CHEMICAL, MICROBIOLOGY AND SENSORIAL COMPOSITION OF POTATO GNOCCHI WITH THE INCLUSION OF DEHYDRATED MIX OF TILAPIA AND TUNA

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Fish has nutritional characteristics that contribute to a healthy diet. However, its consumption in Brazil and the world is still insufficient. During its processing, part of the biomass is discarded, which requires alternatives to take advantage of this raw material, and a way to achieve this goal is to elaborate the dehydrated mix and include it in products commonly consumed but with low nutritional value. Thus, the objective of this study was to evaluate the sensory characteristics, chemical and microbiological composition of potato *gnocchi* with the inclusion of a tilapia (70%) and tuna (30%) dehydrated mix. Four types of potato *gnocchi* were prepared, including this mix, 0%, 10%, 20%, and 30%. The inclusion of the mix did not influence the average values of crude protein (13.35%) and carbohydrates (48.87%). However, the ash content was higher ($P < 0.05$) for the higher inclusion levels, and the lipid content was higher in the *gnocchi* with a fish mix. The inclusion of different levels of the dehydrated fish mix in the *gnocchi* did not interfere in the aroma, texture, taste, and general impression with acceptance rates of 74.60%, 66.00%, 69.30%, and 66.90%, respectively. It is concluded that the addition of the dehydrated tilapia mixes with tuna improved the mineral content and quality lipids of the potato *gnocchi* and that the inclusion of 30% is acceptable since the consumers did not identify differences concerning the *gnocchi* without the mix of fish.

KEYWORDS: FILLETING RESIDUE; NUTRITIONAL VALUE; OREOCHROMIS NILOTICUS

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1. INTRODUCTION

Data from the Food and Agriculture Organization of the United Nations (FAO, 2017) recorded an increase in the number of people in the world suffering from starvation from 815 million in 2016 to 821 million in 2017. Fish, together with the nutritional contribution provided by its primary components, offers high content of minerals, such as calcium, phosphorus, and iron, which are extremely important in the diet (HAJ-ISA; CARVALHO, 2011).

Brazil does not keep up with the per capita world consumption of fish. In 2016, 14.04 kg per capita/year was consumed, significantly below the world average of 20.3 kg per capita/year (FAO, 2016). To increase those numbers, it is necessary to adopt measures that make fish consumption feasible, from the price, accessibility, and its nutritional importance orientation, as well as the spines elimination technologies application, which is another factor that influences consumption. In this context, an alternative is to use the fish processing residues to produce food for human consumption. These products with added nutritional value meet the guidelines to increase the consumption of fatty acids in the ω-3 series since they are associated with biochemical and metabolic processes involving the prevention and reduction of cardiovascular diseases, cancer, neurological dysfunction (FELTES et al., 2010; NGUYEN et al., 2010; OTTESTAD et al., 2012; VISENTAINER et al., 2005).

However, while the fish processing residues use is reduced, the amount generated in the process is broad, ranging from 50 to 60% of biomass discarded during the canning or filleting process (PESSATI, 2001).

Due to the fish nutritional richness, the low consumption incidence of this food by Brazilians, and the large amount of waste generated by the processing industry, several studies have been carried out along with a fish meal or protein concentrate in food products, resulting in good sensory acceptance. These food products are consumed daily by the population, but present low nutritional value, such as chips in the extruded snacks form (GOES et al., 2016; JUSTEN *et al*., 2017); lasagna (KIMURA *et al*., 2017); pizza (CAMPELO *et al*., 2017); snacks, like biscuits and cookies (FRANCO *et al*., 2013); chocolate cakes (VEIT *et al*., 2012); spinach (GOES *et al*., 2016) and “alfajor” (KIMURA *et al*., 2017), among others.

The inclusion of fish derivatives in several products is significant because it increases their consumption, even indirectly providing nutritional enrichment and bringing benefits to the consumer health.

Pasta is a product of good acceptance and is part of the traditional food habits of the population; when made with the fish mix, they should maintain: color, good texture, pleasant taste, and low loss of solids during cooking, in addition to increasing the nutritional value of the product. Among pasta products, the *gnocchi* was consumed as a differentiated dish using wheat flour, potato, cassava, and even sweet potatoes in its formulation, thus achieving diversification in this type of food.

