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Chemical composition of commercial cuts of pirarucu (Arapaima gigas) processed in different weight classes in the Western Amazon

The tropical fish are a food source rich in nutrients, including proteins of high biological value. The fish is present in society's eating habits due to its numerous benefits. Therefore, it is important to know the nutritional components present in the musculature of the fish, this will promote its commercialization and reach more demanding markets, in addition to promoting public health and well-being through its regular consumption. The aimed of this study was to evaluate the chemical composition of commercial cuts of pirarucu (Arapaima gigas) processed in different weight classes. The sample collections were carried out in fish processing units in the state of Rondônia, Brazil. The data were obtained from 77 fish in five weight classes and their commercial cuts evaluated for chemical composition. The Kruskal-Wallis test (a=0.05) was used to compare the averages. The crude protein content of filet mignon increased (p<0.05) with increasing weight. However, the highest lipid content, 6.04%, was in Class 3. The tail filet showed no difference (p>0.05) between the weight classes for mineral content and total lipids. The total lipid levels did not vary between weight classes (p>0.05). The moisture content decreased with increasing body weight. Among the weight ranges with good commercialization, class 4 stands out (14.1 to 18 kg). Among the weight ranges with good commercialization, class 4 (14.1 to 18 kg) stands out, since it presented satisfactory values of proteins and lipids and a good percentage of mineral matter. In other words, it was the most efficient category for production and marketing.

Keywords: Bromatological evaluation; Centesimal composition; Crude protein; Lipids; Mineral matter.

Composição química de cortes comerciais de pirarucus (Arapaima gigas) processados em diferentes classes de peso na Amazônia Ocidental

Os peixes tropicais são uma fonte alimentar rica em nutrientes, inclusive em proteínas de alto valor biológico. O pescado está presente nos hábitos alimentares da sociedade devido aos seus numerosos benefícios. Por isso, é importante conhecer os componentes nutricionais presentes na musculatura do pescado, isso fomentará sua comercialização e alcançará mercados mais exigentes, além de promover saúde pública e bem-estar através de seu consumo regular. O objetivo desse estudo foi avaliar a composição química de cortes comerciais de pirarucu (Arapaima gigas) processados em diferentes classes de peso. As coletas de amostras foram realizadas em unidades de processamento de pescado no estado de Rondônia, Brasil. Foram obtidos dados de 77 peixes em cinco classes de peso e seus cortes comerciais avaliados quanto à composição química. O teste de Kruskal-Wallis (a=0,05) foi utilizado para comparar as médias. O teor de proteína bruta do filé mignon aumentou (p<0,05) com o aumento do peso. No entanto, o maior teor de lipídios, 6,04%, foi na classe 3. O filé cauda não apresentou diferença (p>0,05) entre as classes de peso para teor de minerais e lipídios totais. Os níveis de lipídios totais não variaram entre as classes de peso (p>0,05). O teor de umidade diminuiu com o aumento do peso corporal. Dentre as faixas de peso com boa comercialização, destaca-se a classe 4 (14,1 a 18 kg), uma vez que apresentou valores satisfatórios de proteínas e lipídios e bom percentual de matéria mineral. Ou seja, foi a categoria mais eficiente para produção e comercialização.

Palavras-chave: Avaliação bromatológica; Composição centesimal; Lipídios; Matéria mineral; Proteína bruta.

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Jucilene Cavali
Universidade Federal de Rondônia, Brasil
http://lattes.cnpq.br/3950218993166956
http://orcid.org/0000-0002-2069-4543
jcavali@unir.br

Carla Taveira Nunes
Universidade Federal de Rondônia, Brasil
http://lattes.cnpq.br/9253415895937837
http://orcid.org/0000-0001-7494-5670
nutricao@facsaopaulo.edu.br

Jerônimo Vieira Dantas Filho
Universidade Federal do Acre, Brasil
http://lattes.cnpq.br/9897986496945784
http://orcid.org/0000-0002-5965-9438
jeronimovdantas@gmail.com

