# COMMERCIAL TURKEY PSE (PALE, SOFT AND EXUDATIVE) MEAT IN BRAZIL DURING SUMMER SEASON

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**Abstract – The present paper aims to report the incidence of turkey breast PSE meat in a commercial processing plant located in the Brazil southern region during the summer 2013. Its functional properties were also evaluated by processing turkey breast smoked product. A total of 2610 breast fillets were collected and a Minolta lightness (L*) value of 53 was a cutoff value for turkey PSE breast meat characterization. By applying these criteria it was found an incidence of 41.7% PSE meat. A comparison of its functional properties was carried out in relation to normal meat samples and it was found out a 5.5 % lower of water holding capacity (WHC) as consequence of lower pH values giving rise to a higher L* values. The turkey breast smoked PSE meat showed lower WHC of 3.9% and 31.3% higher texture in relation to the product processed with normal meat.**

**Key Words – Functional meat properties, Meat quality, Turkey smoked meat product.**

## I. INTRODUCTION

According to USDA [1], Brazil ranks as the third major turkey meat producer in the world with 531 tons yearly while USA with 2,669 tons and EU with 1,910 tons, are the first and second, respectively. These figures offered an idea of the potential importance of this meat type for Brazilian economy. However, a color abnormality occurs named PSE meat and it is an abbreviation that stands for pale, soft, and exudative and refers to meat that is pale in colour, soft appearance, and wet at its surface due do its poor water holding ability. This meat functional defect was promoted by the protein denaturation caused by rapid postmortem muscle glycolysis, which lowers the pH of the meat while the carcass is still warm [2, 3]. Most frequently used in reference to pork, this defective meat is being seen with increasing frequency in turkey and broiler processing plants. It is has been estimated that this PSE type meat represents 5-40% of meat that is produced in the poultry industry representing a loss in excess of $200 million dollars yeraly by the turkey industry alone [4]. Turkey PSE meat in Brazil so far has not been evaluated extensively as broiler meat as the incidence has been reported to be 20-80% depending on the pre-slaughter management circumstances [2,5,6,7]. Recently, we have demonstrated the broiler PSE meat samples were identified by consumers as paler, and the preference was for the control samples. Among the attributes of cooked samples, such as tenderness, flavor and juiciness, only flavor was significantly different and control samples presented higher acceptance values ($p \leq 0.05$) by the consumers [8]. The broiler PSE meat functionality was also evaluated in an emulsion meat product as broiler mortadella by examining the water holding capacity (WHC), texture profile, emulsion stability (ES), and color of the final products and the results showed the denatured protein affected the ES. Addition of additives was necessary to enhance the functional properties of PSE meat [9]. The present paper aims to describe quantitatively the turkey breast PSE meat condition in a commercial processing plant under Brazilian conditions in the summer and also the influence of its presence in meat products such as turkey smoked breast fillet meat.

## II. MATERIALS AND METHODS

*Animals*

A total of 2610 breast fillet meat samples from turkey of 140 days of age, BUT-9 lineage were

obtained from a commercial processing plant in southern of Brazil during the summer 2012/2013 of minimum and maximum temperature from 24 to 36°C and RH from 46 to 68% throughout the day, in a cooperative integrate system. The animals were slaughtered according to the standard industry practice, essentially consisting of hanging, electric stunning, bleeding, scalding, defeathering, evisceration, cooling the carcass, deboning and removal of the breast samples, pectoralis major. Samples were refrigerated at 4°C for 24h for subsequent color analysis and other physical chemical analysis.

*Color and pH measurements*

pH was measured by inserting electrodes into the meat samples (using a contact pH meter system (Testo 205). Analyses were performed in triplicate at 24h post-mortem, as reported by Olivo et al. [2]. A Minolta CR400 colorimeter was used to evaluate the color and L* (lightness) of the posterior surface of intact skinless breast muscles at 24 h post-mortem. The L* values were measured at three different sites on the same sample: the proximal extremity of the muscle, the distal extremity of the muscle and the medial side half way between the proximal and distal extremities [10].

*Water-holding capacity (WHC)*

WHC was determined based on the technique described by Hamm [11]. Twenty-four-hour post-mortem samples were collected from the cranial side of the breast fillets and cut into 2.0g (±0.10) cubes. A total of 16 samples were analyzed in triplicate. They were first carefully placed between two filter papers and then left under a 10 kg weight for 5 min. The samples were weighed and WHC was determined by the exudated water weight via the following formula: 100 - [(Wi -Wf / Wi) x100], where Wi and Wf were the initial and final sample weights, respectively.

*Turkey smoked meat processing*

Samples either PSE or normal breast fillet were processed by adding ingredients as described in Table 1 following the steps of grinding, brine, tumbler, stuffing, smoking, vacuum packed and pasteurization.

Table 1 - Ingredients used for preparing smoking turkey breast PSE and normal meat.

| Ingredients | % |
|---|---|
| Water | 17.50 |
| Preservative | 0.08 |
| Flavoring | 0.13 |
| Spices | 0.60 |
| Sodium Nitrite | 0.02 |
| Colorants | 0.01 |
| Starch | 6.14 |
| Either PSE or normal turkey fillet meat | 72.00 |
| Vegetable protein | 1.63 |
| Salt | 1.82 |

*Texture measurement*

The smoked meat products were cut into rectangular pieces of 1.50 cm height x 1.00 cm wide x 2.00 cm long. The shear force (SF) was measured in a texturometer Mycro Stable Systems TA-XT2i coupled with Warner Bratzler lamina and the results were expressed in Newton (N).

