



Original Research Article

Colour Properties, pH Value and Sensory Evaluation of Commercial Beef Sausages

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ABSTRACT

Sausage is becoming more popular to the Indonesian consumers. A study on quality characteristics for beef sausages marketed in Indonesia was conducted to gauge the trend of marketed sausages today. A total of six samples of beef sausages from different brands were analyzed to determine the colour properties, pH value, and sensory evaluation. The colour properties (L^* , a^* , and b^*) for uncooked beef sausages were significantly different, in the range of 16.06- 20.61, 8.12-12.70, and 5.02-6.60, respectively. The colour properties (L^* , a^* , and b^*) for cooked beef sausages were significantly different, in the range of 15.39-21.75, 7.20-17.96 and 5.10-12.41, respectively. The range of pH value of raw and cooking beef sausages sample were significantly different, in the range of 5.13-6.52 and 5.09-6.66. However, significant differences were observed for the sensory evaluation test. The colour, odour, hardness, juiciness, taste, and overall acceptable range between 2.77-4.86, 2.14-5.97, 2.46-4.51, 2.6-4.31, 2.34-4.89, 2.11-6.17 and 2.09-4.91. The results of this analysis showed that beef sausages produced by different manufacturers will vary significantly in colour, pH, and sensory properties.

Keyword: Commercial beef sausages; colour properties; pH value; sensory evaluation

INTRODUCTION

The sausages are one form of processed beef which is currently quite popular in the community. Sausages are also familiar as one of the ready-to-eat breakfast menu items among schoolchildren. The sausage meat is a food

product derived from a mixture of delicate meat (containing meat not less than 75%) with flour or starch with or without the addition of seasonings and food additives as otherwise permitted and put into sausage casings [3].

mentions that the main component of the sausage consists of meat, fat, and water. In addition, the sausages also add additional ingredients such as salts, phosphates, preservatives, coloring, ascorbic acid, protein isolates, and carbohydrates [2].

Commercial sausages produced in Indonesia, mostly in frozen form, are generally made from chicken, beef, and fish. Many factories have been produced beef sausages due to high demand in the country. This study was conducted to determine the quality characteristics associated with beef sausages available in the Indonesian markets at present. These data could be used as references for the better understanding of the quality characteristics (colour, pH, and sensory evaluation) of beef sausage products produced by local manufacturers.

MATERIALS AND METHODS

Sampling

Six commercial of beef sausages (BS1-BS6) from different brands or manufacturers were collected from supermarkets located in Padang, West Sumatera-Indonesia. Two packets of each brand were picked randomly and brought to the laboratory for analysis. The sausages were prepared by thawing at room temperature for about 4 h and heated in boiling water for 5 min.

Colour measurement

Samples were heated at 90°C for 5 min and sliced into pieces 4 mm thick. The colour of heated samples was measured using a colorimeter (ColourFlexEZ Spectrophotometer). The colorimeter was calibrated by using the zero calibration box, followed by white calibration plate. Target-mask of petri dish was used where samples in the Petri dish was placed on the optical center and covered with a black container. Three measurements of L^* , a^* , and b^* values were taken for each formulation to obtain consistent results and mean values. The method of colour measurement used is *Commission Internationale de l'Eclairage* (CIE) L^* , a^* , b^* colour space. In this method, the colour space is considered spherical. L^* indicated lightness (perfect black = 0; pure white = 100, (+) a^* values indicated redness, (-) a^* values indicated greenness, (+) b^* value

indicates yellowness and (-) b^* indicates blueness [7].

pH Value

The pH values of samples were measured with a 10 g of the sample which was homogenized with 40 ml deionized water. The pH meter used was pH Meter. pH values for each sample were determined in triplicate [9].

Sensory evaluation test

Sensory evaluation was carried out by 30 panelists/session consisting of students of the agricultural product technology division. The sensory laboratory consists of six isolated sensory booths. Beef sausages were shallow pan fried in cooking oil until golden brown (core temperature = 75 °C) and kept in aluminum containers until served. All beef sausages were served at room temperature and distilled water was also provided. Hedonic ratings using 7-point scales were adopted. Beef sausages were presented in three-digit coded glass containers, and the order of serving was determined by random permutation. Attributes evaluated including colour, appearance, odour, taste, gumminess, hardness, juiciness, oiliness and overall acceptance. The higher rating indicated good quality attribute (1, dislike very much and 7, like very much) [11].