Beatriz Andrade Nóbrega
Universidade Federal de Rondônia, Brasil
http://lattes.cnpq.br/1666134751198857
http://orcid.org/0000-0003-2713-3295
policarpoandrade@gmail.com

Rute Bianchini Pontuschka
Universidade Federal de Rondônia, Brasil
http://lattes.cnpq.br/0019860541206945
http://orcid.org/0000-0002-3789-1252
rutepont@unir.br

Maria Luiza Rodrigues de Souza
Universidade Estadual de Maringá, Brasil
http://lattes.cnpq.br/8419428271315171
http://orcid.org/0000-0003-1135-6443
mlrsouzauem@gmail.com

Marlos Oliveira Porto
Universidade Federal de Rondônia, Brasil
http://lattes.cnpq.br/0604395200725977
http://orcid.org/0000-0002-9398-0065
marlosporto@unir.br

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INTRODUCTION

The production of fish in captivity has reached high importance as an alternative source of animal protein and other nutrients, which provide multiple beneficial effects for the population's health, balancing important physiological factors and representing a valuable diotherapeutic complement (OLIVEIRA et al., 2014; HONORATO et al., 2014). The fish meat in general is rich in amino acids, and an important source of fatty acids, proteins and minerals (LIMA et al., 2018). It has characteristics such as easy digestibility due to proteins of high biological value (BATALHA et al., 2019).

The pirarucu *Arapaima gigas* (SCHINZ, 1822) belonging to the Actinopterygii class, order Osteoglossiformes and family Arapaimidae, occurs naturally in the Amazon River basin (SILVA et al., 2016). In the wild, the species can reach up to 3 meters in length and weight over 200 kg (OLIVEIRA et al., 2014; SILVA et al., 2016). It has records of its commercialization for the human diet since the beginning of the 19th century, mainly in the form of charqueado pieces, that is, salted and dried (SILVA et al., 2016). Since then, it has been exploited by fishermen, fish farmers and local residents, such as riverside dwellers (NUNES et al., 2012). However, its consumption is still discreet due to the low processing rate, product characterization, adequate standardization, lack of health and nutritional information, among other aspects that prevent the promotion of its trade (MARTINS et al., 2017; CAVALI et al., 2020).

It is essential to know the body composition of fish to encourage and promote consumption, allowing its dissemination as a biological value protein (BATALHA et al., 2019), adding commercial value and diversifying the processing of native species in the Amazon (NUNES et al., 2012; MEANTE et al., 2017). Addressing the aspect of the elaboration of new products and by-products originating from fish justifies that, for constant consumption it is essential that different forms of presentation are available to the consumer, proceeding in greater options of choice (BORDIGNON et al., 2012).

The pirarucu has requirements typical of consumer favorite fish, such as white meat with a firm texture, delicate flavor and easy filming, and few intramuscular spines (HONORATO et al., 2014). In recent years, crops for the production of pirarucu on a commercial scale have emerged, aiming to achieve promising and very profitable markets (MEANTE et al., 2017; MARTINS et al., 2020). Therefore, not knowing the chemical composition in your commercial cuts, in different weight classes makes marketing difficult. The advance in the search for fish consumption is associated with changes in the eating habits of the population, which increasingly seeks nutritionally balanced and healthy food, with the intention of increasing the quality of life and promoting health, with an increasing appreciation being observed increasing consumption of fish (BRABO et al., 2016).

The state of Rondônia is the largest producer of native fish in Brazil, accounting for 47.5% of the production of a total of 68.8 thousand tons of native fish in 2019. The state of Rondônia has the potential for creating and processing pirarucu, and the slaughterhouses and new processing units have been expanded (FERREIRA, 2016). However, it is still an incipient market in terms of accessibility to importers and added value to meat, due to the lack of product standardization and nutritional information. Knowing the chemical composition of commercial cuts allows assessments of the effectiveness in nutritional transfer and also of the technical and technological averages to be used for the best processing, in addition to adding commercial value and diversifying the processing of native species from the Amazon (OLIVEIRA et al., 2019). It is important to know the nutritional composition of the fish, especially the nutritional value of the cuts most consumed by the population, so that the commercial value is valued and recognized. In addition to nutritionally categorizing the weight ranges of pirarucu for commercialization, in order to ensure safe information to the consumer.

