PHYSICOCHEMICAL ANALYSIS OF DIFFERENT TYPES OF CUTS OF BEEF MEAT AND POULTRY

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Abstract – This paper describes physicochemical analysis of different types of beef and chicken meat`s cuts. The physicochemical analyses were used to determine pH, tests of hydrogen sulphide (H_2S) and ammonia (Eber reaction). We analyzed 511 samples of different types of beef cuts and 188 samples of different types of poultry cuts. The beef cuts were analyzed outside round, topside, rump, chuck, eye of round, shoulder clod, knuckle, shin/ shank and striploin. Thigh/drumstick and fillet were the poultry`s cuts analyzed. Statistical analysis showed that pH of the types of chuck and shin/ shank cuts were different from other types of cuts beef ($p<0.001$). The sections of thigh/drumstick and poultry fillet were statistically different ($p<0.001$). Only cuts of poultry had changes in tests of hydrogen sulfide and ammonia. We conclude that the results showed that the cuts of poultry showed physicochemical changes compared with the different beef cuts.

Key Words – Ammonia test, pH, test of hydrogen sulfide.

I. INTRODUCTION

Two of the main highlights of the Brazilian agribusiness on the world stage are the cattle and poultry. Owner of the second largest herd in the world, Brazil has approximately 200 million head of cattle, taking the lead in exports. Furthermore, Brazil has become the third largest producer and leading exporter of poultry. Currently, brazilian poultry reaches 142 countries [1,2].

In Brazil, it is understood as muscle meat edible parts of different species of animal butchery, those handled in hygienic conditions and from animals in good health, certified by the veterinarian responsible for the inspection service [3].

The anatomical location of the muscles is an intrinsic factor which influences the composition of meat, varying according to the kind of cutting meaty and muscles involved [4]. In Brazil (Table 1), notes that the types of beef cuts and types of poultry are given names and correlate with specific anatomical muscles [5].

In table 1 one can observe some kinds of beef cuts consumed in Brazil and the muscles involved in its formation.

This study aimed to evaluate the physicochemistry of beef and poultry different cuts.

II. MATERIALS AND METHODS

Samples

During the period from 17th May, 2011 to 9th March, 2012 were analyzed 699 samples of different types of beef and poultry cuts. We analyzed 511 samples of different types of beef cuts and 188 samples of different types of poultry cuts. The beef cuts analyzed were outside (62 samples), topside (57 samples), rump (55 samples), chuck (51 samples), eye of round (58 samples), shoulder clod (52 samples), knuckle (64 samples), shin/ shank (61 samples) and striploin (51 samples). Thigh/drumstick (121 samples) and fillet (67 samples) were the poultry cuts analyzed. Samples were sent to the Physical Chemistry Laboratory of the Discipline of Inspection of Food of Animal Origin, Department of Veterinary Hygiene and Public Health, Faculty of Veterinary Medicine and Animal Sciences, São Paulo State University, Botucatu, São Paulo, Brazil.

Table 1 - Components that make up some muscle beef cuts consumed in Brazil [5].

Cuts	Muscular components
Striploin	Gluteus medius, iliocostalis , latissimus dorsi, semispinalis capitis, interspinales, intertransversales lumborum, retractor costae, levatores costarum, intercostales externi, intercostales interni and multifidus dorsi.
Topside	Sartorius , gracilis , pectineus, adductor, semimembranosus, gemellus, obturator externus, obturator internus and quadratus femoris.
Outside	Biceps femoris.
Eye of round	Semitendinosus and popliteus.
Knuckle	Rectus femoris, vastus lateralis, vastus medialis and vastus intermedius.
Leg of Shank	Gastrocnemius, soleus and flexor digitorum superficialis.
Shin / Shank	Long digital extensor, lateral digital extensor, medial digital extensor, peroneus longus, peroneus tertius, tibialis cranilis, extensor digiti primi longus, deep digital flexor and popliteus.
Rump	Tensor fasciae latae, biceps femoris and gluteus medius.
Chuck	Trapezius, rhomboideus, serratus ventralis, scalenus, serratus dorsalis, iliocostalis, longissimus, semispinalis capitis, levatores costarum, intercostales externi, intercostales interni and longus colli.
Shoulder Clod	Cutaneous omo-brachialis, deltoideus, supraspinatus, infraspinatus, redondo menor, subscapularis, redondo maior, longissimus, triceps brachii, tensor fasciae antibrachii, anconeus, biceps brachii, coracobrachialis, brachialis, extensor carpi radialis and common digital extensor.

Determination of pH

The pH meter (Analion PM 608) was appropriately calibrated with buffer solutions at pH 7.00 and pH 4.00. Samples were crushed and 50 g were transferred into a beaker of 100 mL. Distilled water was added and homogenized with a glass rod. The determinations of samples pH were read at the apparatus properly calibrated.

