Commercial pre slaughter blue light ambience for controlling stress and broiler chicken PSE (Pale, Soft, Exsudative) meat

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Abstract— **The influence of light on the birds behavior has been the subject of research and blue light is known to maintain their ambience comfort. The objective of this work is to report the blue light environmental effect on the control of broiler stress by measuring the occurrence of PSE meat just before slaughtering. Birds (n = 602) were divided into two groups before slaughter at the point of being hung on shackles: broilers group under monochromatic blue light (fluorescent lamp, ~6000K) ambience and control group under yellow light (incandescent lamp, ~3000K).The chickens were slaughtered at a commercial abattoir and the fillets (*Pectoralis major* m.) were collected 24h post-mortem and analyzed for pH and color (CIELAB system). The fillets were classified as PSE meat associating pH (<5.8) and lightness (L *> 53) values and results were submitted to the Student t test (Statistica 7.0). Fillet meat samples in the control group showed pH_f of 5.77 lower value ($p \leq 0.05$) in comparison to samples from the group under blue light with pH_f=5.81. Samples in the control group presented L* = 54.26, b*= 6.27 and samples from birds under blue light ambience presented L* = 52.86 and b* = 5.22 ($p \leq 0.05$). These results revealed that the birds under monochromatic blue light ambience just before slaughtering contributed for alleviating the ante-mortem stress by observing the decrease in 14.0% in the occurrence of PSE meat.**

Keywords— pH, colour, Pectoralis major, pre-slaughter handlings

I. INTRODUCTION

The PSE (Pale, Soft, Exudative) meat originates from inadequate pre-slaughtering handlings such as feed catching, transportation, temperature and relative humidity that leading to animal stress resulting in accelerated rigor mortis [1,2]. The rapid glycolysis post-mortem, leading to the denaturarion of myofilbril and sarcoplasmatic proteins, thus compromising their functional properties and making them inappropriate for processing [1].

The use of artificial lighting in poultry breeding has been investigated by directly influence the metabolism and consequently welfare improving the productive performance [3]. Charles *et al*. [4] observed that chickens exposed to high light intensity had a lower percentage of fat and higher percentage of protein. There are also reports that the birds growth rapidly under blue, red and white lights and blue and green monochromatic lights promote the development of myofibrils due to effective stimulation of testosterone secretion [5].

Birds, like humans, have called the third eye, chicken pineal gland, located just rostro-dorsal to the superior colliculus and behind and beneath the stria medullaris, between the laterally positioned thalamic bodies. This gland produces the hormone melatonin, which is responsible for preparing the body and induces it for sleeping. The secretion of melatonin follows circadin rhythm release during darkness and inhibited by light [6].

The blue light (440-490nm) has a calming effect on birds [7] and its has been used in catching the birds overriding the visual capacity of the birds that stay still facilitating the movement of the catcher [8].

Thus, some Brazilian slaughterhouse have being using the blue light just before slaughter at the point of being hung on shackles and the combination of partially dark ambient with use of blue light reduces the excitement of the birds, leaving them immobile. Then, the objective of this work is to report the blue light environmental effect on the control of broiler stress by measuring the occurrence of PSE meat just before slaughtering.

II. MATERIALS AND METHODS

A. Chickens and Groups

Six hundred and two chickens of the *Cobb Fast* and *Avian* 48 lineages aged 42 days were divided into two groups before slaughter at the point of being hung on shackles: broilers group under monochromatic blue light (fluorescent lamp, ~6000K) (Figure 1) ambience and control group under yellow light (incandescent lamp, ~3000K) (Figure 2).

Figure 1 Birds under monochromatic blue light (fluorescent lamp, ~6000K) before slaughter at the point of being hung on shackles

Figure 2 Birds under monochromatic yellow light (incandescent lamp, ~3000K) before slaughter at the point of being hung on shackles

The animals were slaughtered according to the standard industrial practice and essentially consisting of electrical stunning, bleeding, defeathering, evisceration, water-cooling the carcass, deboning and refrigeration [9]. Fillet meat (Pectoralis major m.) samples were collected at 24h post-mortem at 4ºC.

B. pH measurement

pH was measured by inserting electrodes into the meat samples using a contact pH meter system (Testo 205). Analysis was performed in triplicate at 24h post-mortem as reported in Olivo et al. [1].

C. Colour measurement

A Minolta CR400 colorimeter was used to evaluate the color (L*, a*, b*) of the posterior surface of intact skinless breast muscle at 24h post-mortem. The L*, a* and b* values were measured at three different sites on the same sample: the proximal extremity of muscle, the distal extremity of the muscle and the medial side half-way between the proximal and distal extremities [10].