The aimed of this study was to evaluate the chemical composition of commercial cuts of filet mignon, tail filet, loin and pirarucu deboned (*Arapaima gigas*) of different classes of body weight marketed in the Western Amazon.

MATERIALS AND METHODS

This study was conducted by the Physico-chemical and Microbiological Analysis Laboratory of the Universidade Federal de Rondônia (UNIR), with the support of the Rondônia Research Support Foundation (FAPERO) and approved by the Ethics Committee on the Use of Animals (CEUA) with protocol number 02/2017. The sample collections were carried out from May 2017 to December 2018 at two fish processing units in the state of Rondônia, in the municipalities of Ariquemes and Vale do Paraíso. Both registered in the Brazilian System for the Inspection of Products of Animal Origin (SISBI-POA).

The seven classes of body weight were defined for the pirarucu in relation to body weight, class 1: below 8 kg; class 2: from 8.1 to 11 kg; class 3: from 11.1 to 14 kg; class 4 from 14.1 to 18 kg; class 5: from 18.1 to 23 kg; class 6: from 23.1 to 32 kg; class 7: over 32 kg. Were 77 pirarucu with body weight ranging from 4.7 kg to 48.2 kg were studied. From these classes, the commercial cuts of filet mignon, tail filet, loin and deboned cut were evaluated, making 8 to 10 fish per commercial cut destined to the analysis of the chemical composition.

The sampled specimens were selected from fish farms previously characterized, excluding batches of production systems that adopted productive management very different from that adopted in fish farms, such as reports of parasite infestations, deaths from high stocking densities, malnutrition, among others. The fish were removed from the tanks through a fishing net, and then went through the process of stunning by concussion, followed by exsanguination by section of the carotid veins, according to procedures adopted by the respective units of fish processing. In the processing industry the fish were washed, gutted and processed in commercial cuts according to market demand.

The initial processing step was performed on the evisceration table, with the procedure of removing the skin with scales, removing the head and viscera. In definition, the loin is located in the upper part of the deboned, the filet mignon is the largest meat part that covers the ribs and the tail filet is located in the caudal portion of the deboned cut (Figure 1).

The samples destined to the analysis of the chemical composition were obtained from the homogenization of three points of the commercial cut in order to obtain greater representativeness. The deboned cut were sampled by removing 4 cm from the right side of the carcasses (Figure 1), and 3 cm of samples were removed for analysis. The samples were properly identified and stored at -18°C for further processing and analysis of the chemical composition. They were left labeled and frozen in a freezer at -18°C until the moment of chemical composition analysis.

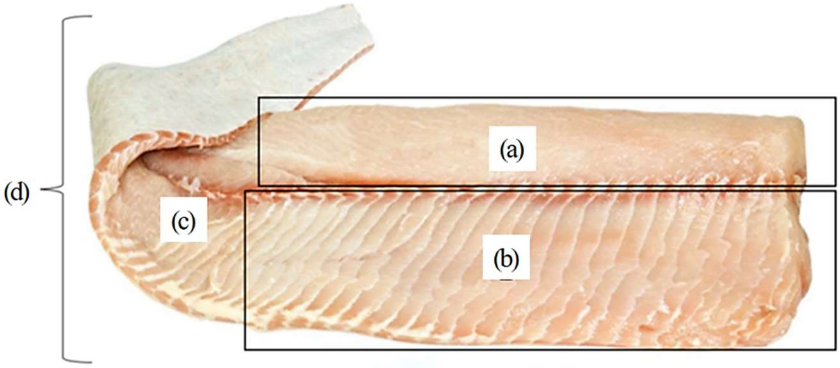

Figure 1: Representation of commercial cuts of pirarucu (*Arapaima gigas*) produced in processing industries in the Amazonian state of Rondônia, Brazil: (a) Loin; (b) Filet mignon; (c) Tail filet; (d) Deboned.