Tests of hydrogen sulphide (H_2S)

For this analysis, it was weighed 10 g of sample into a 125 mL Erlenmeyer flask. Was added 20 mL of distilled water. The Erlenmeyer was closed with a filter paper soaked in the center with a drop of solution of lead acetate to 1%. The flask was transferred into a beaker of 500 mL with water. Then, it was transferred to the fire and measured 10 minutes after the start of boiling water. It was observed the presence of black color on the filter paper. Interpretation: the presence of black color is considered positive.

Ammonia test (Eber reaction)

A piece of sample (1 cm^2) was cutted and placed at the end of a wire (15 cm). The wire on the sample was placed in a test tube with a solution of Eber (three parts of ethyl alcohol, one part of hydrochloric acid and one part of ethyl ether). It was observed the presence of smoke in the sample. Interpretation: the presence of smoke was considered positive.

Statistical analysis

Statistical analysis of the above variables was performed by Anova and complemented by the multiple comparison Tukey test for the contrast between means of groups. Results were expressed as mean ± standard deviation. The statistical conclusions were performed with 5% significance level. Details about the methodology employed can be found in Zar [7].

III. RESULTS AND DISCUSSION

Statistical analyzis of the Tables 02 and 03 had *p* values of 0.0001 considered extremely significant.

The pH values of chuck and shin/ shank cuts were significantly different from the others beef cuts. The pH of the different beef cuts ranged from 5.60 to 5.89 (Table 02). All pH values of different types of beef cuts were within the Brazilian official established standards [3].

The average pH values of the cuts thigh/drumstick (pH=6.34) and fillet (pH=5.96) showed highly significant differences. The pH values of thigh/drumstick cut were high compared with the poultry fillet (Table 03). Although there is no specific legislation and detailed pH of different poultry cuts, the pH of thigh/drumstick are higher than the standards set for the Brazilian beef cuts [3]. The Brazilian legislation establishes that the pH of beef in a position to be consumed is up to 6.4, above this value the meat is considered unfit for consumption, indicating a beginning decomposition [8].

Only poultry cuts had changes in hydrogen sulfide and ammonia tests (Table 04). Under Brazilian law, the hydrogen sulfide and ammonia tests may not be positive for the beef samples [6]. Tests for hydrogen sulfide and ammonia indicate the conservation status of the meat. In the case of poultry cuts, these tests showed an altered state of preservation.

Table 2 – Mean and standard deviation of pH of different types of beef cuts. Statistical analysis (p<0.05).

Types of cuts	*n*	Mean ± standard deviation
Outside	62	5.64 ± 0.14 a[1]
Topside	57	5.64 ± 0.09 a
Rump	55	5.60 ± 0.08 a
Chuck	51	5.80 ± 0.04 b
Eye of round	58	5.66 ± 0.12 a
Shoulder clod	52	5.78 ± 0.10 a
Knuckle	64	5.74 ± 0.13 a
Shin/ Shank	61	5.89 ± 0.23 b
Striploin	51	5.72 ± 0.08 a
Total	511	-

[1] *Tukey test (p<0.0001)*

Table 3 – Mean and standard deviation of pH of different types of poultry cuts. Statistical analysis (p<0.05).

Types of cuts	*n*	Mean ± standard deviation
Thigh/drumstick	121	6.34 ± 0.24 b[1]
Fillet	67	5.96 ± 0.27 a
Total	188	-

[1] *Tukey test (p<0.0001)*

Table 4 – Tests of hydrogen sulfide (H_2S), ammonia (Eber reaction) and determinations of pH of different types of poultry cuts (thigh/drumstick and fillet) and beef cuts (cushion hard, topside, rump, acem, lizard, shoulder, duck, muscle and against beef).

Types of cuts	*n*	Test		pH	
		H_2S	Eber	< 6.4	≥ 6.4
Outside	62	0/62	0/62	62/62	0/62
Topside	57	0/57	0/57	57/57	0/57
Rump	55	0/55	0/55	55/55	0/55
Chuck	51	0/51	0/51	51/51	0/51
Eye of round	58	0/58	0/58	58/58	0/58
Shoulder clod	52	0/52	0/52	52/52	0/52
Knuckle	64	0/64	0/64	64/64	0/64
Shin/ Shank	61	0/61	0/61	61/61	0/61
Striploin	51	0/51	0/51	51/51	0/51
Thigh and drumstick	121	35/121	20/121	65/121	56/121
Fillet	67	3/67	0/67	64/67	3/67
Total	699	38/699	20/699	640/699	59/699

IV. CONCLUSION

Based on this work, we concluded that:

(a) The different cuts of beef and poultry directly influence the pH.

(b) All beef cuts were suitable for human consumption under Brazilian law.

(c) The present study showed that the different poultry cuts had an inadequate state of repair.

(d) It is necessary to establish official standards for pH in the Brazilian legislation for different cuts of poultry.

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