Therefore, the present study had the objective of evaluating the inclusion of a mix of dehydrated Nile tilapia (*Oreochromis niloticus*) and tuna (*Thunnus ssp*.) residues in potato gnocchi regarding its nutritional, microbiological, and sensory aspects.

2. MATERIALS AND METHODS

2.1 PREPARATION OF FISH MEAL AND DEHYDRATED FISH MIX

The fish meal was elaborated at the Experimental Farm of Iguatemi (FEI) Fish Technology Laboratory that belongs to the State University of Maringá (UEM) (Maringá/PR/Brazil). Nile tilapia (*Oreochromis niloticus*) from Company Smart Fish (Rolândia, PR) and tuna (*Thunnus ssp.*) from Gomes da Costa Company (Itajaí, SC) carcasses were used.

The fish residues from different origins were frozen, transported in isothermal boxes to the laboratory, and stored in a freezer (-18°C) until the flours were prepared. In the flour production process, two species carcasses were thawed, removing the fins and the head, if present. Then, residues were washed, weighed, sanitized (proxitane 1512® 0.1 mg/kg), and baked in a pressure cooker with antioxidant (BHT 0.5 mg/kg) for 60 minutes. After that, they were pressed (capacity 10 tons) and subjected to drying in a forced air drying for 24h at 60°C. The dehydrated product was crushed and milled in a knife-type mill (Willye - model TE-650). Finally, the tilapia and tuna flours were vacuum-packed separately and frozen until the preparation of the dehydrated mix for the inclusion in the product to be developed.

The dehydrated mix was prepared at the time of its inclusion in the food product. This process included 30% of tuna meal in 70% of Nile tilapia flour, and the mix was homogenized so it could be used in the gnocchi.

2.2 ELABORATION OF *GNOCCHI* WITH DEHYDRATED FISH MIX

Four batches of potato *gnocchi* were prepared, one control batch (without the dehydrated mix), and three with the dehydrated tilapia and tuna mix in the proportions 10%, 20%, and 30%, according to the weight of the wheat flour.

For the *gnocchi* preparation, the potatoes were cooked and mashed. After that, other ingredients (Table 1) were added to it, including the dehydrated fish mix (except in the control treatment), and homogenized. The dough was then processed in a manual device (Tupperware® brand) specific to produce the *gnocchi* granules, which provided the *gnocchi* its characteristic aspect, with granules of uniform size 3 cm long and 2 cm wide. The dough was vacuum-packed and frozen (-18°C) until it was time to cook and serve it. The samples for the centesimal composition analyses were also frozen, and the microbiological analyses samples were kept in the refrigerator (5-7ºC) until the analyses were performed (24h).

TABLE 1. INGREDIENTS AND THEIR RESPECTIVE QUANTITY IN THE POTATO *GNOCCHI* PREPARATION.

Ingredients	Quantity
Potato	500 g
Wheat flour	125 g
Unsalted margarine	40 g
Shaved parmesan cheese	25 g
Egg	60 g
Tilapia and tuna dehydrated mix	0 g; 12.5 g; 25 g; 37.5 g*

*Inclusion of tilapia and tuna dehydrated mix according to 0, 10, 20, and 30% levels, respectively.

To prepare the *gnocchi* sauce, the tomatoes were scalded and had their skin removed. Then, they were sautéed with other ingredients (Table 2). The sauce was added to the cooked *gnocchi* dough, and the dish was served hot in the sensory analysis.

TABLE 2. INGREDIENTS AND THEIR RESPECTIVE QUANTITY IN THE POTATO *GNOCCHI* SAUCE ELABORATION IN EACH TREATMENT.

Ingredients	Quantity
Tomato	250 g
Onion	100 g
Garlic	15 g
Olive oil	20 g
Tomato sauce (Arisco*)	300 g
Salt	2 g

2.3 MICROBIOLOGICAL ANALYSIS OF THE DEHYDRATED FISH MIX AND THE POTATO *GNOCCHI* WITH THE INCLUSION OF THE DEHYDRATED FISH MIX

Microbiological analysis occurred at the Laboratory of Microbiology and Food Microscopy, Department of Clinical Analysis at the State University of Maringá - UEM. It was performed for the most probable number (MPN) of coliforms 35°C and 45°C, *Staphylococcus coagulase* positive count in CFU/grams of *Salmonella spp.*, according to American Public Health Association [1988]. The microbiological protocol followed the standards recommended by Resolution RDC No. 12, of January 2, 2001, of the National Sanitary Surveillance Agency (BRAZIL, 2001).

