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Effect of Pre-Slaughter Management on Quality of Poultry Meat

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ABSTRACT

Poultry meat quality is complex interactions between the environment and genotype especially the stresses undergone before slaughter like heat stress before slaughter showed the lowest ultimate pH of meat. Qualities of poultry meat are based on various aspects like management techniques, weather, rearing conditions, genetics, transportation, and bird's ability to respond to the external environment. Different pre-slaughter conditions has impact on meat quality attributes such as muscle ultimate pH, water holding capacity, texture, juiciness, flavor, colour and microbial population. Stressful condition before slaughter reduce the initial rate of the pH drop with increased in redness of breast meat, increase in lactate concentration in breast muscle. This paper tries to give an insight about various pre-slaughter conditions which affect the poultry meat quality.

Key words: *Pre-Slaughter Management, Poultry Meat Quality*

INTRODUCTION

Increase in global poultry meat consumption contributed by new and efficient processing systems, and novel products that meet the market chain requirements as well as end-consumer needs[21]. In overall world poultry production and processing technologies have become readily accessible, and implemented, thereby allowing continuous expansion and competitiveness in this meat sector[1]. Complex interactions between the genotype and the environment like handling stresses before slaughter affects the quality of meat[2,6]. In different production stages, slaughter, and meat processing most of factors viz., age, gender, nutrition, management, bird density, harvesting method, environmental conditions, handling, etc influencing poultry meat quality can be controlled[14]. Factors including thermal demands of transport microenvironment, acceleration, vibration, motion, impacts, fasting, and withdrawal of water, social disruption and noise cause adverse effects on the animals that may range from mild discomfort to death[15].

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A closer control of environmental conditions during transit and more careful bird handling to reduce trauma have been reported as crucial factors to reduce mortality and carcass defects (mainly: hemorrhages, bruises and broken bones)[24]. In present review pre-slaughter factors/ conditions affecting meat (Chicken) quality of poultry has been discussed.

Feed Withdrawal

Since many years standard management strategy has been used by poultry industry like removal of feed (with ad lib water) before catching, transport and slaughtering practice[17]. Poultry for slaughter is normally fasted for about five or more hours prior to catching for transport to the slaughterhouse. Pre-slaughter fasting result empty gut with the aim to reduce carcass fecal contamination during slaughtering which helps to improve the quality of poultry meat. Moreover, it was established that a long pre-slaughter fasting can lead to an increase in muscle ultimate pH, higher water holding capacity and darker colour of the meat[4]. Rasmussen & Mast [20]concluded that birds subjected to feed withdrawal treatments for 18 hours experienced 3.8% shrinkage. When feed withdrawal time increased from 16 to 24 hours shear values (indicator of tenderness) increased significantly from 5.78 kg/g. to 6.01 kg/g.[7].

Water withdrawal

Re-synthesis of glycogen to increase energy reserves and therefore to obtain higher meat acidification post mortem is one of the aims of adlib water intake of animals during the pre-slaughter period in lairage. Spraying broilers birds with water during resting period increases meat cooking loss and causes lower shear and water retention capacity. Drip loss as well as cooking losses, pH and color of poultry meat measured after 24 hrs postmortem demonstrated that water showering before slaughter of birds inhibited PSE development in chicken breast meat[19]. Shrinking of muscle cell diameter by approximately 10% in water showered birds muscle along with extra cellular enlargement of endomysium and perimysium sheaths is observed after 72 h postmortem.

Temperature

Heat stress during rearing is also one of the prominent ante-mortem stressors that results in a faster pH decline and pale color in the breast meat of turkeys[12]. Yalçin *et al*.[25] found that breeder age influenced meat quality and that broilers from young breeders had lower pH values when reared at high ambient temperatures. Holm & Fletcher observed that broilers held at 29°C during crating had lower ultimate pH than those from broilers held at 7°C and 18°C. Sandercock *et al*., reported that acute heat stress during crating leads to alterations in blood acid-base status and influences postmortem muscle glycogen levels and breast meat pH. However, conflicting results have been reached in some studies; Froning *et al*.[9] reported that turkeys exposed to immediate pre-slaughter heat stress did not exhibit PSE meat characteristics.

