GLYCOLYSIS RATE IN BROILER CHICKEN *Pectoralis major* m. IN A BRAZILIAN COMMERCIAL PROCESSING LINE AND ITS INFLUENCE ON MEAT QUALITIES

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Abstract - Successful products are obtained only by consumers acceptance and this is directly dependent on their qualities. An important issue faced by poultry industry is the processing of meat known as PSE (pale, soft, exudative), which has its functional properties compromised due to the rapid post-mortem glycolysis. As the consequence there is a rapid decrease of the pH values while the muscle temperature is still high. The aim of this study was to evaluate the establishment of glycolysis in chicken breast meat in a processing line in Brazil, by monitoring the formation of PSE meat throughout *rigor mortis* installation. The experiment was conducted in a commercial slaughterhouse plant having Cobb lineage with mixed gender under the age of 47 days (n = 300). pH, color and temperature were determined in breast meat samples after 0.17h, 3.5h, 6.5h and 24.0h post mortem, kept under temperature of 36.63, 5.82, 5.81 and 3.91ºC, respectively. Results showed the formation of 0.33%; 0.67%; 9.25% and 24.72% of PSE meat, respectively indicating in order to occur this abnormality there was a need to have the complete transformation of muscle into meat.

Key Words – Animal welfare, *Post mortem* management, PSE meat.

I. INTRODUCTION

Brazil has become the third largest producer and the world's largest exporter of chicken meat with an annual production of 13.05 million tons and an annual export of 3.9 million tons in 2011 [1]. However, there are difficulties to overcome and birds welfare has been a challenge for the poultry industry, and proper management is a topic to be aware to avoid the stressful conditions that can lead to compromise meat quality, as in the case of PSE (Pale, Soft and Exudative) meat [2,3,4]. The development of PSE meat causes problems for the poultry meat-processing industries, and PSE is estimated to create costs of over US $200 million in the USA and over US $36 million in Brazil annually [5,6]. Consumers can detect the visual color abnormality of the PSE breast fillet meat at the point of the purchase and can taste flavor abnormalities due to PSE after cooking [7].

Several pre-slaughtering factors are related to broiler PSE meat formation, particularly transport, lairage, and slaughtering conditions. Journey maneuvers from the farm to the slaughterhouse, such as showering the birds at the farm, heat, vehicle acceleration, vibration, movement, impact, food and water deprivation, social disruption, and noise, are especially important [2,8,9]. PSE meat originates from a rapid decline in pH while the muscle is still hot before the completion of glycolysis leading to the denaturation of myofibril proteins thus compromising their functional properties [10,11]. The aim of this work was to evaluate the establishment of glycolysis in chicken breast meat in a commercial processing line in a slaughterhouse by monitoring the formation of PSE meat throughout *rigor mortis* installation.

II. MATERIALS AND METHODS

The experiment was conducted in the spring season, during the year of 2012 in a commercial processing plant in the state of Paraná, Brazil. The birds were Cobb lineage (n=300), both gender of 47 days of age. They were sacrificed in accordance with the routine practices of industrial slaughter activities as shown in the Fig. 1.

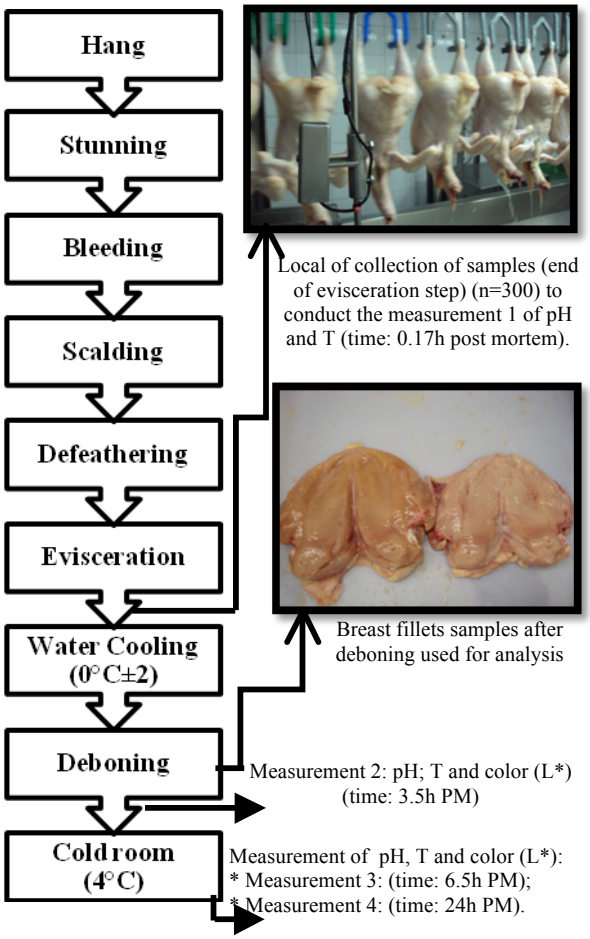

Fig. 1 – Fluxogram showing a typical processing line of breast chicken slaughter house in Brazil and the location where the samples were taken for analysis. After evisceration it was performed the first measurement at the time of 0.17h PM for pH and T. Subsequently other 3 measurements were performed for pH, T and color (L*) after 3.5h, 6.5h and 24h storage. PM* PM: Post Mortem; T: temperature

The first location for measurement of temperature (T) and pH was after 0.17h post mortem (PM). The second measurement of T, pH and color was after 3.5h PM after cooling and the third and fourth measurements were carried out at 6.5h PM and at 24h PM while the meat samples were stored in a cold room at 4 ^{o}C. The samples pH and temperature were measured in duplicate by inserting electrodes into the breast muscle, *Pectoralis major m*., using a pH meter system (Testo 205) and Minolta CR10 colorimeter was used to evaluate color, L* (lightness), on the posterior surface of the intact skinless at three different sites on the same sample as described in Olivo et al. [11]. The classification as PSE or Normal meat was performed by determining the pH value and lightness (L*) and pH values ≤ 5.8 and $L^* \geq 53$, as PSE and $pH > 5.8$ e $44 < L^* < 53$, as Normal as described in Soares et al. [12].