2.4 ANALYSIS OF CHEMICAL COMPOSITION OF DEHYDRATED FISH MIX AND POTATO *GNOCCHI* WITH DEHYDRATED FISH MIX

For the chemical composition analysis, samples of each formulation of the *gnocchi* dough and the dehydrated tilapia mix with tuna used in the product were separated. The analyzes occurred at the Laboratory of Food and Animal Nutrition (LANA) in the State University of Maringá/UEM.

The chemical composition (moisture and ash) was determined according to the Association of Official Analytical Chemists (AOAC, 2005) methodology. The crude protein contents were evaluated by the semi-micro Kjeldahl method (QUEIROZ; SILVA, 2002). The total lipids were extracted and measured according to Bligh and Dyer (1959), and the carbohydrates were determined by the difference in the other nutrients analyzed.

The caloric value (CV) was determined according to Souci *et al.* (2000), obtained by the sum of the multiplication of crude protein (CP), total lipids (TL), and carbohydrates (CB) multiplied by factors 4, 9, and 4, respectively. Following the formula:

a) CV (Kcal/Kg) = CPx4 + TLx9 + CBx4.

2.5 SENSORY ANALYSIS OF POTATO *GNOCCHI* WITH DEHYDRATED FISH MIX

Sensory analysis was performed with 60 untrained individuals of both sexes, selected among students, teachers, and employees of the State University of Maringa. The investigation occurred in the technology laboratory of products of animal origin in this university, where there are specific booths for this type of analysis.

Disposable cups, identified with three random numbers containing about 20 g of *gnocchi* from each treatment, were offered to the untrained tasters. Along with the *gnocchi*, they received a glass containing water (for the residual taste removal), a fork, a disposable napkin, and the

evaluation form. Before the sensory analysis, the tasters were oriented on the method and procedure for conducting this evaluation.

Two sensory tests were applied using a sensory analysis card (evaluation form). The acceptance test evaluated the attributes of color, aroma, texture, taste, and general impression, using a structured nine-point hedonic scale anchored between minimum and maximum: I've disliked it extremely (1) to I've liked it extremely (9) (Dutcosky, 2013).

The purchase intention was also evaluated, with the 5-point hedonic scale, where 1 represents the minimum grade (would certainly not buy), and 5 designates the maximum degree (would certainly purchase), according to Damasio and Silva (1996). Also, the Acceptance Index (AI) of the *gnocchi* was evaluated using the equation: IA = A x 100/B, where A = maximum score of the product and B = minimum score of the scale, indicated by Dutcosky (2013).

The project to include a freshwater and marine fish meal in food products was approved by the Ethics Committee of the State University of Maringá, whose Certificate of Ethical Presentation - CAAE is 14219213.1.0000.01.04.

2.6 EXPERIMENTAL DESIGN

The experimental design was completely randomized, and the data analyses were submitted to the UNIVARIATE SAS procedure to verify the assumptions of the variance analysis. For the statistical analysis, the SAS/STAT R 9.2 Program (SAS Inst. Inc., Cary, NC, USA) was used, at a significance level of 5%, for the regression analysis.

The microbiological analysis was conducted to determine if the product was proper for consumption or not, so the statistical analysis was not performed.

3. RESULTS AND DISCUSSION

The nutritional value of the food can be observed through the proximate analysis or chemical composition. Regarding the analysis of potato *gnocchi* composition with the inclusion of different levels of dehydrated fish mix, the results are in Table 3. There was a variation in moisture (22.87% to 30.22%) that resulted from the difficulty in obtaining homogeneity in the *gnocchi* length since they were produced manually and without a pattern.

TABLE 3. CENTESIMAL COMPOSITION OF POTATO *GNOCCHI* WITH THE INCLUSION OF DIFFERENT LEVELS OF DEHYDRATED FISH MIX.

Treatment	Moisture (%)	Crude protein (%)	Lipids (%)	Ashes (%)	Carbohydrates (%)
0% mix	30.22±5.15	12.93±0.42	6.08±2.41	3.01±1.21	47.73±1.14
10% mix	22.87±2.20	13.51±0.16	9.88±1.39	3.78±0.44	49.94±1.07
20% mix	23.65±1.42	13.19±0.16	9.21±0.72	4.55±0.33	49.39±0.52
30% mix	23.53±1.54	13.76±0.41	8.77±0.28	5.53±1.31	48.40±0.47
P. value	0.0006	0.5674	0.0003	0.0022	0.0812
C.V. (%)	2.33	4.33	2.65	5.91	1.30

Values expressed in Average ± Standard Deviation at 5% probability. C. V. = Coefficient of Variation.

