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The Effect of Poultry Preslaughter Fasting and Condition on the Quality of Meat and Luncheon Processed in Syria

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Abstract The aim of this work was to evaluate the influence of chicken transport time and lair before slaughtering on the quality of locally meat and luncheon. One hundred and fifty chickens were tested and submitted to thirteen-hour preslaughter fasting periods in average. Deboned breast meat submitted to the following analysis: pH, drip loss (DL), water holding capacity (WHC) and emulsion stability (ES). The results show that 20% of meat considered as pale, soft and exudative (PSE) and the luncheon prepared with local meat have good properties.
Keywords Poultry; Preslaughter fasting; Luncheon quality; PSE (pale, soft, exudative) meat

Introduction

The food consumption pattern has changed over the last decades, with consumers becoming more and more aware of food quality characters. Nowadays, quality characters include not only nutritional and sensory characters, but also food safety, environmental and animal during rearing. Members of the industry have tried to maintain their markets by addressing these new consumer interests.

Before slaughter, while the chickens are still on the farms, the feed withdrawn and the chickens submitted to a feed withdrawal (FW) period, these aims to reduce the gastrointestinal contents and thus fecal contamination of the carcass during transport and evisceration. Although 10 h to 12 h of FW is enough to minimize carcass contamination and yield loss (Wabeck, 1972; Veerkamp, 1986; Castillo et al., 2007), Wabeck (1972) suggested eight hours as the minimum time to empty the broilers' gastrointestinal contents. Weight loss by the birds during the period between FW and processing called as live shrink or shrinkage (Bilgili, 2002). After broilers have been without feed for more than 6 h, they begin to draw moisture and nutrients from their own body tissues and this weight loss may then effect edible yield (Northcut, 2010). The degree of shrinkage caused by FW (SFW) affected by bird age, gender, diet density, house environmental control, ambient temperature, length of FW, transportation, and plant holding conditions (Bilgili, 2002). Feed withdrawal periods linearly correlate with carcass yields before, and after carcass chilling (Lyon et al., 1991). Broiler dehydration during FW and transport, besides causing weight loss, may affect the physical and chemical characteristics of the meat. Several events preslaughter have an influence on poultry processing efficiency including feed and water withdrawal, catching methods, transportation system, distance to the plant and plant holding conditions, which are significant factors effecting poultry slaughter quality (Bilgili, 1995). Because of the increase in volume of deboned chicken cuts and further processing, the effects of FW on fillet pH, tenderness, cooking weight loss and chemical composition have become the focus of attention for several researchers (Ali et al., 1999; Berri, 2000; Castillo et al., 2007).

Murray and Rosemberg (1953) reported that glycogen concentration related to pre-slaughter fasting. Glycogen concentration lows when a 16 h fasting period is applied, and increases 33% between 1 h and 10 h when re-fed birds with ground corn. Mellor et al. (1958) evaluated the relation between glycogen and pH and found that chicken meat with high glycogen concentration presented pH 6.2 therefore the highest glycogen level was related to more acid meat as low pH 24 post mortem is related to PSE (pale, soft, exudative) meat. According to Kotula and Wang (1994) glycogen levels decrease as fasting time increases as they found that 0 hour and 36 hours of fasting resulted in glycogen values at 0 hour post mortem of 7 mg/g and 3.5 mg/g respectively.

Romo (2001) found that broiler not submitted to pre-slaughter fasting presented has a higher incidence of PSE meat (pH<5.7 up to 15 minutes) as compared to those submitted to fast, with a 24% (12 birds) incidence in Ross broilers and 13.33% (eight birds) in Cobb broilers. Castro (2006) also asserted that higher PSE frequency relates to very short fasting periods, as there is high glycogen availability in the muscle. Therefore, fast relate to meat pH and influences the incidence of PSE in chicken meat (Komiyama et al., 2008).

