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Quality of Pork on Electrical Stunning and Non-Stunning Reviewing from Water Holding Capacity, Wetted Area and Cooking Loss

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Abstract. Pigs cannot be separated from the lives of most Indonesians, especially in Bali. Pork will always be a superior commodity among the public. Meat quality is a major factor for consumers to ensure their safety. The method of slaughter plays an important role in determining the quality of the meat, whether it is using the stunning technique and the non-stunning technique. The purpose of this study was to determine the quality of pork slaughtered using electrical stunning and non-stunning techniques by testing the water holding capacity, wetted area and cooking loss parameters. This study used 40 samples of pork hamstrings (*musculus biceps femoris*), weighing ±50 g/head taken from 40 pigs in two different slaughterhouses in the Darmasaba area. The results showed that the difference in slaughtering techniques did not have a significant effect ($P > 0.05$) on the value of water holding capacity and cooking loss of pork, while on the value of the wet area, the difference in slaughtering techniques had a significant effect ($P < 0.05$). It is necessary to conduct a study with a more detailed unit of measurement and a larger number of samples.

Keywords: Pig; Slaughter Method; Pork Quality

I. INTRODUCTION

Pig is one of the livestock that has great potential to be developed because it has many advantages compared to other livestock. Pork will always be a leading commodity among the people, especially in Bali. The quality of the meat is very important for consumers to ensure their safety, therefore the quality of the meat must be maintained. Good meat can be judged from its physical, organoleptic, chemical, and microbiological qualities. High/good quality pork has the following criteria, namely slightly pale to pink/gray in color, has an aromatic (typical) smell, has a chewy consistency, has fine meat fibers, and white fat and looks thick (Naibaho et al., 2013). Physically, meat quality can be influenced by several factors, including factors before slaughtering and factors after slaughtering (Kuntoro et al., 2013). The method of slaughter also plays an important role in determining the quality of the meat (Bourguet et al., 2011).

Slaughter in general is an act to kill an animal using a sharp object with the condition that the respiratory tract (trachea), food passage (oesophagus), jugular vein and common carotid artery. Slaughter method can be done by stunning non-stunning. According to Zivotofsky and Strous (2012), stunning is a treatment that aims to eliminate the awareness of the animal before the slaughter process is carried out.

There are several methodsstunningwhich is commonly done in the process of slaughtering livestock, namely by using theelectric, mechanical and gas (OIE, 2011). Method electric this can be done by applying a device that has been supplied with electricity of 220 Volt and 1.3 Ampere for 3-4 seconds on the head or body of the livestock (Pleiter, 2010), mechanically stunning can be done usingcaptive bolt gunor by hitting the cattle's prefrontal area using a wooden block (Goba, 2013). Whereas stunning with gas can be done using exposure to carbondioxide gas levels of 80-90% for 3 minutes (OIE, 2011). Inappropriate slaughtering methods can lead to poor physical properties and meat quality, such as becoming *Dark Firm Dry* (DFD) and *Pale Soft Oxydative* (PSE) due to stress before cutting (*pre-slaughter stress*). Physical parameters such as water holding capacity, wet area area and cooking loss have a relationship with each other on meat quality.

Until now, research on the comparison of the quality of pork slaughtered using electric stunning and without stunning techniques is still very limited. Therefore, further studies are needed to be able to provide an overview of the comparison of the quality of pork slaughtered using electrical stunning and non-stunning techniques when viewed from the water holding capacity, wetted area and cooking loss, in order to complete the data and become the basis for further research on good method of slaughtering pigs.

II. MATERIAL AND METHODS

Object of Research

The object of this study used samples of meat from landrace pigs aged 6-8 months with an average weight of 80-100 kg, as many as 40 heads.

Research Variable

The variables in this study can be divided into independent variables, dependent variables and control or controlled variables. In this study, the independent variable was stunning technique (electric and without stunning). The dependent variable is the quality of pork in terms of water holding capacity, wet area and cooking loss, while the control variable isbreed, age, and weight.

