DEVELOPMENT OF FUNCTIONAL BREADS WITH PARTIALLY DEFATTED SUNFLOWER SEED FLOUR

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INTRODUCTION:

Wheat flour is one of the most used ingredients in culinary preparations, being the basis of most of the products consumed among which are bakery products. On the other hand, this flour is a rich source of high glycemic index carbohydrates and, if ingested in large quantities, it can have a negative impact on health (COSTA et al., 2008; ROBERTS, 2009). In this environment, similar flours with beneficial nutritional characteristics have been sought by the industry as viable alternatives from an economic and nutritional point of view, in order to prioritize the aspect of a balanced and healthy diet within the industrial field. Regarding its nutritional characteristics, sunflower seed flour, also known as nugget, has a high protein content, ranging from 40 to 66%, being considered an alternative and promising protein source when compared to animal protein (FRITSCH et al., 2016). Furthermore, these proteins contain organoleptic and functional properties that make them useful in food products. In view of this, the choice to use sunflower seed flour in food preparations involves terms such as nutritional quality, increasing availability, in addition to climate and soil favorable to planting and other socioeconomic issues (WILDERMUTH; YOUNG; WERE, 2016). It is worth mentioning that such flour presents in its composition a phenolic compound seen as an obstacle for use in bakery products, chlorogenic acid. There is this challenge due to the occurrence of oxidation reactions that promote the formation of green color compounds in the food. Thus, the present research aimed to develop loaf bread enriched with sunflower nugget flour, which replaced wheat flour at different concentrations, verifying the proximate composition and changes in the organoleptic characteristics of the final product.

METHODOLOGY:

The breads were prepared based on the International AACC method (10-11.01) with some changes. The recipes were based on the ingredients wheat flour, sunflower nugget flour, salt, biological yeast and vegetable fat. Sunflower nugget flour was added at different concentrations to the loaves of bread, replacing the standard formulation wheat flour, starting with 10% sunflower nugget flour to 90% wheat flour and so on up to 60% flour of sunflower nugget. After the preparation of all the breads, a

proximate analysis and the analysis of the physical and rheological properties of the breads were performed (Figure 1).

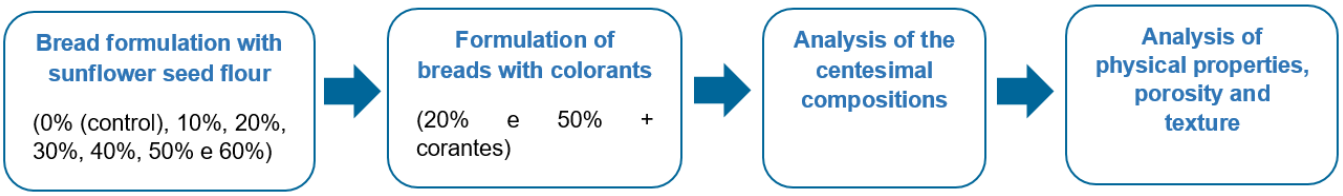

Figure 1. Scheme of materials and methods.

RESULTS AND DISCUSSION:

The sunflower seed flour used in the production of breads presented 38.89% of proteins, 45.59% of lipids, 7.84% of carbohydrates, 4.72% of ash and 2.96% of moisture (Figure 1). Wheat flour, in general, has: 9.80% protein; 1.40% lipids; 75.10% carbohydrates; 0.80% ash and 13% moisture (NEPA, 2011). In this sense, sunflower seed flour proves to be an alternative and effective source of proteins and minerals, due to its low cost, nutritional qualities and absence of risks to consumer health. From the analysis of the proximate composition of breads enriched with different amounts of sunflower nugget flour (Table 1), it was possible to notice that as the amount of nugget flour increased, the amount of proteins, lipids, ash and moisture also increased. In the present study, breads with 10%, 30% and 60% of sunflower flour presented 11.71%, 16.19% and 24.73% of proteins, respectively, values higher than the amount of protein found in bread control (10.27%), which demonstrates that this flour has the potential to be an alternative source of protein for the consumer. Regarding the ash content (Table 1), the breads again presented a considerable ash value when compared to the control bread. Furthermore, as it has a high lipid content, using sunflower seed flour would reduce the amount of fat used in the formulation of breads (SOUZA, FLICIANO E BESSA, 2018). However, considering the results of the analyses, the amount of lipids found

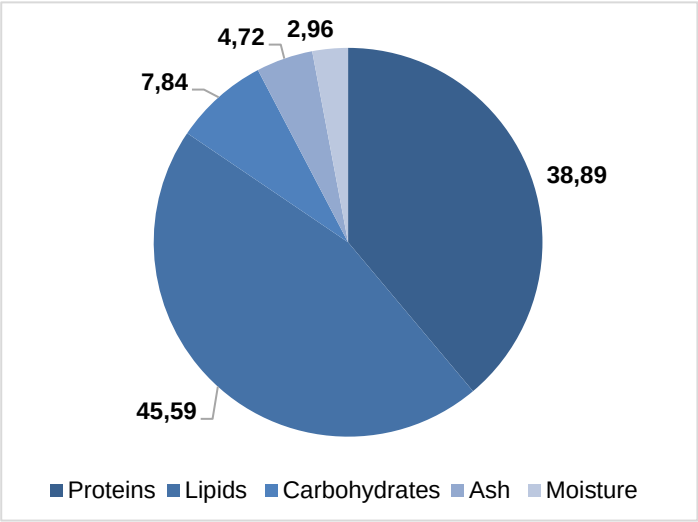

Figure 2. Centesimal composition of sunflower seed flour.

