 3: Parameters of color measurement of chicken nuggets added with different concentrations of Oat Fiber.

	$L^*$	$a^*$	$b^*$
<b>Std</b>	45.77 ± 2.91 <sup>a</sup>	6.23 ± 1.01 <sup>a</sup>	18.76 ± 2.13 <sup>a</sup>
<b>3%</b>	49.61 ± 2.47 <sup>b</sup>	6.26 ± 0.91 <sup>a</sup>	21.84 ± 2.44 <sup>c</sup>
<b>4.5%</b>	49.31 ± 2.60 <sup>b</sup>	6.59 ± 0.45 <sup>a</sup>	23.05 ± 1.14 <sup>bc</sup>
<b>6%</b>	51.01 ± 3.09 <sup>b</sup>	6.75 ± 0.76 <sup>a</sup>	24.63 ± 1.28 <sup>b</sup>

Values in the same column with different letters indicate significant difference ( $p < 0.05$ ).

Std – Standard

Victorino (2008) [6] added wheat and oat fiber in emulsions with high levels of mechanically separated meat (CMS), and found that the results of  $L^*$  are statistically significant ( $p \leq 0.05$ ), indicating that both adding wheat fiber and oat fiber influence linearly in the  $L^*$  parameter, and the higher the addition of larger fibers higher the luminosity of the sample.

In parameter  $b^*$ , the standard sample differed statistically from other ( $p > 0.05$ ). The formulation with the addition of 3% of OF had significant difference with the formulation of 6% of OF. And the formulation with addition of 4.5% was not statistically different from the other samples with fibers. Thus, it was found that the higher the addition of OF, the greater the intensity of the brown color.

Table 4: Mean scores of sensory analysis by testing for multiple comparisons

Formulation	Average Scores
<b>3%</b>	2.87 ± 1.26 <sup>a</sup>
<b>4.5%</b>	2.70 ± 1.22 <sup>a</sup>
<b>6%</b>	2.96 ± 1.08 <sup>a</sup>

Means with the same letters in the same column indicate no difference at 5% by Tukey test.

The results obtained in the sensory analysis, specifically for multiple comparisons can be

seen in Table 4, indicating that the three formulations are equal ( $p = 0.549$ )

For the attributes of color, flavor and texture no significant difference ( $p < 0.05$ ) between samples of breaded chicken with addition of OF were observed. However, juiciness attribute the tasters noted difference between the samples at 5% significance. It was observed that a higher fiber addition, the higher the score given by the panel, being a score 1 the best and a score 5 worst value in the range of multiple comparison to a reference (R). Bortoluzzi (2009) [7] also found that products made with the highest concentration of orange fiber in bologna are often more dry. It can be observed from Figure 1 that formulation with addition of 3% of OF, presented the highest scores in all evaluated parameters, however, it was also not observed statistical difference among samples with added 4.5% and 6% of Oat Fiber (OF).

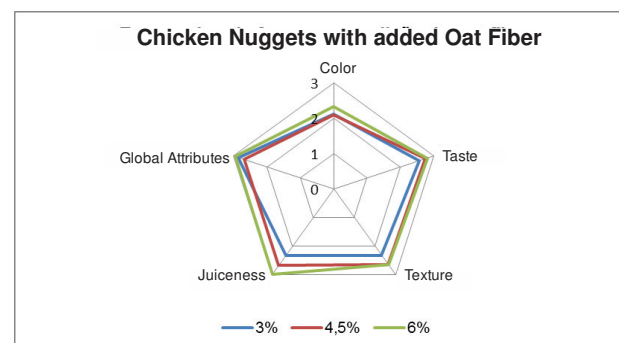


Figure 1 Average scores obtained by Multiple comparison for breaded chicken (nuggets) added with 3%, 4.5% and 6% of OAT FIBER.

#### IV. CONCLUSION

The data obtained in the development of this study indicate:

- The chemical composition of the samples with addition of Oat Fiber met the criteria required by Brazilian legislation;
- The formulation with addition of 6% Oat Fiber impact on the coloring of the final product, and interfered with the succulence of chicken nuggets;
- All formulations showed good acceptability and indicated excellent purchase intent for formulations 3% and 4.5%.

This work has proved to be possible develop formulations of restructured products with great acceptance, and showed good behavior with addition of OF. However, many variables must be evaluated if there is industrial scale production. An economic evaluation involving all areas must be performed in order to check availability of raw materials, target consumer, packaging and distribution system. These factors should be carefully evaluated to not impact the cost and sales of products, which could contribute to the success of the final product.

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