

IS COLOUR PREFERENCE FOR BEEF CHANGING FOR NEW ZEALAND CONSUMERS?

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I. INTRODUCTION

Colour of beef at the point of purchase is one of the main parameters used by consumers to make buying decisions. Bright red meat colour has been reported as the preferred colour by consumers [1]. Similarly, a survey conducted in New Zealand in 2004 indicated that the most preferred colour was bright red and the least preferred was dark red (unpublished). Consumer colour preference for bright red fresh meat is a key driver of retail packaging formats resulting in widespread use of overwrap-permeable film and high oxygen modified atmosphere packs. However, it has been established that these packaging formats result in poorer meat quality compared with vacuum packaging (eg. tougher meat, higher oxidation) [2]. Consumer cues are becoming more complex and extrinsic factors are gaining relative importance in purchasing decisions. Have colour preferences for fresh beef changed for New Zealand consumers over 10 years? The purpose of this work was to document unpublished results from a study conducted in 2004 and to re-evaluate with a larger number of consumers their visual preference for fresh beef steaks differing in colour.

II. MATERIALS AND METHODS

Two studies were conducted to evaluate consumer preference for colour of beef steaks by attendants of National Fielddays in Waikato, New Zealand in 2004 and 2015. This is the largest agricultural four day annual event and the ultimate launch platform for cutting edge technology and innovation [3]. Four steaks varying in their colour were subjected to consumer test for colour preference by visitors to the AgResearch stand (n=503 in 2004 and n=1,272 in 2015). In the 2015 study, three age categories were recorded for respondents (young children: 5-18 years old, young adults: 18-35 years old and adults: >35 years old). Beef loins from heifers (18 months old) with a range of pH values were selected from a commercial abattoir. Instrumental colour was measured using a Minolta colorimeter (illuminant D65, 1 cm diameter aperture, 10° viewing angle; CR-300, Konica Minolta Photo Imaging Inc., Tokyo, Japan) in the CIE-LAB space [4] to further select the loins from four animals for final consumer evaluation. Each loin was cut into four equal portions to allocate into the four evaluation days and vacuum packaged and held at -1.5°C until fabricated into steaks. Each loin portion was fabricated into two 2-cm steaks, placed on polystyrene trays, overwrapped with an oxygen permeable film and allowed to bloom overnight. The bloomed steaks were used for colour acceptability evaluation by consumers and samples were replaced at lunch time every day. Differences among consumer preference frequencies were obtained using Newmans-Keuls method with chi-square test statistic for multiple comparisons within each year.

III. RESULTS AND DISCUSSION

Instrumental colour data corresponding to consumer colour preferences for beef steaks are shown in Table 1. For the Fielddays 2004 study, there is evidence that as meat lightness and redness increase, the proportion of people that prefer the colour increases, indicating a clear preference for lighter and more red beef steaks. Seventy two percent of the consumers preferred colour steaks corresponding to 39.5-40.9 L*, 16.8-21.6 a* and 6.3-9.1 b* colour values. A second survey conducted in 2015 at the same Fielddays, showed that the colour of each beef steak was preferred by a similar proportion of consumers with no clear preference for a particular colour. Holman *et al.* [5] used instrumental measures to predict consumers' acceptance of beef colour and reported that colour was considered acceptable (with 95% acceptance) when a* values were equal to or above 14.5. Results from both studies agree with the proposed threshold value for a* as about 70% of

the respondents preferred beef steaks with redness colour values around or above 14.5. However, 30% of consumers preferred beef colour values below this threshold indicating preference for darker beef with lower redness and yellowness values for this consumer segment. No respondent demographic data were recorded except for three age categories in 2015. There was no evidence of a preference difference for beef colour between young adults and adults, while young children preferred beef that was lighter with higher a^* and b^* values (data not shown).

Table 1. Beef steak colour values corresponding to the frequency and percentage of most preferred meat colour by consumers surveyed in 2004 and 2015 at the Fieldays.

<i>Fieldays</i>	Lightness (L^*)	Redness (a^*)	Yellowness (b^*)	Hue angle	Chroma	Consumer Preference Frequency	Consumer Preference %
2004	33.96	10.46	3.21	16.50	10.96	76 ^c	15
	37.74	13.33	4.61	18.63	14.12	66 ^c	13
	39.50	16.81	6.30	20.27	17.95	203 ^a	41
	40.89	21.59	9.06	22.70	23.42	158 ^b	31
2015	32.19	11.02	3.59	18.03	11.59	382 ^a	30
	33.38	14.94	5.24	19.33	15.83	247 ^c	20
	36.88	14.37	5.16	19.76	15.26	295 ^b	23
	39.78	20.77	8.35	21.89	22.39	348 ^a	27

^{a,b,c} Consumer preference frequencies with different superscript letters in columns within a year differ ($P < 0.05$).

IV. CONCLUSION

Most consumers (around 70%) in 2004 and 2015 preferred beef with redness values around or above 14.5 which has been proposed as a threshold for beef colour acceptability to consumers. However, 30% of consumers preferred darker and less red meat. The frequency of consumer preference increased with L^* , a^* and b^* values of beef in 2004, while a similar frequency of preference by respondents was observed for all evaluated beef steaks in 2015. A broader range of meat colours (with corresponding instrumental values) and consideration of other beef cues would improve our understanding about consumer colour preference and its relative importance in meat purchasing decisions with packaging and marketing implications for beef.

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