Determination of Water Holding Capacity and Measurement of Wetted Area Prosedur

The measurement of the wet area of the meat can be done simultaneously with the measurement of the water holding capacity. First, each pork sample was weighed as much as 5 grams, then chopped and placed between two Whatman No. filter paper. 1 on a ceramic slab. Mark the meat samples according to the type of group, then place another ceramic plate on the top. The next step is to take a weight of 35 kg and place it on the ceramic slab, then wait about 10 minutes. After 10 minutes, remove the weight and re-weigh the meat sample to determine the change in weight (Suardana and Swacita, 2009). The weighing process is carried out 3 times, and the final results obtained will be averaged. Here is how to calculate the water holding capacity:

Water Holding Capacity (%) = (Final weight of meat) / (Initial weight of meat) x 100%

After the meat samples are separated, measure the area of the wet area contained in the filter paper by obtaining the difference in the area of the outer circle (the area of the pressed meat/area of the meat) and deep (area of water that comes out of the meat as a result of pressing / area of meat) on filter paper. The measurement of the circle is done using a ruler. The weight of free water released due to the pressing process can be calculated based on the formula below:

Wetted Area = Wetted Area - luas area daging

Cooking Loss Determination

Cooking loss measurement can be done in the following way: first weigh a sample of 10 grams of pork, then each sample of meat is put into a plastic clip measuring 5 x 8 cm which has been labeled with the name according to the type of treatment, then repackaged by using plastic polyethylene tightly so that during the boiling process, water cannot enter the plastic bag. The meat samples were boiled in a water bath at 80^{o}C for one hour. After the boiling process is complete, the meat samples are removed from the waterbath and cooled for 15 minutes using a beaker that has been given water. Then the sample was removed from the beaker glass and dried using a tissue, then weighed again to determine the change in weight. The weighing process is carried out 3 times, and the final results obtained will be averaged. Here's how to calculate cooking loss:

Cooking loss (%) = (initial weight of meat - final weight of meat) / (initial weight of meat) x 100%

Data Analysis

The research data were first tested for normality with the Saphiro Wilk test, then

tested with parametric and non-parametric tests according to their normal distribution. The results of the next analysis are presented in the form of tables/figures.

III. RESULTS AND DISCUSSION

Water Holding Capacity Test

Water Holding Capacity is an indicator to measure the ability of meat to hold or bind its own water due to the influence of pressure or external forces such as heating, cutting meat and grinding. Following is the result of testing the water holding capacity of pork slaughtered without stunning and using electrical stunning.

Table 1. The results of testing the water holding capacity of pork slaughtered without stunning and using electrical stunning.

Variable	Non Stunning	Electrical Stunning	p-Value
	Mean ± SD	Mean ± SD	
Water Holding Capacity	71.47 ± 3.21	72.57 ± 3.33	0.2930

Descriptively, the mean water-holding power score of pork slaughtered without using stunning technique was (71.47 + 3.21) with 95% conf. intervals were in the range of 69.96 – 72.97, while the mean water holding capacity power score of electrical stunning pork was (72.57 ± 3.33) with 95% conf. the interval is in the range of 71.01 – 74.13.

Based on the results of statistical analysis in table 1, it shows that the water holding capacity of pork slaughtered using the electrical stunning technique was not significantly different ($P > 0.05$) with no stunning, which means that the difference in slaughtering technique did not have a significant effect on the binding power value pork water holding capacity in both groups.

Wetted Area Test

The wet area (amount of water coming out of the meat) is the area of water absorbed by the filter paper due to compression and is obtained from the difference between the area of the outer and inner circles on the filter paper. The following are pictures and tables regarding the results of testing the wet area on pork slaughtered without using stunning techniques and using electric stunning techniques.

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Figure 1. Measurement of wet area of control and treatment pork. Wet area of control pork (left); wet area of the treated pork (right).

Table 2. Results of testing the wet area of pork slaughtered without stunning and using electrical stunning.

