

Dietary *Curcuma sp* supplementation on meat quality of Bali cattle fed with fermented palm oil sludge.

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ABSTRACT :

The research was conducted to find out the effect of *Curcuma sp* on the meat quality of Bali cattle. Sixteen male Bali cattle, all of which are 2.53 years old, are ready to sell the *Qurbani* used in this study. All cows were fed a diet consisting of 40% grass and 60% palm sludge fermentation. Eight Bali cattle were adapted for one week before receiving up to 50 mg/kg LW *Curcuma manga* and *Curcuma longa* supplements for 15 days. The other eight cows were not given *Curcuma sp*. As *Qurbani* / sacrificial animals, 7 cows with *Curcuma sp* supplements and 5 cows without food supplements were successfully sold. At Eid al-Adha or Sacrifice, meat samples are taken during the slaughter process. Results showed that the meat colour of Bali cattle supplemented with *Curcuma manga* and *Curcuma longa* is red cherry, while pH, cooking loss, drip loss, water holding capacity meat from *Curcuma sp* supplementation are similar to meat from non-supplemented cattle.

KEYWORDS – Cooking loss, *Curcuma sp*, meat colour, pH, WHC, sludge

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I. INTRODUCTION

The Codex Alimentarius defines meat as "all parts of animals that are used or have been judged to be safe and suitable for human consumption. Meat is made up of protein, minerals, fats and fatty acids, vitamins, water and other biologically active ingredients, and also carbohydrates. It contains all essential amino acids, as well as highly bioavailable minerals and vitamins especially B12 and iron, both of which are scarce in vegetarian food [1].

Indonesia's National Standardization Agency (2018) defines meat as a skeletal muscle part of cattle carcass and can be tangible as fresh, cold/frozen meat that is safe, prevalent and suitable for consumption [2]. To ensure the inner peace of the community, the Directorate General of PKH (Directorate General of Livestock and Animal Health) recommends that beef must be Safe Healthy Intact and Halal (ASUH) meaning that the meat must come from livestock that is halal-cut thoyiban while still meeting sanitary hygiene standards.

The quality of meat is influenced by before and after-mortem. The effect of nutrition pre-mortem has been reported [3]. Dietary olive cake supplementation can increase meat quality [4]. Suryani [5] showed the administration of cornmeal supplementation in Bali cattle can reduce the percentage of fat but does not affect the protein content of meat. [6] found supplementation Oregano oil increase significantly pH and colour parameters (yellowness–redness). According to Cheng and Sun [7], nutrition will have a direct effect on muscle characteristics, while [8] noted the meat colour from male Bali cattle fattened with forage is dark red with a score of 9.

Several researchers [9][10], said that other factors that affect meat quality are stress before and during the slaughter process, inadequate infrastructure, and slaughtering method. Resting before slaughter will improve the quality of meat [11]. In general, the meat quality that is first seen by consumers is the meat colour [3]. [12] reported 78% of consumers to favour bright red meat. The appearance and colour of meat is also a consideration for consumers in Brazil [13] Poland [14] the same is also reported in Italy [15] and Greece [16]. According to [17], the colour of meat is an indicator of the freshness of the meat, the change in the colour of meat from light to dark indicates a decrease in quality. Color also determines the shelf life of meat [18]. Tsitsos [16] states that social culture and economic circumstances will affect consumer preferences for meat.

In addition, taste, smell, acidity/ pH, sarcomere length, freshness, visible fat, appearance, water binding activity, tenderness, drip and cooking loss also can be used as an attribute for meat quality [19], Because it is related to the reduction of muscle glycogen reserves, pH measurement is one of the most crucial parameters of meat quality [9]. The pH of fresh meat at the time of slaughter is around 7, the pH will decrease gradually because glycogen in the muscles will be converted to lactic acid [20]. Other parameters that could be used as the

quality of meat are cooking loss and WHC. Cooking is a function of time (length of cooking and cooking temperature). Water holding capacity is an important sensory aspect to know the meat quality [21].