The potato *gnocchi* moisture content results, with the inclusion of different levels of dehydrated fish mix can be explained by the quadratic regression equation $y = 1.81 - 6.04x + 38.94x^2$ ($R^2 = 94.72$), as there was a decrease, followed by a slight increase in the product moisture content. However, it can be observed that the highest moisture content was for the control treatment (30.22%)

and the dehydrated mix inclusion provided a reduction in the *gnocchi* moisture content. Goes et al. (2016), evaluating the fresh pasta nutritional characteristics, reported that the moisture content did not differ (P> 0.05) among the pasta samples when included 0% to 30% of fish protein concentrate, the moisture values varied between 36.03 to 38.97%. The results obtained in this *gnocchi* study (Table 3) were lower than those reported by Goes et al. (2016). According to ANVISA in RDC No. 93, dated October 31, 2000, the moisture content of *gnocchi* can be classified as fresh pasta since the legislation allows the maximum moisture content of 35% and all samples presented content below this value.

The dehydrated fish mix inclusion did not influence the protein and carbohydrate contents, since the incremental value was very small, not statistically different between treatments (Table 3), the percentage of fish mix added would have to have been higher to increase the protein levels and reduce the carbohydrate ones. Giese (1992) states that pasta is a product that contains large amounts of carbohydrates and can contain up to 70g of carbohydrates/100g of dry pasta. As for protein, Belitz, Grosch, and Schieberle (2009) states that pasta noodles usually contain an average content of 11.5%. The protein content of the *gnocchi* with the fish mix was from 13.19% to 13.76%, calculated with fresh dough.

Goes et al. (2016) mention that when 30% of protein concentrate was included in fresh pasta, it presented 18.28% of protein, a value way higher the one obtained for the same level of inclusion in the gnocchi of this study, whose content was only 13.76%.

Maluf et al. (2010) reported that the inclusion of 30.6% of cured pacu meat (*Piaractus mesopotamicus*) in fresh pasta resulted in 15.21% crude protein and 9.73% lipids. This protein content was much higher than the numbers obtained in this experiment, although the lipid content was similar. The percentage of lipids was lower (6.08%) for the *gnocchi* dough without the fish mix (0%), and when included 10% of fish mix, the lipid content was higher (9.88%), increasing 38.46% of lipid when compared to the sample without fish (Table 3). Therefore, a quadratic equation ($y = -1.06 + 6.04x + 1.34x^2$, $R^2 = 98.72$) is described regarding the lipid contents found in the *gnocchi*, representative of the results obtained. However, it is known that this increase in the lipid content shows the presence of fatty acids and quality since the fish has a high quantity of polyunsaturated ones. According to Petenuci et al. (2010), 24 fatty acids were identified in tilapia spine meal, 27.4% palmitic acid (C16: 0), 35.15% oleic acid (C18: 1n-9), and 11.82% linoleic acid (C18: 2n-6).

The ash content ranged from 3.01% to 5.53% (Table 3), the positive linear equation used was $y = 0.003 + 8.453x$ ($R^2 = 99.34$).

Goes et al. (2016) evaluated four types of pasta enriched with 0%, 10%, 20%, and 30% of tilapia protein concentrate. This inclusion provided positive linear effects for crude protein, total lipids, ashes levels, and contradictory linear results for the carbohydrate level and the caloric value of the pasta.

Melo et al. (2017) state that the inclusion of different concentrations of the fish meal increases the nutritional value of the pasta, besides being part of the required daily amount of nutrients to be consumed. According to the same authors, spaghetti with fishmeal formulation is a technologically viable alternative and accessible to the target population as an arrangement to minimize nutritional deficiency or as a food supplement to a healthy diet.

Therefore, this variation in nutrient content in foodstuffs, with some fish derivative kind, is due to several factors such as the fish species, the type of fish processing, the parts of the fish used in the preparation, and its inclusion. These are factors that can interfere significantly with nutrient contents, especially protein, lipids, and ashes.

