

ENRICHED CEREAL BAR WITH RAY MEAT *Hypanus guttatus* (DASYATIDAE – MYLIOBATIFORMES) CAPTURED ON MARANHÃO STATE COASTAL

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ABSTRACT

Rays are world-class fish stocks, predominantly marine and tropical. The *Hypanus guttatus* ray, commonly known as a stingray and is one of the most caught species of elasmobranchs on our coast, however, most catches are seen as companion fauna. The objective of this work was to develop formulations for cereal bar innovations with the use of *Hypanus guttatus* ray meat to incorporate fish protein in a differentiated way in human food. Two types of cereal bars were prepared, one with granola [WG] and another no granola [NG], both enriched with ray pulp. Analyzes of centesimal composition (lipids, carbohydrates, ashes and proteins) were also performed. The cereal bar enriched with ray meat presented high protein (10.21 and 6.71%), low lipid content (2.57 and 3.02%) and was well accepted by the sensory panel, which included judges Aged between 18 and 57 years, with the granola treatment receiving an acceptance of 54.84% and no granola 45,16%. There are diversified ingredients in these bars and contain functional properties that make them ideal to be consumed as a daily snack.

Key words: rice flake, granola, functional food.

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BARRA DE CEREAIS ENRIQUECIDA COM CARNE RAIÃO *Hypanus guttatus* (DASYATIDAE - MYLIOBATIFORMES) CAPTURADA NO ESTADO DO MARANHÃO

RESUMO

As raias são recursos pesqueiros com distribuição mundial, predominantemente marinhos e habitantes de águas tropicais. A espécie *Hypanus guttatus*, comumente conhecida como raia bicuda é uma das espécies da ordem dos elasmobrânquios mais capturadas em nosso litoral, porém, na maioria das capturas vem como fauna acompanhante. O objetivo desse trabalho foi desenvolver formulações para inovações da barra de cereal com o aproveitamento da carne da raia da espécie *Hypanus guttatus* para incorporação de proteína de pescado de forma diferenciada na alimentação humana. Foram elaborados dois tipos de barras de cereal, uma com granola [CG] e outra sem granola [SG], ambas enriquecidas com polpa de carne de raia. Foram também realizadas análises de composição centesimal (lipídios, carboidratos, cinzas e proteínas). A barra de cereal enriquecida com carne de raia apresentou alto valor proteico (10,21 e 6,71%) e baixo teor lipídico (2,57 e 3,02%). Essas barras possuem ingredientes diversificados e contém propriedades funcionais que as tornam ideal para serem consumidas como lanche diariamente.

Palavras-chave: Floco de arroz, Granola, Alimento funcional.

1 INTRODUCTION

To increase fish consumption, value added was one of the attractive alternatives to be developed, thus seeking innovations in the processing of fish meat, not only using fillet, but also presenting ready-made products, pre-ready or by-products facilitating the day-to-day population. For the preparation of the cereal bar was used stingray beaked *Hypanus guttatus* an accompanying species captured accidentally

artisanal fishing and discarded for not being a species of commercial value (high) and there is still no specific information about their nutritional value.

The lack of recognition of the waste from fish processing industries as raw material and source for use in the development of other products generates the waste of large quantities of by-products (Pessati, 2001; Stevanato, Souza, Matsushita & Visentainer, 2007). In some cases, the production of waste comes to reach about 70% of the original weight of the raw material in aquaculture, fishing and fish processing during (Seibel & Souza-Soares, 2003).

The presentation form of Brazilian native fish for marketing limits consumption due to the lack of practicality and standardization of products (Bombardelli, Syperreck e Sanches, 2005). Fish-based products are foods with high nutritional value, digestibility proteins having around 90%, and are sources of calcium, unsaturated fatty acids and vitamin B complex (Kirschnik, 2007). The objective of this study was to prepare cereal bars enriched with fish protein, and this protein source is the guttatuas Hypanus ray meat.