Along with increasing public awareness to consume healthy meat products reflected in meat selection behaviours taking into account food safety, health consciousness and meat characteristics [22]. The use of herbs as supplementation or feed additives to improve livestock health and meat quality has been reported by several researchers such as [23] use *Nigella sativa*, *Curcumin* and *Andrographis paniculata* [24] using *Origanum vulgare* L and *Salvia officinalis*. The study aims to find out the effect of *Curcuma sp* supplementation on the quality of Bali cattle fed based on fermented palm sludge.

II. METHODOLOGY

The research was conducted from June to July 2021 at a small Farm in the village of Central Bengkulu Regency. A total of 16 male Bali Cattle aged 2.5-3 years are ready to be sold for Qurbani used in this study. All the cattle were fed 40% grass and 60% palm sludge fermentation ad libitum. Eight (8) Bali cattle were supplemented with *Curcuma manga* and *Curcuma longa* as much as 50 mg/kg LW for 15 days after previously undergoing adaptation for 1 week. While the other 8 cattle were without *Curcuma sp* supplementation.

Seven cattle with *Curcuma* supplementation and 5 non-supplementation cattle were successfully sold as Qurbani/ sacrificial animals. Samples of meat are taken during the slaughter process on Eid ul Adha or the Feast of *Sacrifice*. The slaughter process is carried out following Circular Letter (SE) Number 8017/SE/PK.320/F/06/2021 on the Implementation of Sacrificial Activities during the Covid-19 Coronavirus Pandemic. Approximately 150grams of meat (musculus biceps femoris) were taken for samples. The parameters evaluated are meat colour and pH, cooking loss, dripping loss and water holding capacity (DMA).

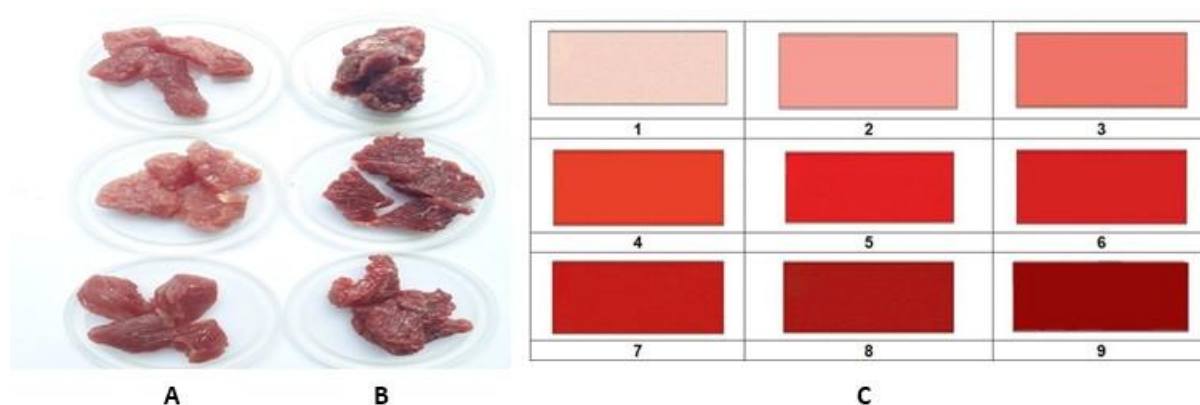
Colour values or scores are determined based on standard colours (BSNI, 2008). The colour of the meat sample is adjusted to the standard meat colour. The pH of meat was measured after the meat has undergone a chilling process for 6 hours. Before testing the pH meter is calibrated using a buffer solution at pH 4 and pH 7. Five (5) grams of ground meat plus 50 ml of aquabidest and softened until homogeneous. Electrodes are inserted into a sample of meat to be tested; pH measurements are carried out twice.

