PROTEIN CONCENTRATE FROM THE BLACK CAIMAN RESIDUES: NUTRITIONAL POTENTIALITIES

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ABSTRACT - Industrial residues of fish and exotic meat chains, such as crocodilian, can be useful for the development of new products. Accordingly, the residues of Black caiman (Melanosuchus niger) from the Brazilian Amazon region were used in a protein concentrate (PC) and characterized. The PC was prepared from meat residues and NaCl (1.5%) using an adiabatic system. The PC presented protein content of 60.00% and the level was according to the Brazilian regulations for fish flour. The oil fraction presented 1.5% of acidity. The PC seems to be useful as emulsifier or raw material for other products. On the other hand, further studies are necessary to determine their functional properties.

KEYWORDS: crocodilian; Ash; fish flour; meat flour

1. INTRODUCTION

The Amazon region is an important source of raw materials of high nutritional value with commercial exploitation. The fish trade market, for example, is of great importance to provide income to the local population and to meet the needs of consumers seeking mainly to add protein source to their diets. Although this is, a production chain based on frozen products, the residues generated during processing are usually discarded. However, these residues could be used in the production of other fish products, such as flour, silage, or protein concentrate (PC). Rebouças et al. (2012) states that fish PC is a by-product from fish processing that has emerged as an alternative to the use of mechanically separated meat (MSM). In the Amazon region, the fish PC popularly known as "fish flour" is produced in a natural drying process using fish residue raw material or the whole fish, resulting in a dehydrated product with an average protein content of 70% of optimal digestibility (Nunes et al., 2013). The Acari-Bodo (Liposarcus pardalis) flour, known as piracu, is considered the most typical fish flour (Lourengo et al., 2011) and an important nutritional source in some locations where intake is 6.1g/day per capita (Cerdeira et al., 1997). Piracu protein content is around 70%, which is higher than that of the PC of other fish species, ranging from 57.4% to 77.8 g (Murueta et al., 2007). Like fish, caiman meat is a good protein source of the Amazon region raw to obtain PC because besides being exotic and having high market value, it has higher protein content than other meats. For example, the average of protein content of the tail fillet, a commercial cut of the Black caiman (Melanosuchus niger) is 17.79% (Kluczkovski Junior et al., 2015). Residues generated during processing could be used for new product development. Investigating the meat flour from Yacare Caiman’s viscera, Romanelli and Felicio (1999) found average protein content of 39.76%, which is considered good nutritional quality and thus it can be used as raw
material in other formulations. In order to study the residues of the Black caiman meat processing, the PC was prepared in order to evaluate the nutritional characteristics of the product and the oil fraction.

2. MATERIAL AND METHODS

2.1 Raw Material: meat residues (without bones) of Black caiman processing were used. Black caimans were captured and slaughtered in their natural environment (Sustainable Development Reserve of Piagaçu-Purus, in Beruri and Codajás, AM, Brazil) in the high water level season. The official authorization was granted by the Brazilian Institute for the Environment and Renewable Natural Resources - IBAMA (14498-1/2008). The PC was prepared according figure 1. Edible muscle portions were cooked in 100°C water/20 min. Sodium chloride (1.5%) was added, and the material was placed in an adiabatic heating system; the water was evaporated under continuous stirring at speed of approximately 40 rpm (65-70 °C for 4h). The product was vacuum packed in metallized film and stored at room temperature (±25°C). The samples were minced using an industrial blender until homogeneous mass was obtained, and oil fraction extracted by Soxhlet.

Figure 1. Flowchart of the Black caiman protein concentrate production

2.2 Physicochemical characterization: moisture content, ash, lipids and protein were evaluated according to AOAC (2005). The results were expressed as percentages of dry matter (DM). The oil was extracted and evaluated concerning, acidity expressed as oleic acid, density and viscosity.

2.3 Statistical analysis: the samples analyzed in triplicate were compared using analysis of variance and the Student’s t-test (descriptive statistics) with error rate classification to obtain standard deviation of significance level of 5% (p ≤0.05).

3. RESULTS AND DISCUSSION

According to the results in Table 1, the mc average of the PC was 6%. In previous work Romanelli and Schmidt (2003) reported the mc average ranging from 2.40 to 3.82% in meat flour from Yacare Caiman’s. In their work the viscera were dried in an oven for10 hours. In the present study, adiabatic heating was used, the drying time was shorter (4 hours), and the material was previously cooked and not milled can explain this difference.
Table 1. Composition of the protein concentrate of Black caiman.

