DEVELOPMENT AND CHARACTERIZATION OF SWINE HAMBURGER WITH ADDED OKARA FLOUR

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Abstract – The okara is a byproduct of soybean taken as processing waste from the production of soy milk. It has high nutritional value by presenting proteins, lipids and fiber in significant quantities, and bioactive compounds such as isoflavones. The objective of this study was to prepare and characterize different hamburgers formulations containing swine meat added okara and/or textured soy protein. Were produced pork hamburgers using seven different formulations. Were performed analysis of moisture, ash, protein and lipids according to the AOAC, percentage of shrinkage and yield was calculated by the difference between the weight of raw samples (frozen) and roasted. The protein and ash analysis of swine hamburgers showed no statistical difference. The standard formulation had the highest average for the determination of moisture, 69.10%, and F4 formulation containing higher amounts of TSP and okara had the lowest moisture, 59.47%. Evaluating the percentage of lipids was observed that the samples F4 and F6 had the lowest averages, differing significantly from the other formulations. Despite having been added in all formulations, the same amount of fat, this difference is explained by the lack of uniformity in mass caused by the use of a disk grinder with a diameter of 8mm in the grinding of fat, which does not allow a complete and perfect homogenization of the pellet, even though pork had a greater facility in the mixing all ingredients. In the swine hamburgers the smallest moisture loss occurred in the formulation with 8% of and 8% of okara TSP (F4). We also observed a smaller shrinkage and higher yield with the formulation F3 (8% okara) which also had a higher average water retention, a fact which shows that the addition of 8% okara have a positive influence on this determination, but may necessarily be related to the product yield.

Key Words – soybean fiber, moisture, TSP, meat.

I. INTRODUCTION

The okara is a byproduct of soybean taken as processing waste from the production of soy milk. It has high nutritional value by presenting proteins, lipids and fiber in significant quantities, and bioactive compounds such as isoflavones [1]. One of the several possible applications of okara or soy protein is in meat products, specifically in hamburger, because according to the current legislation for this type of product can add up 4% protein not from animal in aggregate. Must attend another physical and chemical characteristics such as fat (maximum) 23.0%, protein (minimum) 15.0%, total carbohydrates 3.0%; calcium content (maximum dry basis) 0.1% in raw hamburger and 0.45% in cooked hamburger [2]. According to the Technical Regulation of identity and quality of the hamburger, it is "an industrialized meat product obtained from ground beef butchering of animals, with or without adipose tissue and ingredients, molded and subjected to appropriate technological process" [2]. The objective of this study was to prepare and characterize seven different hamburgers formulations containing swine meat added okara and/or textured soy protein.

II. MATERIALS AND METHODS

Were produced pork hamburgers using seven different formulations (Table 1). The meat were submitted to manual removal of intermuscular fat and connective tissue and skin. The meat and fat were ground and homogenized with water, textured soy protein (TSP), spices and okara, according to each formulation. At the end of the homogenization process the mixtures obtained were molded to yield approximately 82g hamburgers each unit. Each piece was wrapped in plastic films of PVC, individually and stored in a freezer at temperature of -18°C until the time of analysis.

Table 1 – Hamburgers standard formulations for a total weight of 1000g of product.

Ingredients	***Quantity (g)***
Raw meat	851.1
Swine Fat	70
Water	50
TSP	0
Monosodium glutamate	1
Condiments for hamburgers	26.7
Oregano	0.2
Garlic	1
Okara	0
Total	1000

Table 2 – Different formulations for hamburgers added okara flour and soy protein isolate

	Formulação					
	2	3	4	5	6	7
Raw meat	771	771	691	771	771	771
Swine Fat	70	70	70	70	70	70
Water	50	50	50	50	50	50
TSP	80	0	80	40	40	40
Monosodium glutamate	1	1	1	1	1	1
Condiments for hamburgers	26.7	26.7	26.7	26.7	26.7	26.7
Oregano	0.2	0.2	0.2	0.2	0.2	0.2
Garlic	1	1	1	1	1	1
Okara	0	80	80	40	40	40
Total	1000	1000	1000	1000	1000	1000

The determination of moisture, ash, protein and lipids were performed according to the AOAC [3] in triplicate for all samples. To evaluate the physical chemistry composition, five Hamburgers from each treatment were randomly selected and identified. Samples were roasted at a temperature of 180° C until an internal temperature of 72 ° C. The percentage of shrinkage of hamburgers was determined according to Mansour and Khalil [4] using a caliper (Starrett 125MEB), at three different points. The yield was calculated by the difference between the weight of raw samples (frozen) and roasted according to El-Magoli, Laroia and Hansen [5] and Mansour and Khalil [4]. The moisture and fat retention was determined according to El-Magoli, Laroia and Hansen [5].

