

## **Analysis of Nutrition, Quality and Health of Local Pork by Sex**

**Ida Bagus Ngurah Swacita<sup>1\*</sup>, Ida Ayu Pasti Apsari<sup>2</sup>, Romy Muhammad Dary Mufa<sup>1</sup>**

<sup>1</sup>Veterinary Public Health Laboratory, Disease Prevention Department, Faculty of Veterinary Medicine, Udayana University, Bali, Indonesia.

Email: [ibnswacita@unud.ac.id](mailto:ibnswacita@unud.ac.id)

<sup>2</sup> Laboratory of Parasitology, Faculty of Veterinary Medicine, Udayana University, Bali, Indonesia.

Email: [pastiapsari.45@unud.ac.id](mailto:pastiapsari.45@unud.ac.id)

<sup>1</sup>Veterinary Public Health Laboratory, Disease Prevention Department, Faculty of Veterinary Medicine, Udayana University, Bali, Indonesia

Email: [romymuhammad@unud.ac.id](mailto:romymuhammad@unud.ac.id)

\*Corresponding Author Email: [ibnswacita@unud.ac.id](mailto:ibnswacita@unud.ac.id)

**Abstract.** The purpose of this study was to determine the nutrition, quality and health of local Balinese pork based on gender. This study used a qualitative exploratory survey method, which took 10 samples of local pork slaughtered at the Pig Slaughterhouse (TPB), consisting of five female local pork samples and five male samples at three different locations. Assessment of pork nutrition and quality can be done using the Association of Official Analytical Chemist (AOAC) method, while pork health assessment can be done by inspection, palpation, and inches. The results showed that the average nutritional value of male pork was as follows: water content 74.5%, ash 1.2%, crude protein 19.7%, crude fat 4.6%, while the average female pork was water content 74.9 %, ash 1.2%, crude protein 18.8%, crude fat 5.1%. The quality of local pork, both male and female, is reddish brown in color, smells of fresh blood with a soft consistency and smooth texture, the average pH value of male and female pigs is 5.37, and the average water holding capacity of male and female pork is 89.19%. 88.73. The health of the carcass and internal organs of male and female local pigs were normal (healthy), no abnormalities were found, except for a white spot in the liver of the male pig. It can be concluded that the nutrition, quality and health of local pork are in accordance with meat quality standards and are fit for consumption.

**Key words:** Nutrition, quality and health, local pork, TPB

### **I. INTRODUCTION**

Public knowledge about the safety of food to be consumed is still low. In general, people do not know and some do not want to know whether the animal food consumed comes from a slaughtering process with guaranteed safety. Many of them think that how can they get cheap animal food without thinking whether the food they buy

is safe for consumption. One of the requirements in the supply of food of animal origin in Indonesia is that the food must be safe, healthy and intact (Dirkesmavet, 2005).

Information from WHO (2005) states that around 75% of new diseases that have attacked humans in the last two decades are caused by pathogens of animal origin or

animal products, so that food of animal origin is potentially more dangerous than food of vegetable origin. Therefore, the aspect of food safety of animal origin needs special attention. There are several diseases that can be transmitted through meat (meat borne disease) which are considered by WHO as harmful to human health, including Fascioliasis, Cysticercosis, Trichinellosis and Toxoplasmosis (Pilet et al., 2010; Sripa et al., 2010, Monroy et al., 2001).

Food ingredients of animal origin circulating in the market must meet health and safety requirements (Hadiwiyoto, 1993, Dirkesmavet, 2005). Therefore, in slaughtering animals at Slaughterhouses (RPH)/Slaughterhouses (TPH) must receive strict inspection and supervision, starting from the animals that are still alive (ante-mortem), after slaughter (post-mortem), to the time of slaughter. consumer. Supervision at RPH/TPH is carried out by authorized officers (veterinarians) appointed by the government (Department of Agriculture), or officers appointed under the supervision of veterinarians, with the aim of selecting and checking the health of all animals to be slaughtered. After the animal is slaughtered (post-mortem), supervision and inspection are still carried out to ensure whether the meat produced is suitable and safe for consumption (Dirkesmavet, 2005).

