THE EFFECT A BETA-AGONIST (ZILPATEROL) ON MEAT COLOUR SHELF LIFE

PE Strydom, EM Buys & HF Strydom
Animal Nutrition and Animal Products Institute, Agricultural Research Council, Private Bag X2, Irene, South Africa, 0062

Background

Consumers equate the colour of meat to freshness and rely on colour as a measure of quality. Maintenance of fresh meat colou (cherry red) at the retail level will result in less trimming loss and rewrap, an increased shelf life and higher probability of sale in th original package (Seideman, et al. 1983). This necessitated the development of various methods aiming at the optimisation of mea colour shelf life, from feed supplementation of the live animal through to the packaging of primals and subprimals. Moloney et al (1994) found an increase in glycolytic and glycolytic-oxidative fast-contracting muscle fibre types in animals supplemented with beta agonists, which could result in a better colour (redness) and a longer meat colour shelf life, for the following reasons: A highe concentration of oxidative slow-contracting fibres (red) coincide with a higher concentration of mitochondria. When exposed t oxygen, mitochondria might compete with myoglobin for oxygen, thereby reducing the depth of the bright-red oxymyoglobin layer and therefore the colour shelf life (Monin & Ouali, 1992). The beta-agonist, Zilpaterol, has a significant positive effect on growth performance and carcass yield with no significant effect on muscle tenderness, provided that the supplementation period is limited t 30 days (Strydom *et al.*, 1998).

Objectives

This study determined the effect of the beta-agonist, Zilpaterol on the colour acceptability and discoloration of three muscle type during vacuum storage and subsequent retail display.

Methods

Three groups of twenty crossbred steers each were fed intensively and were supplemented with 0.15 mg Zilmax®/kg live weigh for the final 30 or 50 days in the feedlot, until 48 hours before slaughter; or received no Zilmax (C). Carcasses were chilled for 3 hours, whereupon the *M. longissimus lumborum* (LL; loin), *M. gluteus medius* (GM; rump) and *M. adductor femoris, M. gracillis, M. semimembranosus* (TS; topside) from both carcass sides were sampled. Cuts from the left sides were vacuum packed (oxyge transmission rate (OTR) - 39 ml/m^2/24h/atm at 23 °C & 75 % relative humidity (RH)) and aged at 0 – 2 °C for 28 days, while thos from the right sides of the carcasses were processed immediately (36 h chilling *post mortem*) for colour shelf life measurements. Th LL and GM were cut into steaks, singly placed in Styrofoam trays, over-wrapped with polyvinyl chloride (PVC) (OTR - *ca* 5 00 ml/m^2/24h/atm at 22 °C & 75 % RH) and displayed at 4 °C for a period of 7-8 days in a Costan retail display cabinet. All the muscle of the TS were minced and displayed in Styrofoam trays over-wrapped with PVC at 4 °C for a period of 4 days. Discoloration wa measured in terms of the development of the oxidised pigment metmyoglobin relative to reduced myoglobin plus oxymyoglobin using Pye-Unicam 8700 spectrophotometer provided with a PU8700 diffuse reflectance accessory. Measurements were obtained on a dail basis in duplicate from single samples. The method of Krzywicki (1979) was used to calculate the metmyoglobin percentage Acceptability of the appearance of the displayed samples was rated on a daily basis by a trained panel of 10 people on a scale fro 'totally unacceptable' (1) to 'very acceptable' (8), according to a photographic chart.

Results and discussion

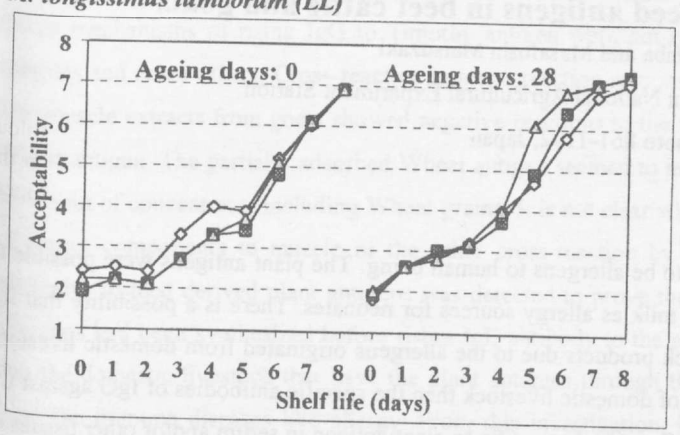
LL and GM steaks and TS mince from Z30 and Z50 treatments were significantly (P=0.025) more acceptable than C for the 0 day ageing treatment (Figure 1). This advantage lasted for the first five days of display for the LL and GM steaks and for four days for the T mince. At 28 days ageing, only the GM steaks and TS mince of the Z30 and Z50 treatments were significantly more acceptable than C. Th advantage lasted, respectively, for four and three days of display for the GM steaks and TS mince. Both LL and GM steaks of all thre treatments were significantly (P=0.001) more acceptable at 0 days ageing than at 28 days ageing, while for mincemeat, the opposite wa found. All three treatments were significantly (P=0.001) less acceptable in general after 28 days vacuum ageing than at 0 days ageing. "slightly unacceptable" (score=5) is accepted as a cut-off point (Buys, 1999), all three treatments attained an acceptability shelf life of 6 day at 0 days ageing and 5 days at 28 days ageing for the LL steaks. GM steaks of the Z30 treatment and C had an acceptability shelf life of days for both ageing periods (0 and 28), but the Z30 treatment attained an acceptability shelf life of 4 days for both ageing periods. TS mince of the Control group attained an acceptability shelf life of 3 days and the Z30 and Z50 treatments a shelf life of 4 days for both ageing period