The samples of the commercial cuts were weighed and stored at 5°C for 12 hours, were cut into 1 cm^2 pieces, placed in previously weighed and identified aluminum pots, and frozen at - 20ºC for 48 hours. And, to evaluate the chemical composition, a LIOTOP L101 lyophilizer was used for 44 hours. In the chemical composition evaluation, freeze-drying was carried out to obtain the dry matter, mineral matter and crude protein content according to Detmann et al. (2012). To evaluate the total lipids, 3.5 g of the lyophilized sample were used and the lipids were extracted using ethanol and chloroform.

The experimental design was completely randomized with four commercial cuts of seven weight classes for the processing of pirarucu, the processing being carried out in triplicate. First, the data were conducted to the Shapiro-Wilk and Levene test ($\alpha=0.05$), to verify normality and homogeneity, then the Kruskal-Wallis ($\alpha=0.05$) test was used for the non-parametric analysis test to compare the averages of chemical composition between weight classes and commercial cuts. The software used to perform the statistical analyzes was the Genes Program made available by Universidade Federal de Viçosa (UFV), version 13.3 (CRUZ, 2013), it is worth mentioning that the R statistical program was linked to facilitate the interpretation of the results.

RESULTS

The chemical composition of commercial pirarucu cuts in the body weight classes was composed of 6 to 1.43% mineral matter, 17.47 to 28.93% crude protein, 1.12 to 5.10% lipids totals 68.50 to 78.82% of humidity (Tables 1 to 4). The crude protein content of the filet mignon increased ($p<0.05$) with the increase in the animals' body weight, from 18.5 to 23.7% of crude protein (Table 1). The maturity of the fish suggests fabrics with less moisture and a higher lipid content, higher concentration of collagen fibers and stronger meat texture. However, in this study there was no variation in the moisture content of the filet mignon ($p>0.05$).

The filet mignon is the commercial cut represented by the central portion of the fish, removed from the central spine. The intramuscular spines separate from the loin, being free of the fins and viscera for a better finish. The filet mignon is used in cooking as shredded baits and in forms of filets, depending on the cooking process, which is well appreciated in fried foods, roasts and sauces. Among the commercial cuts considered noble, this commercial cut has greater commercialization and higher fat content ($p<0.05$).

The pirarucu filet mignon showed no differences ($p>0.05$) in terms of mineral content and moisture in different classes of body weight. However, lipid levels fluctuated between classes of body neck ($p<0.05$). The class 3 stands out, containing fish from 11 to 14 kg of body weight that had the highest total lipid content, 6.04%, which may be related to the diet of fish grown in a production system managed for annual slaughter (Table 1). In the state of Rondônia, annual cultivation in dug tanks predominates with a reduction in the protein : energy ratio of the diets with advancing age and slaughter at 12 to 14 months of age, a period in which there is a new supply of fry for replacement. Thus, fish that escape the annual cultivation system are the result of undesirable management because they have not gained weight efficiently and enter subsequent years under environmental fluctuations, especially regarding water quality, considerably affecting the quality of the meat.

Table 1: Chemical composition (g/100g) of commercial filet mignon of pirarucu (*Arapaima gigas*) according to body weight classes.

Weight classes	Mineral matter[1]	Crude protein	Total lipids	Moisture	*n*
1 (below 8 kg)	1.07 b	18.56 b	5.10 a	75.25 a	9
2 (8.1 to 11 kg)	1.05 b	19.11 ab	4.50 ab	75.84 a	7
3 (11.1 to 14 kg)	1.12 a	20.54 ab	6.04 a	72.28 b	8
4 (14.1 to 18 kg)	1.15 a	19.54 ab	4.57 ab	74.72 a	8
5 (18.1 to 23 kg)	1.06 b	19.71 ab	2.10 b	75.11 ab	6
6 (23.1 to 32 kg)	1.04 b	22.25 ab	3.35 b	73.34 ab	5
7 (over 32 kg)	1.16 a	23.77 a	3.21 b	71.85 b	7
C.V.(%)[2]	16.58	17.76	54.65	5.41	-

In each column having averages followed by different letters (a, b) differ by the Kruskal-Wallis test ($p<0.05$). [1]Mineral material: total iron, sodium, potassium, calcium and magnesium. [2]C.V. - coefficient of variation.