2 METHODOLOGY

The samples were purchased directly from associated fishermen in the Fishing Colony of Raposa-MA, because they were classified as companion fauna, they would be discarded. The samples were conditioned in an isothermal box and transported to the Fish Technology Laboratory - LabTep at the State University of Maranhão under satisfactory hygienic conditions for processing, where morphometric measurements were obtained (CP - total length, AT - height and LG - width and PT - total weight), using ruler, tape measure and digital scale To obtain the fillet, a knife was used and horizontal cuts were made in the upper and lower musculature of the pectoral fin along the cartilaginous rays.. The skins were then removed, measuring the weight of the fillets with and without skin and packed in sealed plastic bags and allowed to freeze at 0 ° C for further processing. To obtain the flesh of the ray meat, the steaks were thawed in refrigerator for 24 hours and subjected to the cooking process at 95°C for approximately 5 minutes followed by cooling and separation of the cartilage and fillet fillet.

The cereal bar was elaborated in two formulations, Treatment 1 containing ray pulp, honey, granola, rice flake, fine oats, flaked oats, cinnamon and coconut oil, and in Treatment 2 only the granola was removed and an addition in greater quantity of

rice flake. To evaluate the nutritional contribution of the ingredients to the two treatments of the cereal bars, they used to inform the energy value according to the United States Department of Agriculture (USDA), and to the norms by ANVISA (National Agency of Sanitary Surveillance), for food labeling as shown in Table 1.

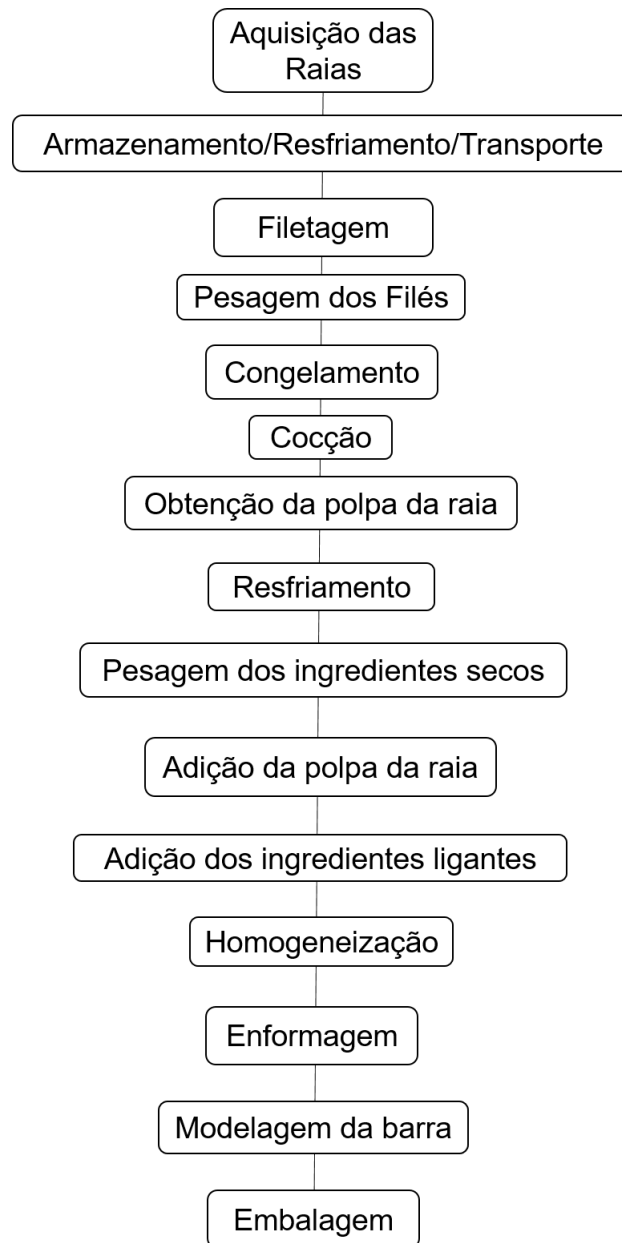
TABLE 1: Formulation of preparation of the samples no and with granola.

Ingredients	Energetic Value (kcal/100g)
Fine oats	393
Flaked oats	393
Granola	471
Rice flakes	343
Cinnamon	261
Honey	304
Coconut Oil	862
Ray	120

Source: USDA.