Statistical analysis

The data from three replications were analyzed using one-way Analyses of Variance (ANOVA) and the Duncan test for multiple mean comparisons. The data was processed using SPSS version 17.0 and significance were defined at $p < 0.05$.

RESULTS AND DISCUSSION

Table 1 shows the general information of commercial beef sausages is labeled on each package.

Table 2 shows the colour intensity results of raw beef sausages. Statistical analysis indicated significant difference ($P < 0.05$) lightness value (L^*), redness (a^*) and yellowness (b^*) among the raw beef sausages. Lightness value was highest in BS6 (20.61) and lowest in BS4 (16.06). Statistical analysis on redness values of raw beef sausages highest in BS4 (16.53) and lowest

in BS6 (8.12). L^* indicates lightness (perfect black = 0; pure white = 100), (+) a^* values indicates redness, (-) a values indicates greenness, (+) b^* value indicates yellowness and (-) b indicates blueness. The physical appearance of meat products is the principle characteristics upon which consumers base

their initial purchase. In considering the specific features comprising physical appearance, researchers agree that meat colour is one of the most important. Adams JR et al [1] reported that consumers relate the colour of lean to its freshness.

Table 1: Ingredient information for the commercial beef sausages

Sample	Ingredients
BS1	Beef meat, spices extract, permitted food conditioner and sodium nitrite, permitted flavour enhancer (4R Cl. 16255), food starch, soy protein, salt and permitted preservative.
BS2	Beef meat, water, food starch, soy protein, spices extract and permitted preservative.
BS3	Beef meat, tapioca starch, soy protein, vegetable oli, salt, spices extract , taste enhancer, permitted preservative and colouring (ponceau-4R Cl No. 16255/45430)
BS4	Beef meat, soy protein, tapioca starch, water, vegetable oil, salt, sodium nitrit, colouring (ponceu 4R Cl No. 16255) and spices extract
BS5	Beef meat, soy protein, salt, spices extract, pepper, water
BS6	Beef meat, water, tapioca starch, vegetable oil, soy protein, salt, spices, flavor enhancer, monosodium glutamate, sekuestran sodium tripolifosfat, kalium sorbat dan sodium nitrit, colouring (ponceau-4R Cl No. 16255, eritrosin Cl No. 45430 and yellow FCF Cl No. 15985)

Table 2: Colour properties of commercial raw beef sausages

Sample	Colour properties		
	L^*	a^*	b^*
BS1	18.48±1.15 ^{abc}	9.04±0.67 ^{ab}	5.16±0.22 ^a
BS2	17.71±1.83 ^{abc}	9.72±0.78 ^b	5.02±0.26 ^a
BS3	20.14±2.31 ^{bc}	9.23±0.15 ^{ab}	6.60±0.50 ^b
BS4	16.06±1.24 ^a	16.53±0.87 ^d	6.42±0.32 ^b
BS5	17.26±1.41 ^{ab}	12.70±0.70 ^c	6.16±0.34 ^b
BS6	20.61±1.10 ^c	8.12±0.26 ^a	6.17±0.10 ^b

^{a-d}Means with different letters in each row are significantly different ($P < 0.05$). n=6

The L^* (lightness) value of cooked beef sausages was between 15.39 and 18.72. A higher L^* value indicates a lighter colour, which is desirable and has high consumer acceptance [9]. With heating, several changes in the appearance and physical properties of meats in sausage occur due heating processes. These changes include discoloration of the meats, due to the oxidization of pigment heme groups [6]. According to Cross HR et al [5], heat applied on meats was responsible for converting myoglobin and hemoglobin to metmyoglobin,

which is brown in colour. Therefore, the colour of meat will generally become darker after heating. Lightness is the main attribute which correlates well with consumer acceptability. The results showed that many of samples did not reach the desirable lightness, even becoming darker after heating. There are several factors which contribute to the colour of the sausages: increasing fat content, end point temperature and the post-cooking time before evaluation will decrease the redness of cooked meat samples [4].

Table 3: Colour properties of commercial cooked beef sausages

Sample	Colour properties		
	L*	a*	b*
BS1	18.04±0.32 ^{bc}	9.56±0.18 ^b	5.21±0.20 ^a
BS2	17.05±1.82 ^b	8.15±1.54 ^{ab}	5.10±0.46 ^a
BS3	18.72±0.78 ^c	9.19±2.06 ^{ab}	12.41±6.46 ^b
BS4	16.42±0.55 ^{ab}	17.96±0.54 ^d	6.81±0.13 ^a
BS5	21.75±0.6 ^d	7.20±0.09 ^a	6.03±0.15 ^a
BS6	15.39±0.32 ^a	13.35±0.17 ^c	6.40±0.14 ^a

^{a-d}Means with different letters in each row are significantly different ($P<0.05$). n=6

The difference in colour properties of beef sausages may be contributed by the effect of oil temperature and sample thickness during frying. The colour change phenomenon gets more intense at higher temperatures and smaller sample thickness [8].