The commercial cut of the tail filet showed no difference ($p>0.05$) between the weight classes for the levels of mineral matter and total lipids, with averages of 1.09% and 4.12%, respectively (Table 2). However, the cut moisture and crude protein contents were inversely proportional ($p<0.05$). The average protein content increased by 5, from 19.2 to 24.09%, as the moisture in the tail filet decreased by 6, from 77.6 to 71.86%, according to the higher the body weight class. It is important to highlight that classes 1 and 2, given by fish below 11 kg, differed ($p<0.05$) in terms of crude protein and moisture content of commercial cut, compared to class 7, given by fish over 32, 0 kg of body weight ($p<0.05$) (Table 2). It can be inferred that the maturity provides less tender meat and a higher concentration of nutrients due to the higher dry matter content.

The tail filet is the commercial cut represented by the final portion of the fish, with very heterogeneous musculature, removed from the central spine. It is denominated by some authors like filezinho of the tail or filet of the tail. Used in cooking as shredded baits and in the form of filets, it can be according to cooking, well appreciated in fries, roasts and sauces. Among the cuts considered noble, it is the one with the greatest stiffness of the meat.

Table 2: Chemical composition (g/100g) of commercial tail filet of pirarucu (*Arapaima gigas*) according to body weight classes.

Weight classes	Mineral matter[1]	Crude protein	Total lipids	Moisture	*n*
1 (below 8 kg)	0.98 b	19.20 ab	2.20 b	77.59 a	9
2 (8.1 to 11 kg)	0.96 b	17.47 b	2.74 a	78.82 a	7
3 (11.1 to 14 kg)	1.12 b	20.32 ab	3.20 a	75.34 ab	8
4 (14.1 to 18 kg)	0.97 b	20.21 ab	2.36 ab	76.44 ab	8
5 (18.1 to 23 kg)	1.15 ab	20.72 ab	3.24 a	74.87 b	6
6 (23.1 to 32 kg)	1.21 a	21.54 ab	3.05 a	74.18 b	5
7 (over 32 kg)	1.03 b	24.09 a	3.00 a	71.86 b	7
C.V.(%)[2]	19.85	17.16	52.65	5.08	-

In each column having averages followed by different letters (a, b) differ by the Kruskal-Wallis test ($p<0.05$). [1]Mineral material: total iron, sodium, potassium, calcium and magnesium. [2]C.V. - coefficient of variation.

The pirarucu loin is a commercial cut considered thin and valued by consumers due to the low levels of total lipids and ease in standardizing the dishes. The lipid contents did not vary between weight classes ($p>0.05$), however they presented average values of 1.89%, well below the lipid contents presented by the other commercial cuts of the species, being tail filet, the filet mignon and deboned cut with 2.82, 4.05 and 2.90%, respectively. The levels of crude protein and mineral matter showed a linear trend, increasing with the reduction of tissue moisture with the increase in body weight or animal maturity (Table 3). Therefore, when it comes to shelf life, cooking performance and protein values, the loin cut stands out in heavier animals. The tender loin is the commercial cut represented by the upper portion of the fish, with very homogeneous musculature, removed from the central spine, and the intramuscular spines that make their separation with the filet mignon and free from the fins and viscera for a better finish. Used in cooking as bait, shredded and in pieces, and can be according to cooking, well appreciated in fries, roasts and sauces, considering a noble cut and of high commercial value.

Table 3: Chemical composition (g/100g) of commercial loin of pirarucu (*Arapaima gigas*) according to body weight classes.