D. Sample classification

Fillet meat samples were classified as PSE or normal based on previously establish parameters associated with pH and L*. Values of pH <5.8 and L *> 53 were classified as PSE and values pH>5.8 e $44<L_{24h}^{*}<53$ as normal [11].

E. Statistical analysis

Statistical analysis was carried out using Statistic software, version 7.0. Student t-test ($p \leq 0.05$) was used to determine significant difference between two groups control and under blue light.

III. RESULTS

Table 1 shows the values of the pH and colour measurement of control and under blue light fillet samples at 24 h post-mortem. The pH, L* and b* were significantly different between samples. Fillet

meat samples in the control group showed pH_f of 5.77 lower value ($p \leq 0.05$) in comparison to samples from the group under blue light with pH_f=5.81. Fillet meat samples in the control group presented L* = 54.26 and samples from birds under blue light ambience presented L* = 52.86 significantly different ($p \leq 0.05$). There was no significant different for a* values between two groups. The b* values were significantly higher for fillets from control groups than fillets from chickens under monochromatic blue light.

Table 1 Mean values of pH, colour measurement of control and under blue light fillet samples at 24 h post-mortem

Groups	pH_f	L*	a*	b*
Control	5.77[b]	54.26[a]	1.91[a]	6.27[a]
(n=302)	(±0.12)	(±3.08)	(±0.80)	(±1.71)
Under blue	5.81[a]	52.86[b]	1.81[a]	5.22[b]
light (n=300)	(±0.14)	(±3.29)	(±0.94)	(±1.52)

Different letters in the same column differ by Student's t-test ($p \leq 0.05$)

The Figures 3 and 4 show occurrence of PSE broiler breast meat in control group and under blue light respectively after the classification of breast meat by pH and L* values. The results indicate occurrences of 53% PSE breast meat in control group, while only 39% of birds under blue light presented PSE meat characteristics.

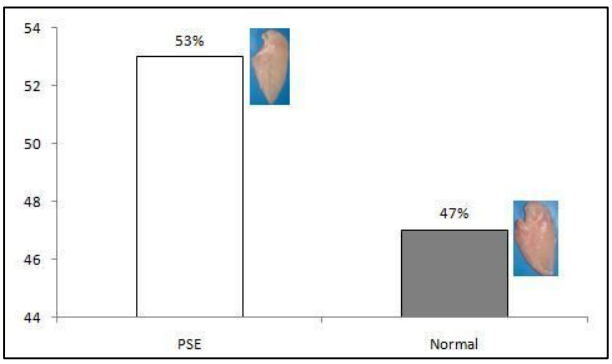

Figure 3 – The occurence of PSE breast meat in control group

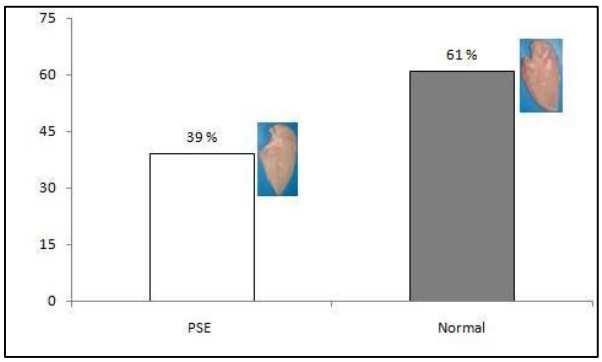

Figure 4 – The occurence of PSE breast meat in birds under blue light

IV. DISCUSSION

The pH and L* values of fillet control group was typical as PSE broiler meat as previously reported [1, 9,10]. Fillets from control group were also more yellow characteristics of PSE broiler meat [12]. Fillets meat from the control group presented functional properties decreased suggest that birds were excited and stressed before slaughter at the point of being hung on shackle due to the absence of blue light. The ante-mortem stressed lead to rapid glycolysis post-mortem with decreased pH and increased of L* and b* values.

The occurrence of PSE breast meat in the control group (53%) were similar to those reported by Simões [2] that found a figure of 52% of PSE broiler breast meat in a commercial plant survey in the summer. The monochromatic blue light ambience just before slaughter inhibited the occurrence of PSE breast meat, probably calming birds reducing ante-mortem stress.

V. CONCLUSIONS

These results revealed that the birds under monochromatic blue light ambience just before slaughtering contributed for alleviating the ante-mortem stress by observing the decrease 14.0% in the occurrence of PSE meat.

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