USE OF ACID TURKEY BREAST MEAT IN EMBEDED PRODUCTS: FORMULATION IMPACTS ON TECHNOLOGICAL CHARACTERISTICS

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Abstract – With the large increase in demand for processed turkey meat products, knowing the impact of raw material defects become very important. Two different formulations were tested, one using acid breast turkey meat and the other with regular meat, using as parameters for acid meat pH<5,67 and for regular meat pH>5,72. The remaining ingredients and process were identical. From the cooked product, samples were stored under vacuum with two slices of approximately 100g each for a period of 40 days. After this period, analysis of proximal composition, pH, WHC (water holding capacity), color, luminosity and dripping were performed, finding no significant differences on the results among the analyzed samples. This demonstrate that the addition of technological ingredients such as soy protein, carrageenan, cassava starch and phosphate can minimize the effects of using turkey acid meat, improving quality, reducing fluid loss, standardizing color, improving the texture and increasing the shelf life.

I. INTRODUCTION

In recent years the production of turkey meat has increased exponentially, as well as being exported. Brazil now ranks second in the ranking of countries exporting such meat, both *in natura* and as processed, only surpassed by United States. Being considered a meat with low-fat, turkey meat is very appreciated by consumers concerned with a healthy lifestyle presenting a great choice of raw materials for industrialization used in many products such sausages and hams for example. In 2012, exports of turkey meat totaled 170.000 tonnes, with an increase of 26.8% compared with the previous year. Financial income increased by 12.5% to $ 500.4 million. The largest volume of exports was cuts (102 thousand tons), as long as the largest buyer market was the European Union, with 46% of the total [1]. The constant monitoring of the U.S. Department of Agriculture (USDA) shows that only three regions have responded for about 96% of world production of turkey meat in the order, USA (just over 57% of total volume), the EU (almost 31%) and Brazil (7%).

Acid meat is one of the causes phenomenon called PSE [2]. It is the result of genetic issues and the application of an inappropriate pre and post handling and slaughter of animals resulting in agitation and causing an accelerated rigor mortis. There are no studies that approached the term acidic meats, but is perceived by the industries and causing losses during processing of raw material change. Studies realized by Chan [3] indicates that low pH meat had the lowest water-holding capacity compared with normal and high pH meat as shown by the increase in cooking loss, which can be explained by factors other than protein denaturation and low pH meat may need additional treatment or ingredient formulations to improve its functionality. However studies are relevant to the PSE phenomenon, and these meats analyzed here cannot be characterized directly as PSE. Similarities in PSE reasons and results were detected between turkey breast muscles and pork muscles more than 20 years ago. However, no attempt was made to assess the magnitude of the problem, or to look for ways to separate PSE from normal meat [4] It is estimated an incidence of PSE meat around 5% - 40% of birds used in the industry [5,6] resulting in losses over $ 200 million only in the processing industries of turkey in the United States[6]. According to studies associating only WHC (water holding capacity) and drip tests carried out in 1995 showed abnormalities in 41% of samples which shows the great loss that can actually generate for an industry that manufactures hundreds of tons of this meat per day [7].

The defects are mainly focused on products for injection brine and prepared in cooking-bag systems, due to the possible release of exudate and breakage during slicing. However Kissel [8] found that chicken PSE meat with other ingredients, can be used as raw material in the production of bologna sausage, but presenting toughness and mastigability values significantly higher than bologna sausage processed using normal meat.

This work aims to evaluate the influence of using meat in developing an embedded product of turkey breast on an industrial formulation utilizing inputs such as carrageenan, soy protein and phosphates for improvement.

II. MATERIALS AND METHODS

To select the samples of turkey breast, pH was measured on the raw material 24h post-mortem according to ODA et al. [9]. Aristides et al. [10] classified samples from pH measured in turkey breasts 24h post-mortem at 0°C, with L*≥55.0 and pH<5.67 as PSE and samples with L*<55.0 and pH>5.72 as normal. The processing was performed in a commercial plant in the food sector. The curing process of meat required the addition of a number of additives and ingredients that are essential for its coloring and flavor following formulation described in Table 1.

Table 1 Standard Formulation used in preparing samples.

INGREDIENTS	***%***
Turkey breast meat	80.804
Water	10.000
Spices	2.913
Soy protein	2.000
Sodium lactate	2.000
Cassava starch	1.512
Phosphates	0.455
Carrageenan	0.181
Sodium erythorbate	0.100
Pigments	0.020
Sodium nitrate	0.015
TOTAL	***100.00***

After processing, the batter were embedded resulting in 20 pieces of final product, weighing approximately 2.5 kg each, and were stored under refrigeration for up to 24 hours at 5°C. The final products were sliced (1 cm each piece) and individually vacuum packaged of approximately 120g and stored until performing analysis at temperature between 0°C and 4°C for 40 days. Sampling was performed in triplicate and analyzed in three replications. In certain periods of time fluid exudate was measured and based on the relationship between the initial weight of the slices and the weight of liquid exudate was calculated the percentage of dripping.