1 Water-Holding Capacity (WHC)

Muscles consist of 65%~80% of water that exists in free, immobilized, or bound form. A product's water-holding capacity is primarily determined through exposing the product to external forces such as cutting, heating, grinding, or pressing (Hedrick et al., 1994). Since water is a polar molecule, it can become associated with electrically charged reactive groups on the muscle proteins, resulting in a strong attraction and immobilization known as bound water. Bound waters will continuously attract other water molecules, resulting in immobilized water. Immobilize water has less order and thus a lower attraction to the reactive groups. Only surface tension holds free waters that can be easily removed with little physical force such as the shrinking of myofibrils during the development of rigor mortis. Rapid pH decline in a high temperature carcass results in denaturant and shrinking of myosin, and reducing filament spacing (Offer, 1991). Consequently, water is expelled from the cells and lost as purge or drip loss. Products processed from PSE meat not only have been lowering water binding capacity (lower yields), but also exhibit the reduced cohesiveness (Solomon et al., 1998; McCurdy et al., 1998; Scott, 2005).

2 Harvesting and Transportation

There is evidencing in the literature that catching often results in injury, especially when many birds are caught with maximum haste by the catching team. (Leandro et al., 2001) identified and quantified losses when comparing both manual and mechanized catching (16.5% to 7% respectively). The authors found bruising in thighs, legs, and breasts of up to 25% of the harvested birds due to handling, catching, transportation, and unloading at the processing plant. However, most damage in the carcass was found during catching in the breast (11%), thighs (33%), and wings (38%). Hip dislocation occurs when birds are caught in the broiler sheds and loaded into the transportation crates. Catchers usually hold several birds by one leg in each worker hand. If one or more birds start flapping their wings, their hip twists, the femur detaches, and a subcutaneous hemorrhagic are produced, killing the bird. Dead birds with dislocated hip often have blood in the mouth. Sometimes, too much haste caused this damage by the catchers (Baracho et al., 2006).

3 Results

The results show that the mean of withdrawal period was 13 hours, and we found bruising in thighs, legs, and breasts of up to 2% of the harvested birds due to handling, catching and transportation (Table 1).

The pH of the samples during 24 h postmortem showed that 80% of the samples considered as normal meat (pH>5.80) and 20% of the samples considered as PSE meat (pH≤5.8).

The results show that the mean of water holding capacity were 62% and (WHC) of 20% of samples were less than 60% and these samples considered as PSE meat (Kissel et al., 2009).

The emulsion stability (ES) value of PSE meat (10.5%) was significantly higher than in normal meat (7.6%~7.8%~7.7%~7.8%). The ES value was less when added starch and isolated soy protein, which suggests that soy protein acts synergistically as an emulsifier. This improve the final product's ES, as previously observed by Wang et al (2000), Kissel et al (2009).

The mean of the drip loss of all samples were 5.5% whereas 20% of samples were more than 6% and these samples considered as PSE meat Jensen et al (Jensen et al., 1998).

Table 1 The results obtained for a feed withdrawal period (FW), ambient temperature during transportation, injury percentage during catching, pH, water holding capacity (WHC), drip loss (DL) and Emulsion stability (ES)

Farm no.	Withdrawal period (h)	Temperature (℃)	Injury (%)	pH	WHC (%)	DL (%)	ES (%) Without addition	ES (%) With addition
1	16	8	2.0	5.77	59	6.1	10.5	2.2
2	10	11	3.0	5.95	65	5.3	7.6	1.7
3	12	14	1.5	5.92	62	5.4	7.8	1.7
4	14	12	1.5	5.86	61	5.4	7.7	1.8
5	13	10	2.0	5.88	63	5.4	7.8	1.8
Average	13	11	2.0	5.88	62	5.5	8.3	1.9

4 Discussions

As shown in Table 1 the pH of the fillets at 24 h postmortem showed, values that varied from 5.77 to 5.95. Kotula and Wang (1994) reported similar pH range of 5.79 to 5.84 for FW periods of 3 h, 6 h, 12 h and 18 h and suggested that 8 h of FW would differences observed among the pH values do not provide a clear picture of the possible influence of FW time on pH. In general, the results of the current study agree with those of other authors (Kotula and Wang, 1994) and lead to the conclusion that pH is probably not affected only by FW time.