For the preparation of the bars, as shown by the flowchart in Figure 1, all the dry ingredients were weighed on an analytical balance and then the pulp of the ray was mixed with fine oats, oat flakes, granola and flake rice, 43% of pre-cooked ray pulp was added to each treatment in relation to the total dry ingredients. After all these ingredients were homogenized by adding the binder ingredients such as honey and coconut oil in few concentrations so that they did not stand out in the consumer's palate. The bars were being shaped into a rectangular baking dish greased with coconut, baked in an electric oven 180 ° C for 20 minutes. The product was cooled to ambient temperature of approximately 25 ° C, followed by cutting, and packed in plastic polyethylene film and stored under ambient conditions.

Figure 1. Flowchart of cereal bar production enriched with ray meat *Hypanus guttatus*



Source: prepared by the author

The physico-chemical analyzes were carried out at the Fish Technology Laboratory - LabTep, at the State University of Maranhão located at Fazenda Escola São Luís. All analyzes were performed in triplicate. The humidity was determined by the gravimetric method, in greenhouses, based on the weight loss of the material subjected to heat of 105 ° C to constant weight. The protein fraction was determined by the micro-*Kjeldahl* method, which first determines the total percentage of organic nitrogen, after digestion, distillation and titration of the sample. For lipid analysis the adapted *Bligh-Dyer* method was used, followed by the quantification of total lipids by gravimetry.

The fixed mineral residue (total ashes) was determined by incineration of the sample in muffle at 550 ° C with a duration of 3 hours, until light or slightly gray ash was obtained, which were quantified by gravimetry. Carbohydrate analyzes were done by the difference, 100 - (% protein +% lipids +% ashes).

The experimental design was completely randomized with two treatments. The physical-chemical analyzes were done in three times. Variance analysis (ANOVA) was performed, with P <0.05. In cases where there were significant differences, Friedman's non-parametric test was applied at a significance level of 5% using the *SysEapro 2.0* program.

3 RESULTS AND DISCUSSIONS

The cereal bars "no granola" [NG] and "with granola" [WG] presented statistical differences regarding protein, lipid and carbohydrate content, but no significant variance was observed in relation to the ash content (Table 2).

Table 2. Centesimal composition of samples with and without granola NG and WG.

Samples	Protein (%)	Lipids (%)	Ashes (%)	Carbohydrates (%)
NG	10,21±2,67 ^a	2,57±0,36 ^a	7,50±0,87 ^{ns}	74,72±2,49 ^{ns}
WG	6,71±1,01 ^b	3,02±1,76 ^b	7,50±1,50 ^{ns}	77,77±2,70 ^{ns}

Mean ± standard deviation, ns = does not differ statistically. Different letters in the same column differ statistically (P <0.05)

The protein results were 10.21% for "no granola" [NG] and 6.71% with "granola" [WG]. With approximate results of protein for the [NG], found in the food bars elaborated with by-products and agroindustrial residues of Paiva (2008), which was 10.6% and for [WG] in the homemade cereal bar of Brito et al (2004) which was 6.27%. The passion fruit cereal bar of Silva et al (2009) had a lower value of 4.3% in relation to the cereal bar [NG]. According to Freitas & Moretti (2006), the high-protein cereals bars marketed in the market present, on average, 4.4% of proteins. Sampaio (2009) found a slightly lower value in cereal bars with an average of 4% proteins. We can

affirm that the elaborated cereal bar [NG] in the present study obtained a higher protein value than the values already obtained in previous studies of other authors, due to the high protein content of the fish.

