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The Comparison of The Quality of Balinese and Landrace Porks in Terms of Water Holding Capacity and Cooking Loss

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Abstract. Pig is one of the crucial livestock in providing animal protein for a portion of the Indonesian population. Pork is one of the critical commodities concerning nutritional, socio-cultural, and economic aspects. This study aimed to compare the water holding capacity (WHC) of meat, i.e., the ability of meat to maintain water content during processing and cooking loss of meat, i.e., a function of temperature and cooking time. Cooking loss is the lost sample weight during smoking related to WHC and meat juice levels. Sampling was performed at the Mr. Mangku traditional slaughterhouse, Abiansemal Sub-District, Badung Regency, Bali. This research design was a randomized block design (CRD) with samples consisted of 16 samples of Balinese pork tenderloin and 16 samples of Landrace pork tenderloin aged 3-4 months. The water holding capacity test used the Hamm method, while the cooking loss test was carried out by boiled the sample in a water bath at 80^{o}C for one hour. The laboratory test results were then analyzed using the Two Independent T-test SPSS. The analysis results showed that the WHC of Balinese pork was relatively higher than that of Landrace pork, although insignificant. Meanwhile, the cooking loss of Balinese pork was significantly lower than that of Landrace pork. It can be concluded that the quality of Balinese pork is higher than Landrace pork on water holding capacity and cooking loss.

Key words: pork; Balinese pigs; landrace pigs; water holding capacity; cooking loss

I. INTRODUCTION

Meat is one of the livestock commodities required to meet the needs of animal protein to meet the nutrients needed by the body[1]. Animal protein needs are generally obtained from beef, goat, pork, poultry, and fish. One of the choices is pork, where pork is nutritious meat consumed by most Balinese. Most of the pork on the market comes from Landrace pigs, and very few are found from Balinese pigs. Balinese pigs on the Bali island are sourced from wild pigs (Sus vitatus)[2]. Balinese pigs have thicker meat fat than Landrace pigs. Balinese pigs are lard-type pigs, while Landrace pigs are meat-type pigs[3]

The quality of carcass and meat is influenced by factors before slaughter. Before slaughter, several factors affect meat quality, including genetics, nation, species, type of livestock, age, sex, feed, hormones, minerals, and stress. In testing and affecting consumer attractiveness, some vital characteristics of meat quality are pH, water holding capacity, color, and tenderness [4]. In this study, the variables studied compared water holding capacity (WHC) and cooking loss (CL) of Balinese and Landrace pigs. Water holding capacity (WHC) is the ability of meat to retain water content during processing. The size of WHC affects the color, tenderness, elasticity, impression of the juice, and the texture of the meat. CL is the weight of the meat sample lost during smoking related to the meat's WHC and juice content [5].

II.MATERIALS AND METHODS

The research samples consisted of 16 Balinese pork tenderloins and 16 Landrace pork tenderloins obtained from Mr. Mangku traditional slaughterhouse located in Banjar Ulapan 2, Blahkiuh Village, Abiansemal District, Badung Regency.

— Water holding capacity

The water holding capacity test used the Hamm method, where five grams of pork was placed between two pieces of blotting paper and then pressed with a glass plate under 35 kg for 10 minutes. The pressed meat was then weighed [4]. The water holding capacity (WHC) percentage was calculated using the formula: final pork weight divide initial pork weight then times one hundred percent

— Cooking loss

The cooking loss measurement was carried out by inserting 10 grams of meat samples into polyethylene plastic, then boiled in a water bath at 80°C for one hour. After boiling, the meat samples were cooled by placing them in cold water at a temperature of 10°C for 15 minutes. The samples were then dried with tissue paper and submerged again [5]. Cooking loss (CL)

was calculated using the formula: initial weight minus final weight then divide with initial weight then times one hundred percent

Statistical analyses were performed using Two Independent Sample T-test SPSS [6].

III.RESULTS AND DISCUSSION

Based on laboratory tests of pork samples from Mr. Mangku traditional slaughterhouse located in, Banjar Ulapan 2, Blahkiuh village, Abiansemal District, Badung Regency, the following results were obtained:

The WHC value of Balinese pork had a variation of 66.40-75.84%, with an average WHC value of 71.82%, while the WHC value of Landrace pork had a variation of 63-39-79.50% with an average WHC value of 71.37%. The results of the Two Independent T-test showed that the WHC values of Balinese and Landrace pork were insignificantly different (P>0.05). Based on the results, the average WHC of Bali pork is 0.45% better than landrace pork.