<table>
<thead>
<tr>
<th>Parameters %</th>
<th>Protein Concentrate</th>
<th>Brazilian legal limits¹</th>
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<tbody>
<tr>
<td></td>
<td>Black caiman²</td>
<td>Yacare caiman³</td>
<td></td>
</tr>
<tr>
<td>Moisture content</td>
<td>6.20±0.01</td>
<td>2.40-3.62</td>
<td>10% Mín ³</td>
</tr>
<tr>
<td>Crude protein</td>
<td>60.00±0.15</td>
<td>36.64-63.44</td>
<td>65% Mín.⁵</td>
</tr>
<tr>
<td>Lipids</td>
<td>0.54±0.01</td>
<td>22.26-52.51</td>
<td>10% Máx.</td>
</tr>
<tr>
<td>Ash</td>
<td>0.90±0.01</td>
<td>2.36-12.40</td>
<td>NI⁷</td>
</tr>
</tbody>
</table>

¹ Brazil (1952); ² Residues (edible part) from process of wild animals; Values expressed in Dry matter; average±standard deviation; ³ Data from Romanelli and Schmidt (2003); PC from animals in captivity; ⁴ Flour classified as “first quality”; ⁵ maximum; ⁶ minimum; ⁷ not informed; ⁸ expressed in NaCl.

Even though, the level of mc is within the acceptable limits established by law (Brazil, 1952), and the term “meat flour” or “fish flour” is the best choice of a term to rate the product in terms of official nutritional parameters. The average protein content (60.00%) was considered satisfactory to characterize the PC as a product that meets the quality standards for “first quality” fish flour. Romanelli and Schmidt (2003) also found similar protein content for the meat flour from Yacare Caiman’s viscera, ranging from 36.84 to 63.44%. The ash content of the PC (0.90%) was lower than that previously reported by Fernandes et al. (2015) of 26.42%. They produced a meat flour from Pantanal alligator (Caiman crocodilus yacare) and in their work, they used solid parts (bones+ meat) and 2% of salt and 0.5% of other dehydrated sausages. In our work the bones were not used in the PC production, consequently, our findings did not exceed the limit established by law for ashes. It actually occurs for different products in the Northern region in Brazil due to an excessive addition of salt during artisanal processing. Nunes et al. (2013), who evaluated piracuí fish flour and found an average ash content of 12.91%, reported such situation. The lipid content (0.54%) was lower than that previously reported for Yacare caiman (22.26%), but it is within the limits established by law. The difference in lipid content can be explained by the type of animals, since Black caiman is not bred in captivity and meat composition depends on environmental variables, such as seasonal availability and access to food in different seasons. Góes et al. (2016) found an average of 59.45% of crude protein in tilapia PC and it was used in the composition of fresh pasta. In this context, the Black caiman PC showed level about 60% and can be useful as raw material for soups or ingredient in other products, such as nuggets produced by Souza et al. (2010) from Nile tilapia (Oreochromis niloticus).

The contents of the oil extracted from the Black caiman residues are presented in table 2 and were similar to those of most fish oils. The value of acidity expressed as oleic acid was 1.50%, which is below the acceptable limit (3%) established by the Brazilian law for fish oil (Brazil, 1952). It can be said that the conservation status of the oil is closely related to the nature and quality of raw material, purity, processing, and especially storage conditions. The density was 0.95 g/mL and Kusmiyati et al. (2016) evaluated oil fish waste and found similar value of 0.8822 g/mL. The viscosity was about 20.15, below the limit reported by Bimbo (1998) of viscosity of 60-90 in crude fish oils. Our low results can be explained by the extraction method with solvent. For future work we suggest the super critical extraction method.

Table 2. Black Caiman oil properties

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Results</th>
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<tbody>
<tr>
<td></td>
<td>Average</td>
</tr>
<tr>
<td>Acidity⁶</td>
<td>1.50 ± 0.05</td>
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<tr>
<td>Density⁷</td>
<td>0.95 ± 0.01</td>
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4. Conclusion

The protein content of Black caiman PC is within the limits allowed by the Brazilian regulation. Due to its low moisture content, it can enhance food stability for human consumption. The PC can be used as emulsifier or as an ingredient for new food products such as dehydrated soups. The oil seems to be a potential source for been commercially explored as other fish oils. Further studies are necessary in order to determine digestibility, shelf life and other functional properties of the products obtained for future applications.

REFERENCES


Gaithersburg.