III. RESULTS AND DISCUSSION

The protein and ash analysis of swine hamburgers showed no statistical difference (Table 3). The standard formulation had the highest average for the determination of moisture, 69.10%, and F4 formulation containing higher amounts of TSP and okara had the lowest moisture, 59.47%. Tavares [6] in the processing of rabbit hamburgers has found humidity similar to the standard formulation, 68.34%. Evaluating the percentage of lipids was observed that the samples F4 and F6 had the lowest averages, differing significantly from the other formulations. Despite having been added in all formulations, the same amount of fat, this difference is explained by the lack of uniformity in mass caused by the use of a disk grinder with a diameter of 8mm in the grinding of fat, which does not allow a complete and perfect homogenization of the pellet, even though pork had a greater facility in the mixing all ingredients.

Table 3 – Chemical composition of raw swine hamburgers performed in triplicate. Values are expressed as percentage

Formulation	Moisture	Lipids	Proteins	Ash
F1	69.10 ±0.57[a]	14.09 ±1.07[a]	17.86 ±1.76[a]	2.50 ±0.01[a]
F2	64.36 ±1.03[bc]	14.35± 1.25[a]	19.60 ±1.11[a]	2.99 ±0.01[a]
F3	66.37 ±0.39[ab]	14.77 ±1.29[a]	20.23 ±0,87[a]	2.81 ±0.28[a]
F4	59.47 ±0.61[d]	9.24 ±1.49[b]	21.67 ±1.55[a]	2.81 ±0.28[a]
F5	65.33 ±0.59[bc]	14.43 ±0.60[a]	18.69 ±1.32[a]	3.13 ±0.30[a]
F6	65.63 ±0.43[b]	9.20 ±0.99[b]	20.04 ±1.88[a]	3.16 ±0.28[a]
F7	62.29 ±2.50[cd]	14.42 ±0.72[a]	19.51 ±1.24[a]	3.33 ±0.58[a]

Mean ± standard deviation. Means followed by the same letter in the same column are not statistically different from each other at 5% significance level by the Tukey test ($p \leq .05$).

Physical analysis of swine hamburgers showed significant differences (Table 4). Lower shrinkage was observed in the formulation with 8% and 8% of okara TSP (F4), with no statistical difference between the other samples. The same effects was observed in a study which evaluated the changes in physical, chemical and sensory characteristics of lamb hamburgers with low fat, added cassava starch and oatmeal, where lower values of shrinkage occurred in the formulations added starch cassava and oatmeal [7]. The formulation F4 showed the best yield (87.48%), but statistically different from the others, followed that sample was added 8% okara (F3). Therefore, the addition of okara and PTS resulted in less weight loss compared to hamburgers in cooked raw. Other studies found higher yields for those samples added of cassava starch and oatmeal in lamb hamburgers [7].

Table 4 - Physical analysis of swine hamburgers performed in triplicate. Values are expressed as percentage.

Formulation	shrinkage	yield	Water retention	Fat retention
F1	14.81 ±1.26[a]	74.81 ±1.56[e]	46.71 ±0.98[bc]	50.90 ±0.89[bc]
F2	12.82 ±0.98[a]	81.52 ±0.78[c]	47.08 ±0.45[b]	73.15 ±0.70[ab]
F3	12.66 ±0.78[a]	85.14 ±0.40[b]	49.05 ±0.23[a]	60.98 ±0.32[bc]
F4	8.85 ±1.08[b]	87.48 ±0.36[a]	46.04 ±0.19[c]	87.53 ±0.21[a]
F5	14.25 ±1.29[a]	78.76 ±0.56[d]	43.50 0.31[d]	51.43 ±0.36[c]
F6	14.09 ±1.22[a]	80.69 ±0.58[c]	45.92 ±0.33[c]	76.17 ±0.55[ab]
F7	13.39 ±1.41[a]	81.57 ±0.96[c]	46.45 ±0.55[bc]	49.52 ±0.58[bc]

Mean ± standard deviation. Means followed by the same letter in the same column are not statistically different from each other at 5% significance level by the Tukey test ($p \leq .05$).

We suggest that these yield values are related to the amount of fat preserved in the product after cooking and not with the amount of water, since the moisture values for this sample after cooking was the smallest. To reinforce this assumption, we analyze the retention of fat, which had the highest average value for F4. For the water retention can be observed that the sample had a higher average F3 and was statistically different from the others. This fact indicates that the addition of okara (8%) have a positive influence on this determination, but may be related to the product yield. Seabra et al. [7] found that the loss of moisture and fat were higher in those samples added oatmeal.

IV. CONCLUSION

In the swine hamburgers the smallest moisture loss occurred in the formulation with 8% of and 8% of okara TSP (F4). We also observed a smaller shrinkage and higher yield with the formulation F3 (8% okara) which also had a higher average water retention, a fact which shows that the addition of 8% okara have a positive influence on this determination, but may necessarily be related to the product yield.

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