The program Statistica for Windows 7.0 was applied to analyze the results. The ANOVA and Tukey test at 5% probability ($p \leq 0.05$) was used to compare temperature, pH, color at different period post mortem.

III. RESULTS AND DISCUSSION

In this experiment carried out under commercial conditions, samples were taken according to the Fig 1: 1) 0.17h PM at carcass temperature of 36.63±2.14^{o}C before the water chiller tank and the pH value was 6.43. 2) After 3.50h PM while the carcasses were treated in a water chiller at 0^{o}C±2^{o}C subsequently deboned and the broiler breast meat samples reached the temperature down to 5.82^{o}C and the pH measured was 6.37 while L* value was 54.24. 3) After 6.50h PM while the samples were stored in a cold room at 4^{o}C the glycolysis was still operative as the pH value was dropping down to 5.96 under similar temperature of 5.81. 4) The completion of rigor was only achieved after 24h PM and the ultimate pH value of 5.88 while the temperature was 3.91^{o}C, as seen in Fig 2 and Table 1.

Under these conditions the amount of PSE meat found was 0.67% at 3.50h PM, 9.25% at 6.50 PM and 24.72% at 24h PM (as shown in Table 1). Our results demonstrated that the cold temperature plays a significant role towards the completion of *rigor mortis* by delaying the ultimate pH value therefore influencing the PSE meat measurement.

Table 1 Temperature, pH, color (L*) and PSE incidence (%) values measured in *Pectoralis major* m

at several periods of glycolysis: 0.17, 3.5, 6.5, 24h post mortem and incidence (%) of PSE meat.

Time (h)	Temperature (°C)	pH	Color (L*)	PSE (%)
0.17 PM*	36.63 ±2.14[a]	6.43 ±0.20[a]	-**	0.33
3.50 PM	5.82 ±0.92[b]	6.37 ±0.23[b]	54.24 ±3.78[b]	0.67
6.50 PM	5.81 ±0.93[b]	5.96 ±0.13[c]	54.44 ±5.06[b]	9.25
24.0 PM	3.91 ±1.71[c]	5.88 ±0.12[d]	57.61 ±2.78[a]	24.72

Means followed by different letters in the same column differ by Tukey test at 5% significance level ($p \leq 0.05$).
* PM = post mortem
** - Analysis not performed

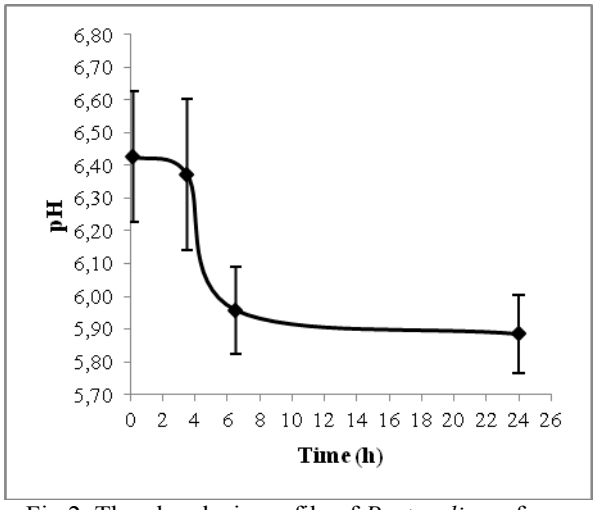

Fig 2. The glycolysis profile of *Pectoralis* m. from broiler chicken and the pH measured firstly in the carcass subsequently in the breast meat samples held at 0.17h, 3.50h, 6.50h and 24h PM under the temperature of 36.63, 5.82, 5.81, 3.91°C, respectively during post-mortem aging. Means (n =300) ($P < 0.05$).

Recently, Olivo et al. [11] demonstrated in an experiments carried out at 23°C, the breast meat samples from stress broiler chicken group presented a final pH value lower than 5.7 within 15 minutes post mortem and they realized that under this condition there was a development of PSE chicken meat. The completion of glycolysis for the former group of birds was only 10-15.0 minutes being the initial pH value of 6.04 and the final pH value was 5.5. Conversely, samples from the birds without stress group displayed a high initial pH value of 6.25 and the completion of glycolysis was relatively slow, reaching the final pH value of 5.65 after approximately 30 minutes. Stressed birds groups displayed completion of *rigor mortis* twice as fast as non-stressed chickens under similar temperature. These two experiments showed the relevance of temperature environment towards the glycolysis onset and the final pH values were determinant for the PSE meat formation in broiler

IV. CONCLUSION

Under commercial conditions, it is recommended for the determination of breast fillet PSE meat incidence to analyze samples after 24h post mortem when the ultimate pH meat value is reached.

ACKNOWLEDGEMENTS

The authors acknowledge with thanks the financial support from PRONEX/Fundação Araucária-CNPq, Protocol #09.277 and UTFPR. MS, EII, FAGC and MRP are CNPq research fellows.

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