Cooking loss is calculated based on the percentage (%) of the weight of meat before cooking and the weight of meat that has been reduced due to cooking. Water binding capacity is measured by the centrifuge method based on [25], with modification, a total of 2.5 g of mashed meat is added 10 ml of aquabidest in the 30 minutes at +30°C after 30 minutes of incubation, meat was centrifuged at a rate of 3000 rpm for ± 30 minutes. The supernatant is taken and the sample was re-incubation for 10 minutes at a temperature of ± 30 °C, the supernatant is taken back, the final weight is weighed.

III. RESULT AND DISCUSSION

The meat colour of Bali cattle supplemented with *Curcuma manga* and *Curcuma longa* is red cherry or bright red while the colour of meat from Bali cattle non supplemented is dark red. Based on SNI 3932 (2008), the standard colour of beef uses a score of 1-9, a score of 1-5 (bright red) and categorized as first quality, rather dark red colour, with a score of 6-7 categorized as second quality while the colour of meat with a score of 8-9 or dark red colour is categorized as third quality meat.

The average colour score of meat in this study was 3.57 (*Curcuma sp* supplementation) and a score of 6.72 for the colour of non-*Curcuma sp* supplementation meat, thus the quality of meat from the *Curcuma sp* treatment group is better than non-supplemented. The results from [26] also showed that *Curcuma sp* flour can improve the colour of lamb sausage. Ornaghi [27] said that natural additives could improve meat quality. According to [14] the bioactive content in herbs is thought to play an important role in inhibiting the oxidation of myoglobin and the formation of metmyoglobin so that meat is brighter than the control.



According to [9] colour is the most important sensory attribute of meat quality because it can affect consumer preferences. Consumers associate bright meat colour with freshness and quality so that if the meat is not bright red, it is considered that the meat is degraded in quality. Our result is in line with [28] who reported that supplementation of *Ocimum basilicum* can improve the quality of meat colour and fat oxidation stability. However ([29] found feed supplementation containing *Schizochytrium limacinum* causing the darker colour.

Table 1. pH and meat colour of Bali cattle supplemented with Curcuma sp

No	Meat colour score (Average + sd)				pH Meat (Average + sd)			
	<i>Curcuma sp</i>		No- <i>Curcuma sp</i>		<i>Curcuma sp</i>		No- <i>Curcuma sp</i>	
1	3.00	0.00	7.80	0.40	6.33	0.24	7.07	0.09
2	3.40	0.55	6.60	0.49	6.67	0.47	6.73	0.17
3	3.80	0.45	6.80	0.40	7.00	0.12	7.04	0.12
4	3.80	0.45	6.20	0.40	6.67	0.47	7.03	0.12
5	4.40	0.55	6.20	0.40	7.17	0.00	6.90	0.08
6	3.40	0.55			6.83	0.12		
7	3.20	0.45			6.50	0.41		
Average	3.57	0.43	6.72	0.42	6.73	0.22	6.95	0.12

The results showed pH of meat 4-hour post mortem 6.72 and 6.94. [30] reported that the pH meat of Bali cattle is around 6.43-6.53. The rate of decline in meat pH gradually from 7.0 when slaughter fell to range from 5.6-5.7 within 6-8 hours after slaughtered and reached the final pH of about 5.3-5.7 Muscles become anoxic after slaughter, triggering anaerobic glycolysis [20]. Because glycogen is hydrolyzed to lactic acid when exposed to high levels of stress hormones before or during slaughter, muscular glycogen reserves are depleted. As a result, lowering the pH of meat from 7.0 to 5.5 is critical for reducing the growth of bacterial.

The pH of meat can rapidly drop to 5.4-5.5 for several hours after death [20]. The pH of healthy and well-rested animal meat is 7-7.2 and will fall over the next 24 hours. Decreasing meat pH is varied between animals. The amount of lactic acid produced from glycogen during the anaerobic glycolysis process will determine the post-mortem pH value.

