A comparison between colourimeter and computer vision system in colour evaluation in broiler chicken meat

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1. Introduction

Meat colour is an important quality attribute that primarily determines consumers' intent to buy meat. This is mainly due to surface discolouration is associated with product wholesomeness and, any condition that negatively affects the visual appearance of a product will influence the purchasing decision, resulting in economic loss. The meat quality defects associated with meat tenderness, water holding capacity, and other quality attributes can be indicated by the meat colour. Mainly, two meat quality defects are known as Pale Soft Exudative (PSE), and Dark Firm and Dry (DFD) develops in meat as a result of genetics, ante-mortem, and post-mortem stressors including environmental temperatures, transportation, preslaughter handling practices, and chilling. Due to its inherited characteristics, meat colour can be varied such as PSE meat get pale colour (L^* (Lightness) ≥ 53) than the normal meat colour and DFD meat gets darker ($L^* \leq 48$) than the normal meat colour (Lesiow and Kijowski, 2003). The determination of meat colour can be performed subjectively and objectively. Subjectively, consumers perform sensory evaluation such as visual appearance while Colourimeters (CL), and Computer Vision System (CVS) are used for the objective measurements of the meat colour (American Meat Science Association, 2012). A comparison of the meat colour assessment methods has not been evaluated in detail locally. Hence, this study aimed to compare the colourimetric assessment methods used to evaluate the broiler meat colour.

2. Materials and Methods

Twenty-two broiler chicken breasts were purchased at local supermarkets and butcher shops. Each breast muscle was cut into samples 4x5x4 cm, coded with random three-digit numbers, placed flat on a uniform on-glare black background, and allowed to bloom for 30 minutes. Colourimeter (CR-10 plus, Konica Minolta) was used to take three sets of measurements from different areas of each broiler breast meat sample and average values of L* (lightness), a* (redness) and b* (yellowness) were calculated for each sample. The CVS measurements were taken as the method described by Tomasevic et al., (2019). Briefly, the surface of the samples was photographed using a digital camera (Canon, DSLR-6D marks ii camera) with a 26.2 Megapixel full-frame CMOS sensor. Based on the measured L*, a*, b* values by both methods colour chips were generated using Adobe Photoshop CC (2020) software. According to Ramirez-Navas and Stouvenel, (2012), the colour chips were selected. The colour chips were compared against the photographs of the meat samples and those were presented as an online questionnaire. Further, 344 respondents were facilitated to choose their answers with multiple options. Student t-test was used to determine the differences in L*, a* and b* obtained through colourimeter and CVS. The Chi-square test (X^2 one-sample test) was used to determine the colour similarity between the generated colour chips and the photographs of the broiler breast meat sample through a consumer assessment. The SAS (2002) software version 9.1 was used and *p*-values below 0.05 were used as the decision criterion for statistical significance.

3. Results and Discussion

The results revealed that (Table 01) the L* a* and b* values of broiler meat samples which were obtained by CVS and colourimeter were significantly different ($p<0.05$). The colour difference was even additionally noticeable as a result of it had been not targeted in only one dimension however instead, considerably totally different values between the CVS and colourimeter were observed for all three dimensions (L*, a*, b*). Similar findings were observed in Tomasevic et al., (2019).

Table 01. The comparison between CVS and Colourimeter (Mean + SE)

Parameter	Method		Pr > |t|
	CVS	Colourimeter	
L*	46.41 ± 1.49[a]	51.03 ± 1.22[b]	0.0277
a*	4.72 ± 0.47[a]	1.04 ± 0.12[b]	<.0001
b*	1.66 ± 0.46[a]	8.93 ± 0.41[b]	<.0001

[a] and [b] mean values were significantly ($p < 0.05$) different within the row across methods

The highest number of respondents (86.53%) were found that the broiler meat colour generated by the colour values obtained through CVS were similar to the actual colour of meat samples. Similar findings were obtained by Girolami et al., (2013); Tomasevic et al., (2019) and the authors indicated that the highest percentage of the respondents/panellists were chosen the CVS-generated colour chips as compared to the colourimeter-generated colour chips. This may be as a result of, the meat does not have a homogeneous surface because of its structure, connective content, and intramuscular fat. Hence, the enlargement of the measured area would possibly include fat and connective tissue, thus yielding unreliable measures. Hence, it is hard to take the measurements using the colourimeter because it causes multiple reflections and refractions where optical discontinuities are present, resulting in a diffusion of light and using the colourimeter can be calculated only one point or of a reduced area such as the area spotted by the colourimeter. But the CVS can be estimated the overall colour of the sample and its heterogeneity, as well as this system, offers the possibility of analysing the entire surface of the meat and its characteristics and defects (Girolami et al., 2013). As of that CVS can be measured the entire surface colour of the meat, thus the CVS-generated colour could be more similar to the actual meat.

4. Conclusions

The computer vision system (CVS) is more appropriate to evaluate the colour of the broiler chicken meat as it generates colour chips that are more similar to the actual meat colour.

5. References

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