During the preparation of the flour and preparation of the mix, many precautions were taken to avoid contamination risks. Consequently, all the processes (the preparation of the dough and the sauce, baking the dough, mixing the sauce with the cooked dough) also occurred under hygienic-sanitary conditions suitable to avoid any possibility of contamination. Thus, it was expected

that the dehydrated fish mix and the different treatments potato *gnocchi* microbiological analyses results would be following the standards established by ANVISA in RDC No. 93, dated October 31, 2000 (Table 4). The results showed that the product was developed in good hygienic conditions and well prepared with a minimum risk of contamination during processing, so the *gnocchi* samples, regardless of the treatment, are proper for human consumption.

TABLE 4. MICROBIOLOGICAL ANALYSIS OF THE DEHYDRATED MIX AND POTATO *GNOCCHI* WITH THIS MIX.

Gnocchi with a dehydrated mix	MPN of coliforms at 35°C (MPN/g)	MPN of coliforms at 45°C (MPN/g)	*Staphylococcus coagulase* positive count (CFU/g)	Search for *Salmonella* ssp. in 25g
Dehydrated mix	<3	<3	<1 x 10^2	Absent
0% mix	<3	<3	<1 x 10^2	Absent
10% mix	<3	<3	<1 x 10^2	Absent
20% mix	<3	<3	<1 x 10^2	Absent
30% mix	<3	<3	<1 x 10^2	Absent

MPN = Most probable number; CFU = Colony forming unit

According to the results found in the sensory analysis, the product showed a good acceptance in all the attributes analyzed by the tasters, whose grades ranged from six to eight on the hedonic scale, which corresponds to “slightly like” and “like very much,” according to Dutcosky (2013). Only for the color attribute, there was a significant difference between the treatments (Table 5). This can be explained by the coloration presented with the dehydrated fish mix inclusion. The equation that illustrates the result obtained for this attribute was a positive linear ($y = 6.459 + 0.0399x$; $R^2 = 87.33$) since with 20 and 30% of inclusion, the value was statistically equal.

TABLE 5. SENSORY ANALYSIS OF POTATO *GNOCCHI* WITH DIFFERENT LEVELS OF DEHYDRATED FISH MIX.

Treatments	Color	Aroma	Texture	Taste	General impression	Purchase intention
0% mix	6.33±0.72	7.33±0.13	6.90±0.30	7.20±0.27	6.93±0.24	3.53±0.04
10% mix	6.93±0.12	7.47±0.01	6.20±0.40	6.53±0.40	6.53±0.16	3.53±0.04
20% mix	7.50±0.45	7.53±0.07	6.60±0.00	7.10±0.17	6.73±0.04	3.53±0.04
30% mix	7.47±0.42	7.50±0.04	6.70±0.10	6.90±0.03	6.57±0.12	3.37±0.12
C.V. (%)	21.65	19.73	24.08	27.76	25.53	31.17
P. value	0.0206	0.9567	0.3823	0.5527	0.7923	0.9129

Values expressed in Average ± Standard Deviation at 5% probability. C. V. = Coefficient of Variation.

Costa, Coelho, and Bicudo (1990) observed that fish protein concentrate addition to noodles led to browning was proportional to the protein level present in the product. The same phenomenon was observed in this study since the fish mix was added to the *gnocchi*, reducing the scores for the color attribute when it reached a certain inclusion level (20%). From this point, the dough became darker, displeasing the tasters.

The other attributes analyzed for product acceptance did not present significant differences in the scores given by the tasters, showing that the inclusion of the dehydrated fish mix in the potato *gnocchi* is feasible. With the public’s indifference to the presence or absence of the mix, it can be

observed that they consumed the product without being bothered by the inclusion. This result shows the possibility to intensify the population's fish consumption and improve the nutritional value of pasta types that are already accepted by consumers.

Malucelli et al. (2009) sensory evaluated potato *gnocchi* with the inclusion of different levels (0%, 4%, and 7%) of flour made from broccoli residue. The authors reported lower grades for flavor, color, texture, and appearance attributes when compared to the present study. For the flavor attribute, Malucelli et al. (2009) reported an average of 5.86 for the treatment with better acceptance, which is below the average obtained (7.20) for the same parameter in the present study (Table 5). However, when it comes to flavor, the *gnocchi* with broccoli flour presented significant differences since the control treatment had less acceptance, unlike the *gnocchi* with the dehydrated fish mix where the tasters did not feel significant differences between the treatments, regardless of the level of fish mix included. Thus, it is noted that including an animal origin ingredient (dehydrated fish mix), which is usually not well accepted by consumers for several reasons, such as: not liking fish, fish having a strong taste and odor, and altering the color of the product with its inclusion, the result was satisfactory when compared to the grades presented in the *gnocchi* with the inclusion of broccoli evaluation.