Weight classes	Mineral matter[1]	Crude protein	Total lipids	Moisture	*n*
1 (below 8 kg)	1.05 ab	18.40 b	1.95 ab	78.59 a	9
2 (8,1 to 11 kg)	1.09 ab	19.73 b	2.60 a	76.56 a	7
3 (11,1 to 14 kg)	1.01 b	18.49 b	2.29 a	78.19 a	8
4 (14,1 to 18 kg)	1.06 ab	19.71 b	2.09 ab	77.13 a	8
5 (18,1 to 23 kg)	1.08 ab	19.30 b	1.71 b	77.89 a	6
6 (23,1 to 32 kg)	1.33 a	24.19 ab	1.47 b	72.98 ab	5
7 (over 32 kg)	1.43 a	28.93 a	1.12 b	68.50 b	7
C.V.(%)[2]	21.08	22.77	60.25 a	6.30	-

In each column having averages followed by different letters (a, b) differ by the Kruskal-Wallis test ($p<0.05$). [1]Mineral material: total iron, sodium, potassium, calcium and magnesium. [2]C.V. - coefficient of variation.

The commercial cut of deboned differed from the other cuts analyzed because it showed differences ($p<0.05$) between weight classes in all evaluated nutrients. The moisture content decreased with the increase in body weight as the levels of crude protein increased, from 18.7 to 25.6%, and mineral matter, from 1.04 to 1.21%. The total lipid content was higher in class 3 (from 11 to 14 kg) 3.84%, higher than class 5 (from 18.1 to 23.0 kg) 2.36% (Table 4). The deboned, as it is a complete commercial cut, which covers the bodily regions: the ventral and the dorsal regions, both in isolation with large discrepancies in the lipid content and which, from a technological point of view, is important for the product's shelf life, because oxidation of lipids leads to the production of undesirable organic compounds in the fatter sections.

Table 4: Chemical composition (g/100g) of commercial Deboned cut of pirarucu (*Arapaima gigas*) according to body weight classes.

Weight classes	Mineral matter[1]	Crude protein	Total lipids	Moisture	*n*
1 (below 8 kg)	1.04 b	18.72 b	3.08 ab	77.14 a	9
2 (8.1 to 11 kg)	1.03 b	18.77 b	3.10 ab	77.08 a	7
3 (11.1 to 14 kg)	1.09 ab	19.79 b	3.84 a	76.62 a	8
4 (14.1 to 18 kg)	1.06 ab	19.82 b	3.01 ab	76.10 a	8
5 (18.1 to 23 kg)	1.10 ab	19.91 b	2.36 b	75.27 a	7
6 (23.1 to 32 kg)	1.20 a	22.66 ab	2.62 b	73.51 ab	6
7 (over 32 kg)	1.21 a	25.60 a	2.45 b	70.74 b	7
C.V.(%)[2]	23.01	31.69	66.53	7.31	-

In each column having averages followed by different letters (a, b) differ by the Kruskal-Wallis test ($p<0.05$). [1]Mineral material: total iron, sodium, potassium, calcium and magnesium. [2]C.V. - coefficient of variation.

DISCUSSION

According to the study by Costa et. al. (2014) they stated that the chemical composition of a fish depends on factors related to the species and the environment, in addition to the time of year, the quantity and quality of the food consumed, the stage of sexual maturation, age and body fraction. Fogaça et al. (2011) in their study showed an average value of 76.39% of humidity in pirarucu at 12 months, in the same cuts, in turn, Maciel et. al. (2014), when evaluating the chemical composition of fresh filets sold at a municipal fair, in the city of Belém, PA-Brazil, find an average of 79.58% for moisture.

The chemical composition of three commercial pirarucu cuts obtained average lipid values of 3.08%, 0.63% and 0.30 for filet, tail filet and loin, respectively (ROSA et al., 2020). The authors highlighted the relation between moisture content and fat concentration in commercial cuts. In the pirarucu, it is noted in the composition of filets and other body fractions, that the species has a wide difference ($p<0.05$) in terms of lipid content between the back, abdominal regions and belly, a fact that from a technological point of view needs more caution in the cleaning process, since the total lipid content is related to the commercial validity of meat food, especially fish, because its deterioration happens at an accelerated rate (NUNES et al., 2012; BATALHA et al., 2019).

