THE INFLUENCE OF *POST MORTEM* PH AND TEMPERATURE DECLINE ON MEAT COLOUR OF FIVE SOUTH AFRICAN BEEF BREEDS

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Abstract – This paper describes how pH and temperature decline affects meat colour of different South African beef breeds (Angus, Bonsmara, Brahman, Charolais and Nguni). Ten animals per genotype were used. pH and temperature were measured at 1, 3, 6 and 20 h *post mortem*. Meat colour was measured on steaks aged up to 3, 9, 14 and 20 days *post mortem*. Ultimate pH for Charolais and Nguni were similarly higher than that of Angus, Bonsmara and Brahman ($P< 0.05$). Nguni produced darkest meat, Angus, Bonsmara, Charolais were intermediately similar and Brahman was the lightest. Meat from Charolais breed seems to be affected most by pH and temperature decline. Charolais seems to be more sensitive to higher environmental temperatures pre-slaughter, which affected its meat colour *post mortem*.

Key Words- Beef genotype, pre-slaughter environmental temperatures.

I.   INTRODUCTION

Meat colour is a very important visual attribute. During meat purchase, consumers assess the quality based on colour. Quite a number of studies have reported that ultimate pH (pH_u) and meat colour are the most important attributes of meat quality [1]. Meat quality is significantly affected by pre-slaughter factors such as atmospheric conditions. The variation in ultimate pH (pH_u) influences factors such as colour and the ability of the meat to retain water. A low pH_u results in meat proteins having decreased water-holding capacity and a lighter colour. Conversely, a higher pH_u will give a darker colour and less drip loss [2]. It is not known how pH and temperature decline affect these breeds differently. The aim of the study was to evaluate the differences in pH and temperature decline between five South African beef breeds and to evaluate how these differences affect meat colour for each breed.

II.   MATERIALS AND METHODS

The following genotypes were studied – *Bos indicus* (Brahman), Sanga type (Nguni), British *Bos taurus* (Angus), European *Bos taurus* (Charolais) and the composite (Bonsmara). Ten animals per genotype (n=50). The animals were fed on a feedlot diet; all animals were slaughtered, processed and sampled at the ARC-Animal Production Institute abattoir. After exsanguination, the carcasses were halved, right sides were electrically stimulated and put in to cold rooms (± 2 °C) within 60 min *post mortem* (pm) (ES treatment). Left sides were placed in a room with a controlled temperature of 10 °C for 6 h, then placed in the cold rooms (±2 °C) (NS treatment). pH and temperature were determined at 1, 3, 6 and 24 h. The carcasses were sampled in to steaks at the *m. longissimus lumborum* (LL) that were aged for 3, 9, 14 and 20 d pm. Meat colour was measured using a Minolta meter at 3, 9, 14 and 20 d pm. Extreme climate conditions during slaughter were noted.

III.   RESULTS AND DISCUSSION

Figure 1 shows the effect of breed on carcass pH and temperature at 1, 3, 6 and 20 h pm. Results show that Charolais and Nguni had slower pH/temperature drop at 1, 3, 6 and 20 h than the other breeds. The pH_u for Charolais and Nguni were 5.70 and 5.78 respectively. pH_u for both the Angus and Bonsmara was 5.46 and 5.38 for the Brahman. The pH_u ranges for these breeds were believed to still be categorized under good quality meat according to most studies, but there is still lot of controversy on which pH_u ranges produce optimum quality meat [1]. Results of meat colour characteristics measured with a Minolta meter (CIE L* a* b*) for the five breeds are shown in Table 1. Steaks from Nguni were the darkest followed by Angus, Bonsmara and Charolais which were similar and steaks from Brahman were the lightest (higher L* values). The Charolais breed which had pH_u values higher than that of the Angus and Bonsmara still had similar meat colour as these breeds. The Nguni, which had the highest pH_u value, gave the darkest meat colour. Higher pH values usually gives rise to darker meat colour [3]. Comparing to the results from our preliminary study, it was found that the Nguni breed had a pH_u similar to that of the other four breeds but still produced the darkest meat colour

(results not shown). Then the Charolais breed had pH_u similar to that of the other breeds but had the lightest meat colour. During the execution of this current study, it was noted that we experienced climatic heat waves and that could explain why the Charolais breed gave higher pH values which were believed to be related to the increase in darkness of the meat colour. The Charolais breed seems to be sensitive to environmental conditions. European breeds (Charolais) have low tolerance to heat and due to this factor, the excessive heat caused stress and affected the pH decline which affected meat colour [3].
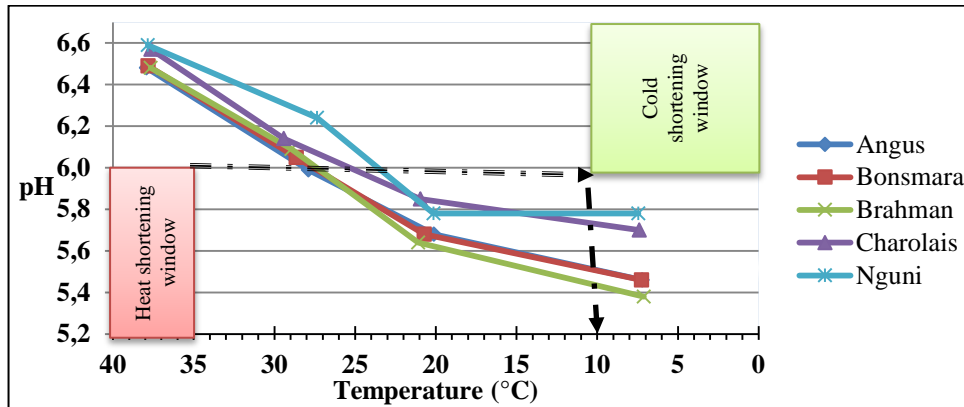

Figure 1: Temperature and pH decline of five beef breeds (Angus, Bonsmara, Brahman, Charolais and Nguni) of LL. Cold shortening and heat shortening windows according to Pearson and Young [4] and Thompson [5].

Table 1: The effect of breed on meat colour characteristics (CIE L*a*b*, Chroma and Hue angle) of LL

| | Beef breeds | | | | | | |
	Angus	Bonsmara	Brahman	Charolais	Nguni	SEM[1]	P-Value
L*	40.42[b]	41.35[b]	43.95[a]	41.06[b]	37.09[c]	5.944	<0.0001
a*	14.19[a]	12.63[b]	13.22[ab]	10.98[c]	10.92[c]	3.494	<0.0001
b*	8.69[b]	8.175[b]	9.89[a]	6.70[c]	6.05[c]	3.537	<0.0001

[1] Standard error of means
[a,b,c,d] Means within a row with different superscripts differ significantly

CONCLUSION

Ultimate pH seems to affect meat colour in some breeds more than in others. The Nguni breed seems to produce darker meat irrespective of the pH decline pattern and the Charolais meat colour differs according to pH and environmental conditions pre-slaughter. The Angus, Bonsmara and Brahman meat colour was not sensitive to environmental climate conditions.

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