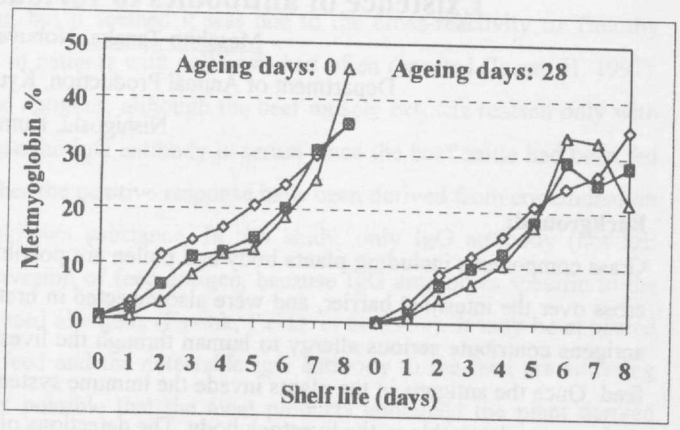
Metmyoglobin % (MMb %) of LL and GM steaks of the Z30 and Z50 treatments were significantly (P=0.001) less during reta display than the Controls at both 0 and 28 days ageing (Figure 1). Z50 also tended to discolour less than Z30 and C for both muscle The GM of the Z50 treatment tended to discolour less than the other two treatments. The difference in MMb % of the LL steaks fro all three treatments was negated after 7 days of display at 0 days ageing and at 6 days of display after 28 days ageing, while this poin occurred after 6 days display for the GM steaks at both ageing periods. In general, ageing (0 vs. 28 days) did not have a significan effect on discoloration during the retail display period for these two muscles. MMb % of the Z50 treatment was significantly les (P=0.001) for TS mince than the Z30 and C treatments at 0 days ageing, while both Z30 and Z50 mincemeat discoloured less durin display than the Control at 28 days ageing. In contrast to the two steak cuts, TS mince from the Z30 and Z50 treatments discolour less during display after 28 days ageing compared to 0 days ageing.

Conclusion

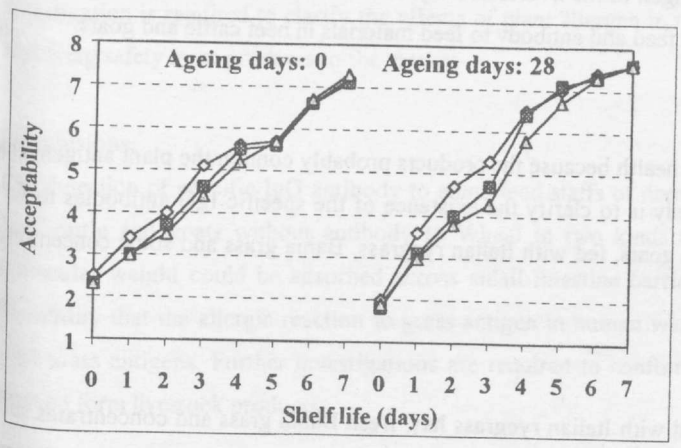
This trial showed that Zilpaterol supplementation of the feed for 30 or 50 days significantly enhanced the colour shelf life of lo and rump steaks as well as topside mince during retail display at 4 °C, at 0 and 28 days ageing at 0 °C. Fifty day supplementatio seemed to have a greater effect on shelf life of the rump, by increasing colour shelf life by one day, while both supplementation perio (30 and 50 days) increased the colour shelf life of mincemeat by one day. The monetary value of this improvement should be added the improvement in growth performance and carcass yield.