Oliveira et al. (2014) compared the chemical composition of fresh, salted and dry pirarucu and demonstrated that after using the salting and drying processes, there was an increase in the concentration of crude protein, total lipids and mineral matter ($p<0.05$) by nutrient concentration effect of water removal. The average values for the ventral region of the pirarucu with 76.89% humidity were also highlighted; 18.21% crude protein; 3.20% of total lipids and 1.09% of mineral matter. There was also a variation of 0.2% of lipids between the initial and final portion of the womb, making a reservation in relation to the high lipid contents of this commercial cut, presenting greater perishability and care in conservation (OLIVEIRA et al., 2014).

Oliveira et al. (2014) observed moisture content of 79.5 and 77.9%, crude protein content 17.6 and 16.1%, total lipids 0.6 and 2.5% and minerals 0.9 and 0.8% for cuts of belly (filet mignon and loin) of pirarucu originating from fish farming, respectively. Fogaça et al. (2011) and Martins et al. (2020) described 75.0 and 75.5% moisture, 20.1 and 21.4% protein, 3.0 and 2.6% total lipids and 1.5 and 0.9% mineral matter in caudal portion of the fish, information that corroborates that the present study. Honorato et al. (2014) indicated an average of 22.07% crude protein, with specimens of animals grown. And yet, the same authors found that the fish diet is one of the decisive factors in altering the nutritional values presented in the chemical evaluation of the fish.

The commercial loin cut had lower lipid values, between 1.99 and 2.47%, compared to the other commercial cuts from the belly, with 3.99 and 4.13%. The weight classes slightly influenced the chemical composition, but caused variations in the thickness and loin area and, therefore, influenced entirely in the industrialization processes of this species. Because, some specimens show fat deposition more sharply, starting from a certain weight, when coming from fish farms (NUNES et al., 2012; BATALHA et al., 2019).

The deboned cut is the commercial cut represented by the muscular areas of the loin, belly and tail, with very heterogeneous musculature, removed from the central spine, and the intramuscular spines and free of the fins and viscera for a better finish. The filet mignon, filet of the tail and loin are formed from its dismemberment. Used in cooking as baits, shreds, filets and slices, it can be according to cooking, well appreciated in fries, roasts and sauces. Despite its high nutritional value, the deboned cut as well as the other commercial cuts of pirarucu is a highly perishable food due to its biochemical composition, pH close to neutral, high water activity and the presence of a natural microflora with potential for deterioration (DARVISHI et al., 2013).

Martins et al. (2017), demonstrated that values of humidity (52.2 to 78.2%), crude protein (17.8 to 25.8%), total lipids (1.0 to 17.1%) and mineral matter (0.9 to 1.2%) varied between commercial cuts and age. The observed variations can be attributed to aspects such as sex, age of the animal, species, diet, seasonality and source of capture (MELO et al., 2019), especially the muscular portion analyzed. Martins et al. (2017) demonstrated that the distribution of the total lipid content was assessed as not homogeneous, but expressed greater lipid content in the ventricle area, suggesting that this region is the area of the deboned cut of the largest fat deposit of the pirarucu. Therefore, the region of the deboned cut considered as filet mignon, in the ventrecha portion is the area with the lowest moisture content. Jensen et al. (2013) found a similar composition in cod fish grown with 78.0% moisture, 18.6% crude protein, 1.0% total lipids and 1.3% mineral matter. Concerning the lipid content, the lipid percentage of the fat deposit area in pirarucu (*Arapaima gigas*) showed 8.4% of polyunsaturated fatty acids, 48.9% of monounsaturated fatty acids and 42.7% of saturated fatty acids, approximate values to other freshwater species such as piracanjuba (*Brycon orbignyanus*), piraputanga (*Brycon microlepsis*) and matrinxã (*Brycon cephalus*) (MARTINS et al., 2017).