Components	Control	10%	30%	60%
Calories (Kcal)	351,42	305,07	315,13	442,99
Proteins (%)	10,27 ± 0,34	11,71 ± 0,25	16,19 ± 0,82	24,73 ± 1,23
Lipids (%)	11,22 ± 0,44	7,88 ± 0,04	13,29 ± 0,08	33,30 ± 0,34
Carbohydrates (%)	52,34 ± 0,06	46,84 ± 3,36	32,70 ± 3,54	11,10 ± 0,93
Ash (%)	1,73 ± 0,12	1,85 ± 0,26	1,48 ± 1,82	3,67 ± 0,04
Moisture (%)	24,44 ± 0,09	31,73 ± 2,88	36,35 ± 2,47	27,21 ± 0,00

Table 1. Centesimal composition of prepared loaves of bread.

in the breads was lower than expected according to the content found in the flour itself. Furthermore, the tests carried out reducing the vegetable fat of the bread formulation with 60% of sunflower nugget flour resulted in a lower quality product.

From the preparation of the breads, it was noted that the sunflower nugget flour has a high content of chlorogenic acid, which in bakery products can cause the final product to turn green (WILDERMUTH; YOUNG; WERE, 2016). Considering this fact, it was possible to notice that as the amount of sunflower nugget flour increased in the loaves, they acquired a darker color. Regarding the volume, it was possible to observe a decrease in the volume of the breads as the sunflower flour was increased. Thus, a possible solution for this change would be to maintain a proportion between wheat and sunflower flour, in order to prevent the dough from becoming internally dense, and consequently impairing the sensory evaluation. The results of the analysis of the physical and rheological characteristics of the prepared breads are presented in Table 2, 3 and 4. From Table 2, it is possible to observe that as the concentration of sunflower nugget flour increases, the specific volume decreases. However, considering that such breads present a reduction in wheat flour, when compared to gluten-free breads, the specific volume found in breads with up to 50% of sunflower nugget flour were higher than that found by Fratelli et al. (2021), who when making gluten-free breads from rice flour found 1.41 cm³/g.

	Control	10%	20%	30%	40%	50%	60%
Loaf specific volume (cm³/g)	3,40	3,57	2,37	2,00	1,94	1,88	1,36
Crumb moisture	42,97	44,97	39,98	39,33	37,59	36,70	43,31
Crumb firmness	3,80	2,11	13,91	31,24	22,63	18,84	17,25

Table 2. Results of the analysis of the physical properties of the prepared loaves of bread.

Regarding porosity, in Table 3, it is possible to observe that as the amount of nugget flour increases, the size of the alveoli decreases and their number increases, so this inversely proportional relationship can negatively affect the volume of the product. Final. Finally, Table 4 shows the results of the texture analysis of the breads, which showed an increasing value of hardness as the flour concentration increased. With regard to elasticity, the prepared breads showed a decreasing elasticity value, but the elasticity found in breads with different flour concentrations was not so discrepant when compared to the control (Table 4). In addition, while the cohesiveness did not show great differences compared to the control, the gumminess and the chewiness presented more divergent results when compared to the control (Table 4). From this perspective, breads enriched with higher concentrations of sunflower nugget flour present characteristics that are more difficult for consumers to accept.

	Control	10%	20%	30%	40%	50%	60%
Nº of alveolus	50,75	23,63	62,50	79,33	80,33	88,33	93,50
Alveolus size (mm²)	0,25	0,28	0,14	0,15	0,11	0,14	0,10
Area (%)	39,09	42,30	28,44	35,50	31,42	38,79	28,17

Table 3. Results of porosity analysis of prepared loaves of bread.

	Control	10%	20%	30%	40%	50%	60%
Hardness	168,50	148,03	528,84	692,83	1195,50	1728,14	2526,40
Springiness	0,97	0,99	0,90	0,89	0,83	0,80	0,76
Cohesiveness	0,67	0,68	0,58	0,58	0,54	0,48	0,47
Gumminess	135,56	140,41	342,64	490,44	616,90	892,13	1262,12
Chewiness	132,28	138,34	311,49	409,69	577,61	714,71	937,97

Table 4 - Results of texture analysis (TPA) of prepared loaves of bread.

Regarding the color of the breads, the attempt to disguise the greening promoted by the presence of chlorogenic acid through the use of natural colorants (paprika, annatto and turmeric) showed positive results, in addition to adding greater value to the final product. In this perspective, considering the results found in the literature and, considering the advantages of a product with a high protein content, breads made with 10% and 20% of sunflower seed flour added with natural colorants have the potential to provide gains to the body of the consumer, without presenting such striking structural changes in terms of the sensory aspect.

CONCLUSIONS:

From the results, it is possible to verify that as the concentration of sunflower seed flour increases in the breads, the protein, lipids and ash increase concomitantly. With regard to sensory changes, the coloring was well resolved as natural colorants were used, which together added greater value to the final product. Regarding structural changes, the choice of an intermediate amount of sunflower nugget flour to replace wheat flour proved to be the best option to provide health benefits without promoting major impacts on the texture and volume of the breads. In this way, the use of sunflower nugget flour together with natural colorants, adds value to elaborated breads, and in addition to providing a sustainable means of reuse, in which the disposal of this valuable by-product to health is avoided, producing a functional food with high potential for benefit to the human body. However, more analyzes are still needed to verify the acceptance of this product in the market and to seek other ways to solve these changes promoted by the substitution of wheat flour.

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