Table 2. Cooking Loss and drip loss of Bali cattle meat supplemented with Curcuma sp

No	Cooking Loss (Average + sd)				Drip loss (Average + sd)			
	<i>Curcuma sp</i>		No- <i>Curcuma sp</i>		<i>Curcuma sp</i>		No- <i>Curcuma sp</i>	
1	45.67	0.54	46.01	3.16	11.26	3.09	14.47	1.71
2	43.20	1.81	47.19	0.58	10.02	4.03	17.19	4.10
3	43.35	1.20	48.56	4.06	12.98	3.73	16.59	4.10
4	41.93	1.60	44.63	4.47	9.03	2.32	13.13	3.33
5	46.21	0.41	45.94	0.91	10.47	4.16	12.45	2.07
6	44.99	2.43			7.80	2.68	-	-
7	43.67	2.26			10.61	2.84	-	-
Average	44.15	1.47	46.47	2.64	10.30	3.26	14.76	3.06

Cooking loss in the meat from *Curcuma sp* supplementation Bali cattle is 44.15% and non-supplementation 46.47%, the results of this study are almost the same as the results of research by [31] cooking lost in beef by 44.65% [31] while cooking loss of meat 6 hours post mortem about 41.40%. According to [32], the type of muscle and cooking temperature will affect cooking loss.

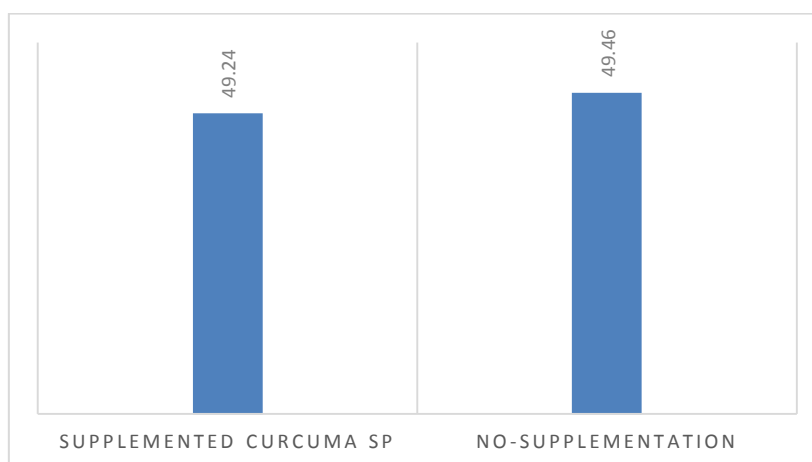


Figure 1. The water-holding capacity (WHC) Bali cattle meat supplemented with *Curcuma sp*

The water-holding capacity (WHC) in the study was 49.24 and 49.46 (non-supplementation). According to Cheng and Sun [7], the factors that affect WHC are the growth phase of livestock, genotype, nutrition, slaughtered methods etc. A variety of pre-and post-mortem factors influence the WHC of meat. The genotype and diet of meat animals are important during growth and development because they have a direct influence on muscle characteristics. Stress conditions such as fasting and slaughter methods tend to affect the WHC. According to [33] 2015) WHC of meat 66.2%, while [34] reported that WHC in fresh and frozen meat with varying depend on thawing period (38.37-43.30%). Low WHC could be due to degradation of myoprotein so that meat becomes pale, tender and exudative (PSE), while high pH causes high WHC as a result the meat become dark firm, and dry meat or DFD [35].

IV. CONCLUSION

Supplementation with *Curcuma mangga* and *Curcuma longa* on Bali cattle can improve the colour of the meat without any effect on pH, drip and cooking loss as well as water-holding capacity, it is possible to consider the *Curcuma sp* as a natural feed supplement. However further research the still needed to evaluate the *Curcuma sp* effect on more comprehensive meat quality.

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