Broilers from female lineage sensibility to halothane gas and its relationship to PSE meat

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Abstract

This work aimed to evaluate broilers from female lineage halothane sensibility and its relationship to develop PSE meat. The halothane test was carried out in an anaesthetic chamber with 3.0% halothane. The unconscious birds were examined for leg muscle rigidity. If both legs were extended and rigid, they were classified as halothane sensitive (HAL+) whilst irresponsive birds were classified as halothane negative (HAL-) and intermediate response chickens (HAL+/-) with only one rigid leg. Results showed from 298 birds aged 42 days old, 95.6% were HAL-, 3.7% were HAL+/- and 0.67% were HAL+. *Pectoralis major* was collected from HAL- (n=105), from HAL+/- (n=11) and from HAL+ birds (n=2), pH and breast fillet colour were determined at 4ºC, 24h *post-mortem*. Interestingly, birds HAL+ did not show any PSE meat characteristic whilst HAL+/- presented 2.5% and HAL- presented 12.7%, respectively, in relation to the total slaughtered birds. By presenting low sensibility towards halothane broilers from female lineage seemed not to develop the Poultry Stress Syndrome (PtSS) equivalent to PSS indicating that PtSS might be inherent of muscle mass development of male lineage. The occurrence of PSE meat in HAL- birds indicated that environmental factors had a relevant influence on the final broiler meat quality.

Introduction

The modern broiler is resultant of the genetic selection as the consequence of economical needs to produce birds with a higher muscle mass gain and quicker growth (Oba et al., 2006). Obviously both male and female from male line produce broiler meat whilst for laying eggs only birds from female line are used (Santini, 2004). However, so far, little consideration has been dedicated to observe the impact which this genetic selection can promote to the muscle development such as miopathy which is the consequence of the increase of muscle fibers transversal area (Scheuermann, 2005). Among those muscle abnormalities PSE meat is probably the main factor being currently evaluated. PSE meat has the characteristic of being pale, soft and exudative as the consequence of post mortem rapid glycolysis with a quick pH fall while the carcass is still hot (Bendal & Wismer-Perdersen, 1962). This association between pH and high temperature is the cause of meat protein denaturation impairing its functional properties giving rise to the formation of meat surface exudates (Candek-Potokar et al., 1998).

In pigs, PSE meat is the final consequence of the Pork Stress Syndrome (PSS) symptoms and there is a relationship between PSS and animal sensibility towards halothane gas anesthetic in particular to those ryanodine mutation carriers by observing theirs leg rigidity. There is an increase of anaerobic metabolism and an excessive muscle contraction giving as consequence this leg rigidity (Mitchell & Heffron, 1982). This genetically interrelationship has been demonstrated by Fujii et al. (1991) whom reported the existence of a point mutation in *ryr* 1 gene responsible for coding ryanodine and this protein controls Ca^{2+} for excitation-contraction coupling in sarcoplasmic reticulum thus responsible for the muscle metabolism acceleration causing the pig PSE meat formation (Mickelson & Louis, 1996). A gene *hal* is related to the animals halothane sensibility being normal pig as dominant (NN), the sensitive animals as recessive (nn) and finally the hybrids as intermediate (Nn) (Fujii et al., 1991). Birds sensibility towards halothane have already been studied by other authors (Wheller et al., 1999; Owens et al., 2000; Cavitt et al., 2004., Soares et al., 2007), however few reports are available to observe the occurrence of broiler from female lineage in relation to Poultry Stress Syndrome (PtSS). Thus the objective of this work was to evaluate the sensibility of broiler from female lineage to halothane gas and its possible relationship to develop PSE meat.

Materials and methods

Broilers from female lineage of 42 days old (n=298) grown by a broiler company in Minas Gerais state, Brazil and they were taken to São Paulo University, Campus Pirassununga. Halothane test was carried out in a chamber specially designed for this test as described elsewhere. Briefly this chamber presents three

compartments where each bird head is inserted as it can be seen in the Figure 1. Anaesthesia was maintained for 5 minutes and birds were examined for muscle rigidity in the legs whilst they were still unconscious. If the legs muscles were stiff, birds were classified as halothane sensitive (HAL+) whilst no response was observed broiler chickens were classified as halothane negative. A third classification as intermediate chickens were those birds with only one leg was observed to be stiff as observed by three randomly judgers and one fixed judger to evaluate the characteristic legs rigidity (Wheller et al., 1999; Owens et al., 2000). Thus birds were classified into three groups as HAL +, rigid legs, response to halothane, HAL +/- rigidity only one leg, intermediate response and HAL- non response to halothane as it can be seen in the Figure 1.