According to Goes et al. (2016), the inclusion of 30% of tilapia protein concentrate resulted in the lowest purchase intention (2.78) for the fresh pasta. This demonstrated that the increase of the tilapia protein concentrate level caused a purchase intention decrease, represented by the negative linear equation (y = 3,643 - 0,022 ×, R2 = 0,62), with average values varying from 2.78 to 3.53. The results obtained in this gnocchi experiment do not corroborate (Table 5) with those obtained by Goes et al. (2016) since it was not significant for this analyzed variable. Therefore, regardless of the level of inclusion of the fish mix, the taster might buy or would probably buy the gnocchi if it was for sale.

Acceptance rates for aroma, texture, flavor and general impression were 74.60%, 66.00%, 69.30%, and 66.90%, respectively. Dutcosky (2013) points out that the minimum acceptance rate should be 70% for the product to be considered well accepted.

Therefore, it would be interesting to use the 30% of the dehydrated fish mix inclusion, add more seasoning to the dough and change its texture when preparing it, making it firmer. Some tasters commented on the sensory chart that the *gnocchi* should be firmer so they would not deform. These corrections, in the *gnocchi* elaboration, will provide better organoleptic characteristics, making a good impression on the tasters regarding the fish inclusion in the *gnocchi.*

These results indicate that the addition of 30% of the dehydrated mix of tilapia and tuna in *gnocchi,* even though it increased only the content of lipids and mineral matter, affected only the color of the sensory properties. It would be possible to carry out other studies that attempt to increase the protein content with a higher level of fish mix inclusion, with minute corrections in the dough preparation.

4. CONCLUSIONS

The dehydrated fish mix and the potato gnocchi with this mix inclusion were fit for consumption because they were within the microbiological standards. The lipids and ashes contents were increased with the dehydrated fish mix addition in the gnocchi, not interfering with the other nutrients.

Regarding the sensory analysis, the potato gnocchi with the inclusion of the dehydrated fish mix was well accepted by the tasters, requiring minute adjustments in the elaboration of the dough so that there is no interference of inclusion in the color of the product.

It is concluded that up to 30% of the dehydrated fish mix inclusion in the gnocchi is indicated.

RESUMO

COMPOSIÇÃO QUÍMICA, MICROBIOLOGIA E SENSORIAL DO GNOCCHI DE BATATA COM A INCLUSÃO DE MIX DESIDRATADO DE TILÁPIA E ATUM

O peixe possui características nutricionais que contribuem para uma dieta saudável, no entanto seu consumo no Brasil e no mundo ainda é insuficiente. Durante o seu processamento, parte da biomassa é descartada, o que requer alternativas para aproveitar essa matéria-prima, e uma maneira de atingir esse objetivo é elaborar o *mix* desidratado e incluir em produtos comumente consumidos, mas com baixo valor nutricional. Assim, o objetivo deste estudo foi avaliar as características sensoriais, a composição química e microbiológica do *ghocchi* de batata com inclusão de *mix* desidratado de tilápia (70%) e atum (30%). Quatro tipos de *ghocchi* de batata foram preparados com a inclusão dessa mistura, contendo 0%, 10%, 20% e 30%. A inclusão do mix não influenciou os teores de proteína bruta (13,35%) e carboidratos (48,87%). No entanto o teor de cinzas foi maior (P <0,05) para os maiores níveis de inclusão e o teor lipídico foi maior no *ghocchi* com *mix* de peixes. A inclusão de diferentes níveis de *mix* desidratado de peixe não interferiu no aroma, textura, sabor e impressão geral com taxas de aceitação de 74,60%, 66,00%, 69,30% e 66,90%, respectivamente. Somente a cor do *ghocchi* foi afetada pela inclusão do *mix*. Conclui-se que a adição de *mix* desidratado de tilápia com atum melhorou o conteúdo mineral e a qualidade dos lipídios do *ghocchi* de batata e que a inclusão de 30% é aceitável, uma vez que os consumidores não identificaram diferenças em relação ao *ghocchi* sem a mistura de peixe.

Palavras-chave: Oreochromis Niloticus; Resíduos de Filetagem; Valor Nutricional

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