The determination of pH was performed using a insertion pH meter (Testo, model 205) described by Oda et al. [9]. For luminosity and color measurement was performed using a Minolta colorimeter in three different points on each sample, where the parameters L* (luminosity), a* (red) and b* (yellow) were measured. These evaluations were made according to the methodology proposed by Van Laack et al.[11]. The chemical composition was determined at the time of initial and final storage. This time was based on the shelf life of the product (40 days). For determination of total lipids, ash, protein and moisture were used methods described by AOAC [12] by 925.38, 923.03, 920.87 and 925.09 methods respectively. The water holding capacity (WHC) was determined by the method proposed by OBA et al.[13]. The results were submitted to ANOVA, Tukey Test and Test t at 5% significance level using the software Statistica® 10.0 to verify the significant differences among products made from acid turkey meat and normal turkey meat related to the chemical composition, pH, CRA, dripping and the color of the final product.

III. RESULTS AND DISCUSSION

Table 2 presents the results of chemical composition for embedded formulated using acid and normal turkey meat, at initial time and final time of storage.

Table 2 Mean values for chemical composition for embedded formulated with both normal and acid turkey meat. (%)

	Initial Time		***Final Time***	
	Normal	***Acid***	***Normal***	***Acid***
Moisture	69.05[a] (±2.07)	70.57[a] (±2.03)	60.09[b] (±2.01)	59.57[b] (±3.70)
Protein	19.64[a] (±1.43)	19.97[a] (1.53)	15.76[b] (±2.31)	15.54[b] (±3.80)
Lipids	0.82[a] (±0.09)	1.16[b] (±0.18)	1.11[a] (±0.09)	1.16[a] (±0.21)
Ash	3.23[a] (±0.05)	3.24[a] (±0.05)	3.02[b] (±0.21)	3.12[b] (±0.10)

[a,b] Different lowercase letters in the same line indicate significant difference at 5%.

For determination of ash in the comparison between the initial and final times were observed significant differences, probably due to the drag of soluble solids by liquid exudate, however when comparing the samples there was no significant difference between acid and normal meat. The high percentage obtained for the ashes can be associated to the ingredients added to the product.

Caldara et al. [14] also found no significant differences in ash content of acid meat considered PSE (1.14%) normal and (1.08%). Regarding the protein content was no significant difference between the initial and final times of analisys, due to loss of water-soluble protein content along with liquid dripping, but no significant difference between normal and acid meat samples. Similar result was found by [14] between the amounts of protein for acid meat considered PSE (16.10%) and normal (16.51%), showing no statistical difference between the samples.

Yang et al. [15], evaluating the implementation of technological ingredients in Frankfurt sausage, did not detect significant differences in moisture, fat and pH between products, similar to the result obtained in this present work. Differences in moisture in both formulations between initial and final times were detected due to dripping, as results also obtained when keeping slices of cooked and sliced turkey ham under refrigeration for 10 days [16].

There was no significant difference between the results of moisture between the products manufactured with acid turkey meat and normal turkey meat. According to Shimokomaki et al [17], acid meat have a low water retention capacity, in other words, the moisture content of products produced from acid meat should be lower when compared to products produced with normal meat, however this result was expected because, due to the addition of technological ingredients was no significant difference both at the initial time and at the final of the analysis time.

Table 3 shows the results for pH, WHC and dripping. It was also observed that there was no significant difference between samples and between times compared to WHC. This result can be explained by the fact that additives are added to assist in _ water retention in the products. Similar results were obtained by Sampaio et al. [18] where meat treated with additives showed difference of 1% between the treated sample with phosphate and standard one.

Table 3 Mean values for analysis of pH, water holding capacity (WHC) and dripping for prepared products with acid and normal turkey meat in relation to storage time products.

	Initial Time		***Final Time***	
	Normal	***Acid***	***Normal***	***Acid***
pH	6.08[a] (±0.16)	6.14[a] (±0.14)	5.45[b] (±0.02)	5.43[b] (±3.80)
WHC	71.48[a] (±3.12)	70.44[a] (±3.45)	72.89[a] (±2.74)	72.59[a] (±1.82)
Dripping	ND	ND	4.24[a] (±0.006)	4.22[a] (±0.005)

ND - Not Determined

[a,b] Different lowercase letters in the same line indicate significant difference at 5%.

Regarding pH, we detected significant differences between storage times, probably due to acidification caused by lactic acid bacteria. Borch et al [19] found similar results in their work. Considering that the pH of the acid and regular meat showed differences before processing, the values presented in Table 4 can be explained due to the addition of alkaline phosphate in the formulation of products.

Table 4 Mean values for analysis of luminosity in products formulated with acid and normal turkey meat.

	Initial Time		***Final Time***	
	Normal	***Acid***	***Normal***	***Normal***
L*	71.41[b] (±1.05)	70.79[a] (±1,21)	74.60[a] (±4.22)	72.16[a] (±2.29)
a*	8.50[a] (±0.87)	8.39[a] (±0.28)	8.79[a] (±0.65)	9.01[a] (±0.97)
b*	8.62[a] (±0.37)	8.81[a] (±0.41)	8.53[a] (±0.44)	8.71[a] (±0.66)

[a,b] Different lowercase letters in the same line indicate significant difference at 5%.

IV. CONCLUSION

The results of chemical composition, luminosity, WHC, pH and drip showed no significant difference between samples prepared with acid and normal turkey meat, showing that the use of technological ingredients like carrageenan, phosphate, cassava starch and soy protein on concentrations studied in this work, corrected the defects that acidity could cause in the processed product. The phosphate acted as stabilizer causing the pH of both formulations, even with a difference in raw material did not present significant difference in the final product. Soy protein, tapioca starch and carrageenan were active in improving WHC and dripping of the sample causing also no significant difference

between them demonstrating that acid turkey meat may be used in processed products in a adjusted formula.

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