Table 1. Laboratory result of water holding capacity and cooking loss in Balinese pork and Landrace pork

	Balinese Pork		Landrace Pork	
No	WHC (%)	Cooking loss (%)	WHC (%)	Cooking loss (%)
1.	75.79	25.86	77.05	30.00
2.	69.51	30.01	66.08	34.93
3.	70.56	27.16	71.84	29.39
4.	74.97	26.74	72.28	32.95
5.	72.42	29.8	78.19	27.07
6.	75.82	23.78	72.96	27.09
7.	72.56	26.05	68.33	31.20
8.	66.40	27.96	79.50	32.05
9.	66.89	32.71	70.44	28.17
10.	73.21	23.91	66.23	24.47
11.	73.21	22.92	68.73	27.85
12.	71.37	25.89	63.39	33.57
13.	75.84	25.18	72.61	29.10
14.	72.51	25.73	73.37	28.63
15.	68.87	30.77	71.26	28.36
16.	69.22	31.81	69.66	30.48
Mean:	71.82	27.26	71..37	29.70

The variation in the SM value of Balinese pork was 22.92-32.71%, with an average SM value of 27.26%, while the variation of the SM value of Landrace pork was 24.47-34.93% with an average SM value of 29.70 %. The results of the Two independent T-test showed that SM values of Balinese and Landrace pork were significantly different (P<0.05). Based on SM, average Balinese pork is 2.42% less than Landrace pork.

Water holding capacity (WHC) is the ability of meat to hold or bind its water affected by pressure or external forces, e.g., cutting, heating, and grinding [4]. The study results on WHC measurements of Balinese and Landrace pork in Mr. Mangku traditional slaughterhouse showed an insignificant difference (P>0.05). It indicates that the difference in the breed of pigs does not affect the WHC.

The factors causing variations in WHC include pH, maturation treatment, cooking or heating, biological, e.g., muscle type, livestock type, sex, and livestock age. Similarly, environmental factors include feed, transportation, temperature, humidity, storage and preservation, health, pre-slaughter treatment, and intramuscular fat also influence WHC. The decrease in the water holding capacity of a liquid is observed in fluid exudation called drip on raw meat [7].

Based on research by Watanabe et al.[8] in Japan, the intramuscular fat content had no significant effect on the WHC ability of pork. It was found that the effect of pH on WHC was more significant than the effect of intramuscular fat content on WHC. Meat pH higher or lower than the isoelectric point of meat (5.0-5.1) will cause the WHC to increase. A higher or lower pH releases a positive charge causing a negative charge surplus, resulting in the repulsion of the myofilaments and giving more space for water molecules. The formation of lactic acid and the breakdown of ATP causes a decrease in pH so that WHC decreases [7].

Cooking loss is a function of temperature and cooking time. Cooking loss is the weight of the meat sample lost during smoking related to WHC and meat juice content [9]. Measurement of cooking loss aims to determine how much meat has lost weight after the cooking process [7]. Based on the study results measuring the cooking loss of Balinese and Landrace pork at Mr. Mangku traditional slaughterhouse, the cooking loss value of Balinese pork was significantly lower than the cooking loss of Landrace pork (P<0.05). It shows that differences in pig breeds affect the value of cooking loss of meat.

This study showed that the cooking loss of Balinese and Landrace pork was in the normal range. The cooking loss value of

meat is generally in the range of 15-40% [5]. WHC influences the cooking loss value. A low cooking loss will follow meat with a high WHC. Low cooking shrinkage meat has a relatively better quality because there is less risk of nutrient loss [1].

According to Soeparno[5] cooking causes changes in WHC due to the solubility of meat protein; high temperatures increase protein denaturation and reduce WHC. The decrease in WHC on heating to a temperature of 80°C was due to the reduction of the acidic group. The loss of the acidic group increases the pH of the meat, so the isometric point of the meat changes at a higher pH. The amount of cooking loss is also influenced by the state of myofibril contraction. Cooking loss may be increased in muscles with shorter muscle fiber lengths. Relatively long cooking will reduce the effect of muscle fiber length on cooking loss.

The amount of cooking loss is used to estimate the amount of juiciness in cooked meat. Juiciness is a combination of the effects of fluid released during mastication and salivation produced by flavor factors including intramuscular fat. Intramuscular fat contributes to the marbling of meat and increases the perception of meat juiciness [1].

The results of this test indicate that the cooking loss of Balinese pork is lower than landrace pig which indicates that the juiciness of Balinese pork is better than Landrace pork.

V. CONCLUSION

The water holding capacity of Balinese pork and landrace pork was not significantly different. The water-holding capacity of Balinese pork has 66.40-75.84% with an average value is 71.82%, while the water-holding capacity of Landrace pork has a variation of 63-39-79.50% with the average is 71.37%. The cooking loss of Balinese pork is significantly lower than that of Landrace pork. The cooking loss value of Balinese pork is 22.92-32.71% with an average 27.26% while the variation of the cooking loss value of Landrace pork is 24.47-34.93% with an average of 29.70%. This is one of the superior parameters of Balinese pork as a germ plasm that must be socialized.

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