Variable	Non Stunning	Electrical Stunning	p-Value
	Mean ± SD	Mean ± SD	
Wetted Area	5.18 ± 0.51	5.57 ± 0.71	0.0269*

Descriptively, the average wet area score of pork slaughtered without using stunning techniques was (5.18 ± 0.51) with 95% conf. the interval was in the range of 4.5 – 6.5, while the mean area score of electrical stunning pork wet area was 5.57 (± 0.71) with 95% conf. intervals are in the range of 4.5 – 8.

Based on the results of statistical analysis in table 2 shows that the variable area of wet pork slaughtered using the electrical stunning technique was significantly different ($P < 0.05$) with non stunning, which means that the difference in slaughtering technique had a significant effect on the value of the wetted area meat pigs in both groups. It can be caused by stress factors before cutting. According to Soeparno (2011), stress before slaughter can be caused by high fear and anxiety due to poor handling, prolonged confinement processes and poor slaughtering techniques. In addition, stress factors before cutting can also be caused by nutrition, climate/temperature, injury, fatigue (excess movement), electrical stimulation, and fasting (Swacita, 2017). In cattle that are stunned using the electrical stunning technique will cause excessive movement statically and continuously for several minutes, so that it can have an impact on the depletion of the amount of glycogen content in the muscles, and shortly after the cattle are cut the glycogen content which is converted into lactic acid is small (Suardana and Swacita, 2009) and cannot make the pH of meat reach normal values. In this condition, muscle glycogen deficiency in livestock can cause the process of converting glycogen to lactic acid to occur very quickly. This causes the pH of the meat to decrease more quickly in

the first hours after the slaughtering process is carried out and the final pH produced is relatively low, and causes a lot of free water to come out of the meat so that the wet area becomes larger. Stunning that function poorly can cause stress to livestock if done improperly, this can later affect the quality of the meat such as the meat becomes mushy, watery and shrinks excessively.

Cooking Loss Test

Cooking loss is the percentage of meat weight lost due to the cooking or heating process. Cooking loss is an indicator of the nutritional value of meat related to the juice content of the meat, namely the amount of water bound in and between muscle fibers. The following are the results of the cooking loss test for pork slaughtered without stunning and using electrical stunning:

Table 3. Results of cooking loss testing of pork slaughtered without stunning and using electrical stunning.

Variable	Non Stunning	Electrical Stunning	p-Value
	Mean ± SD	Mean ± SD	
Cooking Loss	37.38 ± 3.82	38.53 ± 3.40	0.3220

Descriptively, the mean cooking loss score of pork slaughtered without using the stunning technique was (37.38 ± 3.82) with 95% conf. interval was in the range of 35.59 – 39.17, while the average cooking loss score of electrical stunning pork was (38.53 ± 3.40) with 95% conf. the interval is in the range of 36.94 – 40.12. The following is a graph of the percentage of pork quality slaughtered without using the stunning technique and using the electrical stunning technique in terms of water holding capacity, wetted area area and cooking loss.

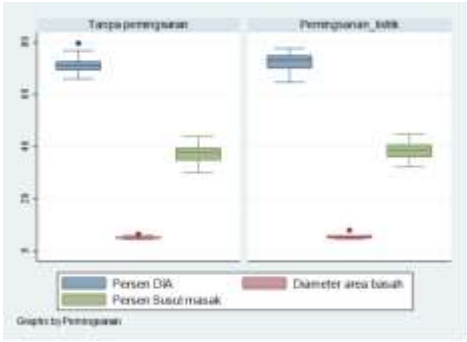

Figure 2. Percentage of the dependent variable of pork slaughtered without stunning and with electrical stunning.

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Based on the results of statistical analysis in table 3 shows that the shrinkage variable cooking loss pork slaughtered using the electrical stunning technique was not significantly different (P > 0.05) with non stunning, which means that the difference in slaughtering technique did not have a significant effect on the cooking loss value of pork in the two groups.

IV. CONCLUSIONS

Based on the research obtained, it can be concluded that the difference in slaughtering techniques does not have a significant effect (P > 0.05) on the water holding capacity and cooking loss of pork, while the wetted area value difference in slaughtering techniques has a significant effect (P < 0 ,05).

V. SUGGESTIONS

It is necessary to conduct a study with a more detailed unit of measurement and a larger number of samples.

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