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Muscle Profiling: Variation in colour across different muscles of the beef carcass (#500)

Michelle Hope-Jones[1], Phillip E. Strydom[1, 2], Lizelle de Lange[1]

[1] Agricultural Research Council of South Africa, Animal Production: Food Science and Technology, Irene - Pretoria, South Africa; [2] Stellenbosch University, Department of Animal Sciences, Stellenbosch, South Africa

Introduction

USDA [1] observed a trend that between 1993 and 1998 the wholesale value of beef ribs and loins had increased by 3 – 5% but that there was a drop of 25-26% of the wholesale value of chucks, rounds and trimmings. In South Africa, the steak yielding cuts such as the loin and rump also sell for considerably more per kilogram than cuts such as the chuck, thin flank and topside. With current economic times it would be beneficial to both the consumer and producer to add value to the cheaper primal cuts.

Methods

Twenty of each of the following muscles were sampled: *Adductor* (Add), *Gracilis* (Gr), *Infraspinatus* (IS), *Rectus abdominis* (RA), *Rhomboideus* (Rhom), Rump cap (RumpC), *Semispinalis* (SS), *Spinalis* (Spinalis), *Supraspinatus* (SS) and *Serratus Ventralis* (SV). The Loin (L) was sampled as a reference muscle. Instrumental colour was performed on fresh meat with a Minolta colour meter (Model CR200, Osaka, Japan) following the CIE colour convention. Colour was measured on day 1 and day 5 after slaughter. Purge was determined by measuring the amount of drip remaining in the tray after removing the steak. Purge was expressed as a percentage of the combined mass of the steak and the drip.

Results

The Add was lighter than all the other muscles with the Gr the darkest (*P* <0.001, Table 1). se results were similar to those found by Von Seggern *et al.* [2] who attributed the difference in lightness to differences in collagen content (higher levels of collagen resulting in lighter muscles) as well as heme-iron concentrations (higher concentrations leading to darker muscles). Values for chroma higher than 20 relate to the bright red colour of bloomed meat and S=18, S=14 and S<12, as dull, distinctly brown and brown to gray-greenish brown [3]. Only the adductor had a desirable chroma value with the rest of the muscles falling between the dull and distinctly brown categories. This shows that the colour of most of the muscles will be unacceptable to the consumer who relies on visual appearance at the point of purchase and associates the bright cherry red colour of meat with freshness [4]. For all the muscles, colour deteriorated from day 1 to day 5 and oxymyoglobin and deoxymyoglobin decreased while metmyoglobin increased (P <0.001, Table 2). A possible reason for the Add standing out could be due to differing oxidative capacity of different muscles [5]. Muscles with more oxidative myofibres (Type 1) have higher myoglobin and iron concentrations and are darker and redder but are more prone to colour deterioration. Different muscles have different color stability when exposed to atmospheric oxygen due to different myoglobin reducing activity [6].

Figure 1 shows that all muscles except for the Add had levels below the acceptable level of 2% purge. The Add had the highest percentage of purge (*P* <0.001) at just below 4% with the L at 1.2%. All other muscles had levels below 1% with the spinalis having only 0.2% purge. The high level of purge for the Add is undesirable as consumers are put off by excessive purge at the point of purchase. High purge would also have contributed to the Add having the highest values for lightness.

Conclusion

Colour of all muscles except for the Add were undesirable. L displayed the same colour issues as the rest of the muscles giving the impression that some other factor could have been affecting colour (although all pH values were normal). All muscles, except for the Add, had very low levels of purge.

References

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Notes

Table 2. The effect of muscle and day after slaughter on lightness (L*), chroma (C), oxymyogobin, metmyoglob and deoxymyoglobin.