As a comparison of commercial pirarucu cuts with 100g portions of other fish species. The pirarucu cuts of weight classes 1 to 5 (from 8 to 23 kg) have lower protein contents than the portions of salmon (*Salmo salar*) (27g/100g), cooked cod (*Gadus morhua*) (25g/100g), tuna (*Thunnus albacares*) (23g/100g) and Nile tilapia filet (*Oreochromis niloticus*) (21g/100g). However, commercial cuts of pirarucu in different weight classes have higher levels of lipids than these same portions, cooked cod (1g/100g), tuna (1g/100g) and Nile tilapia filet (1g/100g) (BABOLATO et al., 1994; USYDUS et al., 2011).

The pirarucu loin in weight class 7 (over 32 kg) has a higher protein content (28.93g/100g) than 100g portions of liver (17.00g/100g) and chicken leg (28.00g/100g) (TORRES et al., 2000; BASTIANELLI et al., 2010). Despite the pirarucu cuts have lower protein contents than most bovine and swine cuts, stiff legs (31.9g/100g), rump (31.8g/100g), against filet (35g/100g), steak (37 pigs, 5g/100g), pork loin (35.7g/100g) and rib (30.2g/100g), have higher levels of lipids, soft leg (1.34g/100g), rump (1.33g/100g), beef (1.95g/100g), rib (0.68g/100g) bovine and also superior to the 100g portions of wings (1.2g/100g) and chicken breast (0.62g/100g) (CUNHA, 2012).

Comparing the content of mineral matter (Tables 1 to 4), with the exception of class 5 (from 18.1 to 23 kg) of the loin cuts and tail filet and from classes 5 to 7 (from 18.1 to over 32 kg) of pirarucu filet mignon all other commercial cuts in the different classes have more mineral material than 100g portions of chicken breast and leg (1.2mg/100g), turkey breast and leg (1.2mg/100g), swine fat (0.7mg/100g) and beef fat (0.1mg/100g) (ROÇA, 2012).

As highlighted in the discussion of commercial tambaqui cuts, on the production of pirarucu, it is not interesting for the industry to sell very thin or even very fat fish (NUNES et al., 2012). Because the fat content is important for commercialization, because the good amount of lipids provides tenderness to the meat, but in excessive quantity it can cause health problems to the consumer (HAUTRIVE et al., 2012), because meats with large amounts of saturated fat are harmful due to the LDL cholesterol action in the body, that is, it loads the cholesterol particles from the liver and from other places to the arteries (SIQUEIRA et al., 2018).

However, fish fat is healthy when consumed properly because it has a balanced percentage of polyunsaturated fatty acids that are essential to human health, that is, human beings are not able to produce them. Examples are omega-3 (linolenic acid) and omega-6 (linoleic acid) (HAUTRIVE et al., 2012). The omega-3 fatty acid is found mainly in fish and fish oils. The pirarucu has in its meat an appreciable amount of omega-3 fatty acids (1376.1 mg/100 g of fresh muscle), such as C18: 3 (ALA), C20: 5 (EPA) and C22: 6 (DHA), essential for human health (MARTINS et al., 2017).

CONCLUSIONS

The class 7 (over 32 kg) stands out due to the excellent nutritional values found in different commercial cuts. In addition, this class had low humidity between commercial cuts, a variable that interferes with the cooking factor. However, it is not a weight category commonly processed and marketed. Among the weight categories with good commercialization, the class 4 (from 14.1 to 18 kg) stands out, since it presented satisfactory values of macronutrients such as proteins and lipids and a good percentage of mineral material. In other words, it was the most efficient category for production and marketing. The muscular zones of the pirarucu, such as the belly and the tail filet, presented similar compositions, however the lower region of the filet mignon, called the ventricle, presented lower humidity and higher total lipid content, being characterized as a fish fat deposit area. Concerning the market and consumption parameters, the class 4 also stands out, because its chemical levels are more interesting for the industry, as well as for wholesale and retail, and above all, for the consumer, since its nutritional attributes are presented available and satisfactory to the market.

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