*Moisture determination*

Gravimetric method was used in a forced-circulation oven at a temperature of 105° C for 6 h and the results were calculated by mass difference according to AOAC [12].

*Statistical analysis*

The program Statistica for Windows 7.0 was applied to analyze the results. The Student t test at 5% probability ($p \leq 0.05$) was used to compare treatments PSE and normal meats.

## III. RESULTS AND DISCUSSION

*1. Fresh breast meat*

The color variation of turkey breast meat can be seen in the Fig. 1. It was observed that L* values varied from 42.28 (dark) to 65.73 (pale), being the average of 52.56. Overall, these results were

higher than those reported from Canada [13] and Portugal [14] as described in Table 2. However, our results were similar to that obtained in USA by Owens et al [4]. Therefore, from the Fig.1 and Table 3, we can assume that cutoff value was L* ≥ 53 to define PSE meat in turkey breast fillet under the conditions of this experiment. Taking this value into consideration, our results indicated the PSE incidence was 41.7%. PSE meat samples presented 5.5 % lower of WHC as consequence of lower pH (5.61) in relation to the control samples (pH=5.73) as shown in Table 3.

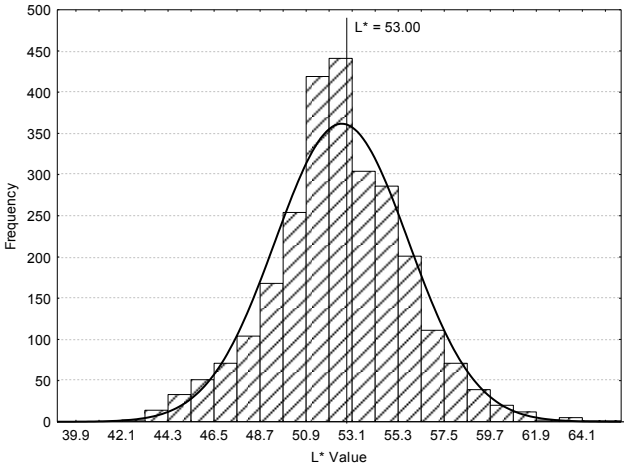


Fig.1. Histogram representing L* value distribution in turkey breast meat (n=2610).

Table 2. Comparative values of turkey PSE and normal meats obtained in different countries in relation to the results described in this work.

| | Barbut [13] | Owens et al. [4] | Fraqueza et al.[14] | Present work |
|---|---|---|---|---|
| Country | Canada | USA | Portugal | Brazil |
| Frequency | 4000 | 2995 | 977 | 2610 |
| L* range | 38 to 57 | 41 to 63 | 35 to 55 | 42 to 66 |
| L* cutoff | 50/51 | 53 | 50 | 53 |
| Incidence % | 12 | 40 | 8 | 41.7 |

This elevated figure of PSE meat was probably caused by the association of high temperature and relative humidity (RH) a common condition in the summer season in this southern region.

## 2. Smoked turkey breast meat

Table 4 shows the comparative differences on the biochemical characteristics between the smoked turkey breast PSE and normal meats. These results showed clearly the functional meat properties were affected by the PSE meat conditions as the moisture content and WHC were higher values in normal meat samples and as consequence the texture measured by SF was higher in PSE meat.

Table 3. Turkey breast PSE and normal meat samples characteristics of 24h post mortem from a commercial processing plant

| | Fresh meat samples | |
|---|---|---|
| | Normal (n=8) | PSE (n=8) |
| pH | 5.73a ± 0.02 | 5.61b ± 0.01 |
| L* | 50.44b ± 1.49 | 57.18a ± 0.82 |
| WHC % | 79.73a ± 1.14 | 74.16b ± 1.16 |

Means followed by different letters on the same row differ by t-test at 5% significance level (p≤0.05).

As moisture and WHC were affected in PSE meat its yield was lower as some of its myofibrillar proteins were denatured and no longer retained intramuscular water. As in the case of broiler chicken meat it would be necessary to use additives in order to recover technologically the former meat water holding ability [9].

Table 4. Values of pH, L*, water holding capacity (WHC), yield, shear force (SF) and moisture of smoked turkey processed with either PSE or normal meat.

| | Smoked product | |
|---|---|---|
| | Normal | PSE |
| Yield % | 87.59a ± 0.45 | 85.47b ± 0.39 |
| pH | 6.41a ± 0.01 | 6.30b ± 0.02 |
| L* | 68.04b ± 0.95 | 73.97a ± 0.51 |
| WHC% | 62.32a ± 1.23 | 59.86b ± 0.65 |
| SF (N) | 8.47b ± 0.50 | 12.33a ± 1.09 |
| Moisture % | 76.16a ± 0.46 | 75.61b ± 0.45 |

Means followed by different letters on the same row differ by t-test at 5% significance level (p≤0.05).

## IV. CONCLUSION

Turkey breast fillet PSE meat occurs under Brazilian summer conditions affecting therefore the meat functional properties resulting as consequence qualities problems to the fresh meat and its products.

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