	C		%Oxy		%Met		%Deoxy	
P value	<0.001		<0.001		<0.001		<0.001	
Day	1	5	1	5	1	5	1	5
Add	24.97^{a}	19.66^{b}	65^{a}	56^{ij}	31^{g}	39^{bc}	4^{l}	5^{kl}
Gr	16.41^{fg}	15.33^{h}	58^{efg}	53^{k}	28^{ij}	37^{d}	14^{bc}	10^{fg}
IS	17.99^{cd}	15.95^{gh}	61^{bc}	53^{k}	29^{hi}	40^{ab}	10^{efg}	7^{ij}
L	17.06^{def}	18.37^{c}	62^{b}	60^{cd}	26^{l}	31^{g}	13^{cd}	9^{fgh}
RA	16.19^{fg}	17.12^{def}	59^{de}	58^{fg}	26^{l}	33^{f}	15^{a}	9^{gh}
Rhom	16.73^{efg}	16.82^{efg}	60^{cd}	58^{gh}	25^{l}	34^{f}	15^{ab}	9^{gh}
RumpC	17.69^{cde}	15.13^{h}	59^{def}	52^{l}	30^{h}	41^{a}	11^{e}	8^{hi}
SemiS	18.21^{c}	16.40^{fg}	61^{b}	55^{j}	28^{j}	37^{d}	11^{ef}	8^{hi}
Spinalis	18.47^{c}	16.61^{fg}	62^{b}	55^{j}	30^{h}	39^{c}	9^{gh}	6^{jk}
SS	17.65^{cde}	16.16^{fg}	59^{def}	53^{k}	28^{ij}	39^{c}	13^{cd}	8^{hi}
SV	18.25^{c}	16.87^{efg}	61^{b}	56^{hi}	27^{k}	35^{e}	12^{de}	9^{hi}

^{abc}*Means in the same column and between day 1 and 5 for a specific trait with different superscripts differ significantly (P<0.05)*

Table 2
The effect of muscle and day after slaughter on lightness (L*), chroma (C), oxymyogobin, metmyoglobin and deoxymyoglobin.

Notes

Table 1. The effect of muscle on lightness (L*), chroma (C), oxymyogobin, metmyoglobin and

	L*	C	%Oxy	%Met	%Deoxy
P value	<0.001	<0.001	<0.001	<0.001	<0.001
Add	44.76^{a}	22.31^{a}	60^{a}	35^{a}	5^{h}
Gr	37.69^{g}	15.77^{f}	56^{ef}	33^{e}	12^{ab}
IS	40.11^{def}	16.97^{cde}	57^{d}	34^{bc}	9^{f}
L	39.97^{def}	17.72^{b}	61^{a}	28^{h}	11^{bc}
RA	40.62^{d}	16.66^{de}	59^{bc}	29^{g}	12^{a}
Rhom	42.84^{b}	16.78^{de}	59^{bc}	29^{g}	12^{ab}
RumpC	38.64^{f}	16.41^{ef}	55^{f}	35^{ab}	10^{def}
SemiS	40.26^{de}	17.30^{bcd}	58^{c}	33^{e}	9^{ef}
Spinalis	38.51^{fg}	17.54^{bc}	58^{bc}	34^{c}	7^{g}
SS	39.75^{e}	16.90^{cde}	56^{de}	33^{d}	10^{cd}
SV	41.92^{c}	17.56^{bc}	59^{b}	31^{f}	10^{de}

^{abc}*Means in the same column with different superscripts differ significantly (P<0.05)*

Table 1.
The effect of muscle on lightness (L*), chroma (C), oxymyogobin, metmyoglobin and deoxymyoglobin.

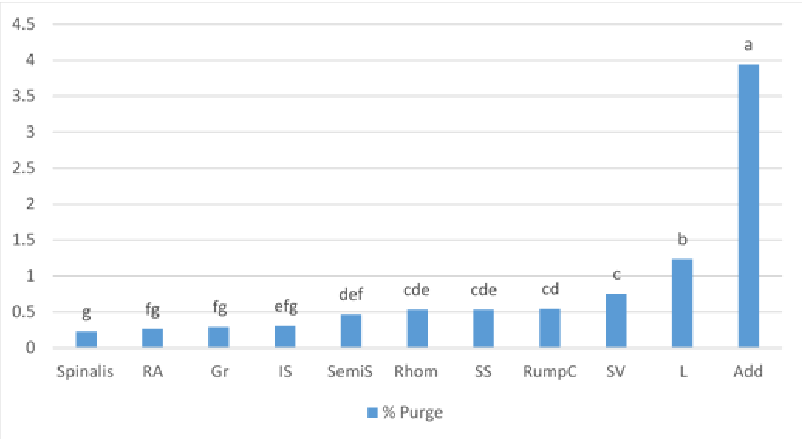

Figure 1: The effect of muscle on percentage purge

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