For the total lipid contents of the cereal bars represent [NG] 2.57% and [WG] 3.02%, such attributes may have been influenced by the addition of granola which is high in fat and composed mostly of carbohydrates, being this, the main energetic source of the food, directly influencing the sample [WG] that obtained greater amount of lipids. Nevertheless, the lipidic percentages of this study differ from those performed by Paiva (2008), in food bars produced with by-products and agroindustrial residues, found a lipid content of 8.3%. The fraction of lipids identified for the cereal bar elaborated with regional ingredients from Paraná, from flour of passion fruit peel, pumpkin seed, watermelon and melon from Becker & Kruger (2010) was 5%. Lima et al (2010); Fonseca et al. (2011) found the highest gains in cereal bars made with pulp and baru almonds (10.5%) and with pineapple peels (9.86%). Thus, it is concluded that the cereal bar of this study presents low lipid contents in the samples [NG] and [WG], being excellent for consumers who make the cereal bar a functional food option less caloric and healthy for a diet, since the lipids found have the origin of grains and seeds

The ash content did not differ significantly between treatments [NG] and [WG], respectively, giving the percentage of 7.5%. Freitas & Moretti (2006) cites that the ash content allows an indication of the amount of mineral elements and signs referring to purity and centesimal composition. According to Cecchi (2003), for cereals, the total ash value is 0.3 to 3.3%. Mourão (2009) found an amount of ash of 1.65% in the cashew and prune bar with high fiber content. According to Becker and Kruger (2010), the mineral content found for the cereal bar made with regional ingredients (passionfruit peel, pumpkin, watermelon and melon seed) was 2.2%, surpassing the average found in by-products and the agro-industrial residues of Paiva (2008), which was 1.4%. In the study of homemade cereal bar Brito et al. (2004) found the content of 1.1%. In the present study it is important to consider the values for cereals, since they are unpublished since there are no values currently established for the cereal bar enriched with ray meat (*Hypanus guttatus*), it indicates an ash content higher than the comparative studies

The carbohydrate analyzes of the cereal bars obtained results in the samples of [NG] 74.72% and [WG] 77.77% (Table 2). Becker (2010) found 37.44% of total carbohydrates in a cereal bar with regional ingredients (passionfruit peel, pumpkin,

watermelon and melon seed) from Paraná. Observing the studies of Paiva (2008) and Brito et al. (2004), who found as average values, respectively, 52.6% and 80.85% of total carbohydrates. It can be affirmed that the cereal bar elaborated in the present study has a higher concentration of carbohydrates in relation to the aforementioned similar studies, due in great part to the high protein concentration in the elaborated bar and when compared with the formulations adopted by Paiva (2008), Brito et al. (2004) and Becker (2010). The glycines are very important because they contribute to the sweet taste of the cereal bar having as animal origin the honey used in the preparation of the product. And the rice flake also being a source of carbohydrates and essential amino acids for the body, because it is rich in fiber, having a direct influence on the nutritional value of the food. According to RDC No. 269 of 2005, the Recommended Daily Intake (IDR) of protein for adults is 50g / day. Cereal bars [NG] and [WG] presented 10.2 and 6.7% respectively of protein in a 100g portion, corresponding to 20.4 and 13.4%, respectively, of the IDR for protein (Brazil, 2005b).

The cereal bars enriched with ray meat presented high protein content compared to three traditional commercial cereal bars, as shown in Table 3.

Table 3. Nutritional composition of cereal bars with and no granola enriched with ray protein (*Hypanus guttatus*), in relation to commercial products

Product	Description	Portion of 20g		
		Fat (g)	Protein (g)	Carbohydrates (g)
NG	Oat and honey	0,51	2,04	14,94
WG	Oat, granola and honey	0,60	1,34	15,55
TRIO	Banana, oat and honey	0,80	0,80	15,00
NUTRY	Banana, oat and honey	0,50	1,0	17,00
NESTLÉ	Banana, oat and honey	1,5	1,4	12,00

Source: prepared by the author

The product presented high nutritional value, characterized by the high content of carbohydrates and proteins, and low lipid content, when compared to similar products available in the market. Certain characteristics come in contact with the current wishes and perspectives of the population, which has sought to consume products with lower fat contents. In this way, it would be possible to consider safe the launch of the product to the consumer market.

4 CONCLUSION

The cereal bar enriched with ray meat is rich in proteins and carbohydrates, being these attributes sources of energy for those who seek to have a functional food in their diet. The positive acceptance of the product reveals the viability of its production and commercialization at competitive prices in relation to trademarks, besides occupying a prominent position in nutritional terms.



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