According to (Komiyama et al., 2008) Meat pH was significantly influenced ($p \leq 0.05$) by the different fasting period. The lowest values were obtained in the meat samples of birds submitted only to 4 h pre-slaughter fasting, and there were no significant differences ($p > 0.05$) in pH (evaluated in different periods) among the remaining pre-slaughter fasting periods (8 hours, 12 hours, and 16 hours). Castro (2006), analyzed meat pH eight hours after slaughter, also did not detect any effect ($p > 0.05$) of the different pre-slaughter fasting periods, with pH values between 5.71 and 5.77.

In this study, values of WHC did not differ significantly between the two formulations: PSE and normal meat. Similar results were observed by Kissel et al (2009), the WHC of PSE and normal meat were (60.6%, 65.9%) respectively and similar results were observed by Daigle (2005) in Delicatessen Rolls that were produced from normal and PSE turkey meats.

Table 1 shows that, in luncheon formulations without ingredients, the ES value of PSE luncheon was significantly higher than in the luncheon made with normal meat. The ES value was even higher when added starch and isolated soy protein, which suggests that soy protein acts synergistically as an emulsifier. This improves the final product’s ES, as previously observed by Wang et al (2000). Kissel et al (2009) observed similar results.

In this study value of drip loss after 16 hour of withdrawal period was 6.1% in another study with birds submitted to 16 hours of pre-slaughter fasting and transported for three km the drip loss was 4.88%.

5 Conclusion

The association of longer Preslaughter Fasting period and PSE meat did not seem to follow negative parameters under the conditions of this experiment. Although the technological functional properties of broiler PSE meat are weak, the addition of normal meat and other luncheon ingredients strengthen it.

6 Material and Methods

6.1Animals and Management

This experiment was carried out in the winter season of (2010) , birds were collected during 5~7 hour and placed in boxes (n=9) with dimensions of 772 mm× 570 mm×303 mm and subjected to road conditions in an open truck at 11℃for transport periods of 3~5 hour. On arrival at the slaughterhouse, birds subjected to lairage under natural ventilation for 2~4 hour before slaughtering. Broilers killed manually. This included cutting, the carotid artery and jugular vein, followed by scalding, feathering, eviscerating, and removing the breast muscle samples, which refrigerated at 4℃ for further analysis.

In this study, 150 broilers were tested, and the injury percentage during catching calculated.

6.2 pH Measurements and Samples Classification

Meat pH directly was measured in the pectorals major muscle using a pH metro (Ama-Digit) coupled to a probe electrode, The initial (pHi) and final (pHf) pH were measured at 15 min and 24 h postmortem at 4℃ in triplicate, as reported in Olivo et al (2001). Samples were classified as PSE or normal meat samples based on previously established parameters associated with pH (Oba et al., 2009). PSE samples presented values of pH≤5.80 and normal meat samples had valued of pH>5.80 (Kissel et al., 2009).

6.3 Water Holding Capacity (WHC) Measurement

To determine water holding capacity 2 g meat cubes were placed between two circles of filter paper placed on two glass plates. A 10 kg weight was placed on the top glass plate for 5 minutes, after which samples were weighed, as the quantity of water loss was calculated as the difference between initial and final weights (Kissel et al., 2009; Hamm, 1960).

6.4 Drip loss (DL) and Emulsion Stability (ES)

Drip loss was determined by keeping breast fillet under conditions that simulate retail sale. Samples were placed on polystyrene trays, covered with permeable plastic film, and stored at (3±1)℃ for 72 h.

Drip loss (DL) was calculated as the difference between initial and final weights (Northcutt et al., 1994; Hamm, 1960; Komiyama et al., 2008). Emulsion stability (ES) was measured immediately after the cutter phase as described in Kissel et al (2009). The ES was measured according to the method described in Lin and Zayas (1987). Briefly, 25 g of the emulsion meat was weighed in centrifuge tubes, subjected to a thermal treatment of 70℃ for 30 minutes and centrifuged at 4 000 rpm for 3 minutes. The measured supernatant was expressed in percent of emulsion stability.

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