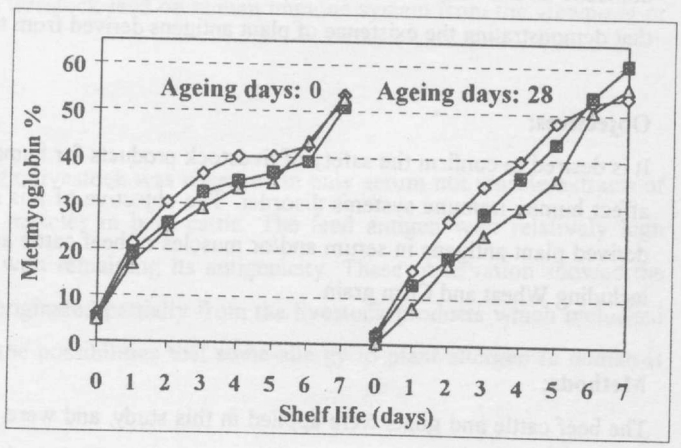
M. longissimus lumborum (LL)



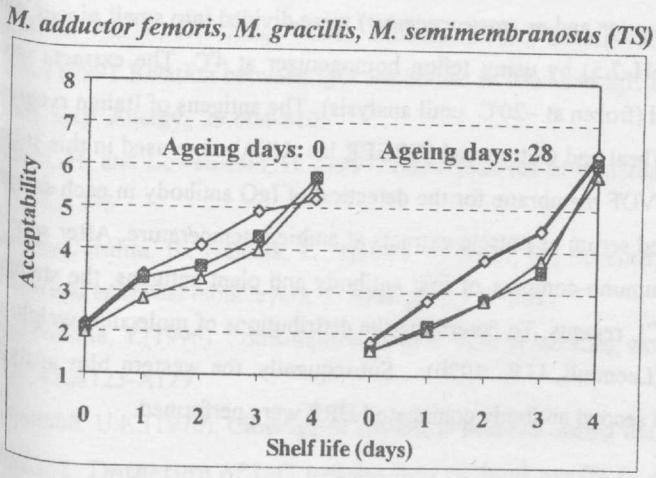


M. gluteus medius (GM)





M. adductor femoris, M. gracillis, M. semimembranosus (TS)



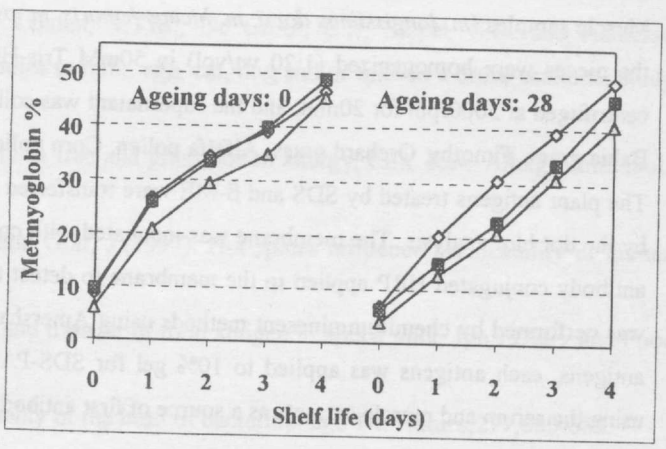


Figure 1: The effect of supplementing Zilpaterol for 30 (—■—) or 50 days (—△—) or feeding a Control diet (—◇—) on colour shelf life acceptability and metmyoglobin accumulation of PVC-overwrapped loin steaks (LL), rump steaks (GM) and topside mince (TS) aged in vacuum at 0 °C up to 28 days and displayed at 4 °C up to 8 days (Acceptability scores: 1=extremely acceptable; 2=acceptable; 3=moderately acceptable; 4=slightly acceptable; 5=slightly unacceptable; 6=moderately unacceptable; 7=unacceptable; 8=extremely unacceptable)

References

Buys, E.M. (1999). PhD thesis, University of the Witwatersrand.
Krzywicki, K. (1979). *Meat Sci.* 3,1.
Moloney, A.P., Allen, P., Joseph, R.L., Tarrant, P.V. & Convey, E.M. (1994). *Meat Sci.* 3, 121.
Monin, G. & Ouali, A. (1992). In *Developments in meat science-5.* Ed. R.Lawrie. pp. 89-157, Elsevier Applied Science, London.
Seideman S.C., Cross H.R., Smith G.C. & Durland P.R., (1983). *J. Food Quality* 6, 211-237.
Strydom, P.E., Osler, E.H., Nel, E & Leeuw, K-J (1998). *Proc. of 44th ICoMST, Barcelona, Spain..*