Table 4 showed that pH for raw and cooked beef sausages significantly different ($P<0.05$) among the sample. BS3 (6.52) has the highest pH value and lower at BS4 (5.13). pH plays an

important role during emulsification and is strictly related to the physicochemical and functional properties of an emulsion [14]. The high pH meat is often characterized as being dark, firm and dry and the lighter meat as being pale, soft and exudative. In addition, muscle pH affected the water binding nature of the proteins and therefore directly affects the physical structure of the meat and its light reflecting properties.

Table 4: pH value of commercial beef sausages

Sample	pH value	
	Raw	Cooked
BS1	6.39±0.01 ^e	6.63±0.01 ^d
BS2	5.62±0.01 ^c	5.29±0.01 ^b
BS3	6.52±0.02 ^f	6.66±0.06 ^d
BS4	5.13±0.02 ^a	5.09±0.04 ^a
BS5	6.34±0.06 ^d	6.38±0.09 ^c
BS6	5.33±0.03 ^b	5.31±0.01 ^b

^{a-f}Means with different letters in each row are significantly different ($P<0.05$). n=6

During sensory tests, it was observed that the panel accepted the colour, odour, taste, hardness, gumminess, juiciness, oiliness and overall acceptability of fried duck nuggets made with different manufacturer of beef sausages (Table 5). Sensory properties are among the major concerns for beef sausages product. Based on the hedonic ratings using 7-point scales (1, dislike very much and 7, like very

much) sensory scores showed that the acceptability of beef sausages was significantly different ($P<0.05$). Panelists had the significantly higher preference for the colour of beef sausages of BS2 code at 4.86, and the lower preference for the colour in beef sausages BS1 at 2.77. for overall acceptance panelists preferred beef sausages with light colour in BS3 at 6.29 value.

Table 5: Sensory evaluation value of commercial beef sausages

Sample	Sensory attribute						
	Colour	Odour	Hardness	Gumminess	Juiciness	Taste	Overall
BS1	2.77±1.33 ^a	2.14±1.24 ^a	2.46±0.98 ^a	2.60±1.19 ^a	2.34±1.14 ^a	2.11±1.30 ^a	2.09±1.10 ^a
BS2	4.86±1.50 ^d	4.77±1.42 ^c	4.26±1.46 ^{de}	4.31±1.45 ^c	4.66±1.61 ^c	4.80±1.55 ^c	4.51±1.27 ^d
BS3	4.17±1.54 ^{cd}	5.97±1.15 ^d	4.51±1.48 ^e	4.14±1.67 ^c	4.89±1.41 ^c	6.17±0.82 ^d	6.29±0.79 ^e
BS4	3.63±2.03 ^{bc}	3.83±1.52 ^b	3.71±1.41 ^{cd}	3.49±1.56 ^b	2.8±1.41 ^a	4.06±1.61 ^b	3.80±1.61 ^c
BS5	4.23±1.56 ^{cd}	2.77±1.40 ^a	2.83±1.22 ^{ab}	2.74±1.09 ^a	2.66±0.97 ^a	2.43±1.38 ^a	2.69±1.21 ^b
BS6	3.26±1.50 ^{ab}	4.83±1.56 ^c	3.11±1.13 ^{bc}	2.83±1.15 ^a	3.8±1.49 ^b	5.09±1.52 ^c	4.91±1.40 ^d

^{a-d}Different letter within a row are significantly different ($P<0.05$). n=30

Beef sausages sample had the highest taste scores (6.17, like in 7-hedonic scale) at BS3 code. According to sensory evaluation results all beef sausages sample had significantly different for overall palatability and received high scores. Trout ES et al [12, 13] found a good correlation between textural measurements and sensory traits in ground beef patties containing texture modifying ingredients.

CONCLUSION

The results of colour properties, pH and sensory evaluation of commercial beef sausages showed significant difference among the brands. The differences in beef sausages could be mainly due to the types and amount of ingredients added, different formulation, different cooking methods and other parameters such as pH, temperature, environment humidity and post cooking time before sample evaluation.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interests.

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