Lairage Time

There are significant losses during pre-slaughter period and current challenges of poultry production are summarized in the reduction of losses during the production process. This stage requires a study of critical control points, especially on the pre-slaughter operations. Frederico *et al*.,[8] concluded at highest temperatures (above 22 ºC), an increase in the lairage time reduced the mortality rates, being more pronounced in the critical (25 – 28 °C) and lethal intervals (above 29 °C). In relation to lairage time, the reduction in mortality rates was more pronounced in the intervals up to 1 hour of waiting. Therefore, the lairage time recommended for broilers during heat stress conditions is over 1 hour, and the greater intervals are more desirable for poultry welfare subjected to pre-slaughter operations.

Season

During the early summer season, the turkey industry reports substantial losses in yield due to poor water-holding capacity, poor texture and pale color. Heat stress has been associated with increased mortality and researchers found that chronic heat stress has been shown to result in a 20% reduction in growth rate in fast-growing strains of poultry. Heat stress has long been recognized as one of the prominent environmental elements influencing meat quality[23]. Stress as caused by either excitation

or increased temperature prior to slaughter reportedly produces redder muscle.

Physical contact

In all husbandry systems especially during pre-slaughter activities human is responsible for production of common stress like exposing chickens to an unfamiliar environment is likely to elicit both fear and stress reactions. The physiological indicators of stress in broiler chickens is increased serum corticosterone level[26]. The broiler birds that had been exposed to physical contact with human showed slightly shorter durations of tonic immobility than did the controls and physical contact with human had slightly reduced fear reactions in broilers but failed to reach significance[13].

Stunning:

Stunning renders animals insensible during slaughtering procedures. Several methods can be used for stunning birds such as chemical, mechanical and electrical. Chemical immobilization of chickens by the use of gases was first attempted in the 1950s. Electrical water bath stunning is the most common way of stunning of birds in commercial poultry processing plants, which shows that higher current frequency (≥480 Hz) results increased postmortem pH declining rate and improved meat quality as compared to the lower frequency (≤350 Hz)[22]. Carcass damage can be reduced due to the elimination of muscular contracture; pain is eliminated; and rigor mortis is accelerated[16]. Other possible benefits are improved working conditions in the hanging area of the abattoir and reduction in pre-slaughter stress if birds are killed by extended gas exposure period before shackling.

Lactic acid supplement:

Proliferation of pathogenic bacteria is due to decrease in crop lactic acid and increased pH which can be minimize with incorporation of lactic acid in the drinking water during pre-transport Byrd *et al*[5]. Feed withdrawal has been reported to cause an increase in broiler crop pH and a decrease in lactic acid concentrations as well as reduction of *Salmonella* and *Campylobacter* contamination in meat[11].

Glucose supplementation:

A negative post-slaughter effect of the birds having fasted and having been transported for long hours can result in reduced slaughter yields and negative influences on meat texture and meat pH. Such animals are often in a negative energy balance, blood glucose concentration decreases, the non-esterified fatty acid (NEFA) concentration increases, and glycogen stores decreases. Saccarose supplementation during feed withdrawal appears to have a measurable impact on shrinkage, lightness of liver and redness of thigh meat colour in broilers.

Dietary chemicals:

Conditions affecting live birds that contribute to pinking (as shown by increased muscle redness) include dietary nitrates and nitrites, moldy feed materials, dietary yeast supplements and milo used as a carbohydrate source[10].

CONCLUSION

Poultry meat quality is potentially affected by management techniques (feed withdrawal, transportation and lairage), weather (temperature and season), genetics, stunning, the ability of the birds to respond to the environment, dietary feed additives, common stressors and all the variables that may interact, affecting in the production cycle which is not only important in respect of quality but also important as welfare of the birds. Poultry industry peoples will obtain good quality meat by better understanding of these management strategies.

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