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VISUAL EVALUATION OF BEEF TENDERNESS BY USING SURFACE STRUCTURAL OBSERVATIONS AND ITS RELATIONSHIP TO MEAT COLOUR

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12th Meat Symposium
7 November 2014

Introduction

- Meat tenderness is the most important meat quality assessment attribute among consumers
- Consumers use visible fat and meat colour to make a purchase decision.
- But this is not an indication of non-visual attributes such as tenderness and juiciness.
- If the connection between visual surface structural properties of meat can be an indication of non-visual attributes it could be used as an additional measure by experienced classifiers.
- Consumers can also be educated accordingly to be able to classify the tenderness of meat.

AIMS

- Determine the possibility to predict beef tenderness by means of visual analysis
- Determine the possibility of evaluating meat colour by visual analysis
- Determine the possibility of a relationship between visual and non-visual measurements (Colour and tenderness)
- Determine if an association exists between visual colour and tenderness

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MATERIALS AND METHODS

- Fifty steers (Brahman, Angus, Charolais, Bonsmara and Nguni), 10 steers per genotype
- Right sides of carcasses were electrically stimulated (20 s, 400 V peak, 5ms pulses at 15 pulses/s).
- Left sides were step-wise chilled (cold room 10 ℃ for 6 hours, then ± 2 ℃ chiller).
- Steaks were sampled from Mm *longissimus dorsi* and aged for 3 d on polystyrene plates (6 ℃), and for 9, 14 and 20 d in vacuum bags (4 ℃).

- Visual analysis were evaluated by a 10 member trained panel using a questionnaire developed at ARC-Irene (Annual book of ASTM Standards)
- Steaks were evaluated for:

  -Visual colour, marbling (1- 8), surface texture (1-6), fiber separation (1-6) and structure integrity (1-4)

  -Instrumental colour using Minolta meter for L*, a*, b* values, chroma and hue

  -Tenderness by WBSF
- Data were analysed by ANOVA
- Correlations were determined by Pearson's correlation coefficients

Table 1: The effect of beef breed on colour coordinates (L*, a*, b*, Chroma, hue angle), WBSF and visual attributes (colour, marbling, fiber separation, surface texture and structure integrity) of LD.

	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	<.0001
a*	14.19[a]	12.63[b]	13.22[ab]	10.98[c]	10.92[c]	3.494	<.0001
b*	8.69[b]	8.175[b]	9.89[a]	6.70[c]	6.05[c]	3.537	<.0001
Chroma	16.70[a]	15.12[b]	16.58[a]	12.95[c]	12.57[c]	4.602	<.0001
Hue	1.49[b]	1.41[b]	1.08[c]	1.57[b]	1.81[a]	0.651	<.0001
WBSF	4.06[b]	4.73[a]	4.17[ab]	4.43[ab]	3.86[b]	2.117	<.0001
Colour[2]	5.30[b]	4.92[b]	4.24[c]	5.09[b]	6.33[a]	5.258	<.0001
Marbling[2]	2.06[ab]	1.91[bc]	1.79[c]	2.18[a]	2.25[a]	2.352	<.0001
Fiber separation[2]	2.38[a]	2.21[bc]	2.16[bc]	2.26[ab]	2.05[c]	1.705	0.0026
Surface texture[2]	2.59[a]	2.39[bc]	2.29[c]	2.50[ab]	2.30[c]	1.481	0.0001
Structure integrity[2]	2.57[a]	2.34[b]	2.32[b]	2.45[ab]	2.05[c]	1.893	<.0001

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Table 2: The effect of ageing/packaging on colour coordinates (L*, a*, b*, Chroma and hue angle), WBSF and visual attributes (colour, marbling, fiber separation, surface texture and structure integrity of LD steaks.

	Ageing/Packaging					
	3dpm	9dpm	14dpm	20dpm	SEM[1]	P-Value
L*	41.25[a]	40.57[b]	40.61[b]	40.84[b]	1.292	0.0007
a*	11.12[d]	13.36[a]	12.94[b]	12.26[c]	1.302	<.0001
b*	9.17[a]	7.59[b]	7.64[b]	7.45[b]	0.852	<.0001
chroma	14.49[b]	15.40[a]	15.10[a]	14.44[b]	1.399	<.0001
Hue	0.97[c]	1.66[a]	1.63[ab]	1.58[b]	0.195	<.0001
WBSF	5.60[a]	4.42[b]	3.76[c]	3.21[d]	0.550	<.0001
Colour [2]	4.51[b]	5.40[a]	5.41[a]	5.46[a]	2.135	<.0001
Marbling[2]	1.64c	2.04[b]	2.17[b]	2.33[a]	1.590	<.0001
Fiber separation [2]	1.74[b]	2.40[a]	2.37[a]	2.35[a]	1.183	<.0001
Surface texture[2]	2.24[b]	2.49[a]	2.50[a]	2.44[a]	1.079	<.0001
Structure integrity[2]	1.72[d]	2.18[c]	2.60[b]	2.93[a]	1.311	<.0001

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Table 3: Matrix showing correlation coefficients of colour coordinates (L*, a*, b*, Chroma, hue angle) and WBSF and ratings of visual of LD steaks.

	Colour	Marbling	Fibre separation	Surface texture	Structure integrity
L*	-0.809	-0.193	0.067	-0.060	0.080
a*	-0.185	0.005	0.232	0.079	0.157
b*	-0.698	-0.289	-0.095	-0.142	-0.106
Chroma	-0.428	-0.123	0.115	-0.008	0.063
Hue	0.797	0.359	0.250	0.219	0.267
Shear force(Kg)	-0.242	-0.312	-0.401	-0.125	-0.410

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CONCLUSION

- It is possible to judge meat colour visually through proper training.
- It could be difficult to predict meat tenderness visually by using surface structural observations (FS and SI) but there is potential.
- It is clear from the results that there is very little relationship between meat colour and tenderness.

ACKNOWLEDGEMENTS

- The ARC, MIT and RMRDTSA for facilities and financial support.
- Jocelyn Anderson and Hanlie Snyman from ARC–API
- Feedlot and abattoir personnel of ARC–API

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