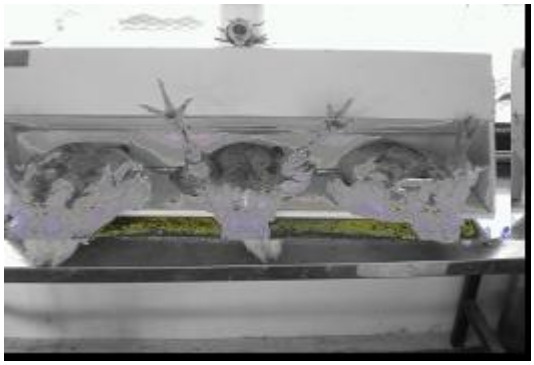

Figure 1. Broilers legs rigidity as the response to their sensitivity to 3.0% halothane gas: a) non responder, HAL - b) responder, HAL +, c) intermediate, HAL +/- (one leg responder).

Approximately after 3-4 hours of halothane test, broilers were slaughtered mimicking as close as possible the routine commercial line procedure. After app. 30 min, *Pectoralis major* was collected from 2, 11, and 105 broilers from HAL +, HAL +/- e HAL – groups, respectively, and pH_i value was determined. The pH_f and color (L*, a*, b*), CIELab system were carried out in 24 h *post mortem* breast fillet samples kept at 4°C (Guarnieri et al., 2004). L* and pH values were used as a parameter to classify PSE fillet meat as described previously by Soares et al. (2002).

Results and discussion

Figure 2 presents the occurrence of female lineage broilers of HAL +, HAL +/- and HAL -. From 298 evaluated birds only 0.67% were halothane responder (HAL+), 3.69% were intermediate (HAL +/-) and finally 95.64% were halothane non responder (HAL -).

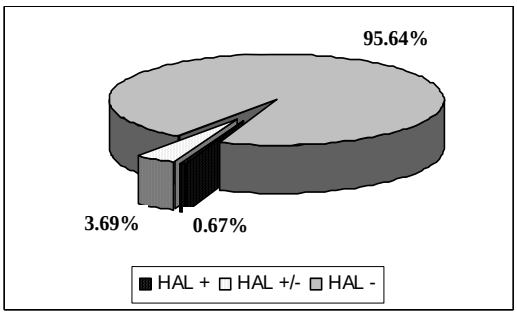

Figure 2. Incidence of broilers halothane responder (HAL +), intermediate (HAL+/-) and halothane non responder (HAL -) after submitting to 3.0% halothane gas for 5 minutes.

The lower incidence of HAL+ broilers was observed because of all these samples were originated from female lineage and they are specifically designed to reproductive improvement rather than to produce a higher yield of muscle mass as it normally happens to the broiler male lineage (Scheuermann, 2005). They are more related to the increase of muscle fibers thus indirectly to the PSE formation (Oba et al., 2006). As already known, the main cause of pig PSE meat is related to the *ryr* 1 gene mutation (Fujii et al., 1991) and our results show that probably this is not the case for broilers female lineage due to the very low incidence of halothane responder (HAL+) as it can be seen in Figure 2.

It can be observed in Figure 3 that HAL+ birds did not present breast PSE meat. This abnormality was only observed in the HAL +/- group with 3 cases of PSE meat and finally in group HAL- there were 15 cases of PSE meat from 105 evaluated samples. Therefore, the HAL+/- group contributed with 2.5% and the HAL-

group with 12.7% of PSE meat from the total evaluated birds. These results are demonstration that the incidence of PSE meat in broilers of female lineage is caused by the environmental and phenotype factors rather than gene *hal* mutation as already reported for the commercial broiler male lineage (Soares et al., 2002; Guarnieri et al.,2004).

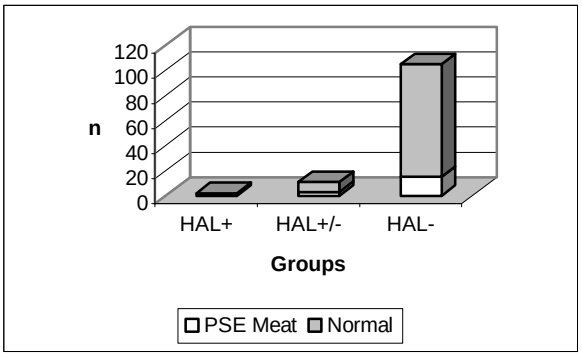

Figure 3. Incidence of broiler breast PSE fillet meat from three groups after halothane test showing the absence of this abnormality in the broiler female lineage.

Conclusion

The halothane test demonstrated that broilers from female lineage show very low sensibility towards halothane gas indicating that the PSE meat from them are mainly related to environmental factors.

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