However, in reality, the chain of distribution of foodstuffs of animal origin, from the place of production (RPH/TPH) to the hands of consumers, does not always receive supervision and inspection. This happens because of limited budget and human resources (HR), so that food of animal origin sold to the market may be unhealthy and endanger consumers (Dirkesmavet, 2005). The existence of limitations in diagnosing a disease in foodstuffs of animal origin is another important factor. Therefore, research is needed to determine nutrition and quality as well as examine abnormalities or diseases that may be found in foodstuffs of animal origin that are slaughtered at local abattoirs/TPHs.

Abnormalities or diseases that may be found in foodstuffs of animal origin (pork) include cysticercus larvae (Dharmawan et al., 2012; Swacita et al., 2015), Trichinella sp. (Monroy et al., 2001) toxoplasma cysts (Damriyasa et al., 2000; Tenter et al., 2000) and abnormalities or diseases found in the lungs can be inflammation (pneumonia), bleeding (haemorrhage), and tubercles; in the heart can be found cysticercus larvae, inflammation (myocarditis), heartworms (Dirofilaria), hypertrophy or hyperplasia; In the liver, inflammation (hepatitis), tumors (hepatoma), liver worms (Distomatosis/Fascioliasis), liver cirrhosis,

and cysticercus larvae can be found (Dirkesmavet, 2005; Mas-Coma et al., 2005).

The existence of local pigs in Bali still exists, because it is often used as a means of religious ceremonies in Bali, it is also very well known to be used as a pork guling, a characteristic of Balinese cuisine which has a better taste when compared to other breeds of pigs (Nitis, 2008). This is in accordance with the RIP of Udayana University which continues to preserve culture in a broad sense and develop local wisdom and sources of local pig germplasm in Bali.

Information about the nutrition, quality, and health of local pork produced by the Pig Slaughterhouse (TPB) in Bali has not been widely reported. Therefore, it is necessary to conduct preliminary research to find out whether the basic data about the condition of the local male and female pork are still suitable for consumption. The specific purpose of this study was to find out basic data on the nutrition of male and female local pork slaughtered at TPB and to identify possible abnormalities or diseases that might be found in the local pork slaughtered at TPB.

## **II.MATERIALS AND METHODS**

### **Research Sample**

The samples used in this study were male and female local pork slaughtered at TPB. The samples of local pork used consisted of five males and five females taken from the thigh (femoral region), back, and stomach each weighing  $\pm 1.0$  kg each. Other materials used for this research include distilled water, 96% alcohol and absolute alcohol.

### **Research Methods**

This study used a qualitative exploratory survey method, namely analyzing nutrition and quality as well as abnormalities or diseases found in male and female local pork slaughtered at TPB. The number of samples examined were 10 samples consisting of five samples of male local pigs and five samples of female pigs, each taken from three different meat locations. The total samples of local pork studied were  $5 \times 2 \times 3 = 30$  samples.

### **Nutritional analysis and meat quality**

Analysis of the nutrition and quality of local pork includes testing for crude protein content, crude fat content, ash content, and moisture content using the AOAC method (Helrich, 1990), while for water holding capacity using the Hamm

method (1972) and pH testing, and meat color using the SNI method (2009).

#### **Determination of water content of meat**

Moisture content was determined by the drying method (AOAC), (Helrich, 1990) and expressed as a percent weight loss of the material as follows: 1). Clean porcelain dishes are dried in the oven for 30 minutes. Then the porcelain cup is cooled in a desiccator and then weighed (a), 2). The pork sample was chopped, then put into a porcelain dish, then weighed (b) and dried in an oven for 4 hours at 105°C to obtain a constant weight, 3). After 4 hours the porcelain cup and sample were cooled in a desiccator and then weighed (c), 4). The water content is calculated using the formula:

$$\text{Water content (\%)} = \frac{(b-a) - (c-a)}{(b-a)} \times 100\%$$

Description:

a = weight of empty cup (g)

b = weight of the cup + initial sample (g)

c = weight of cup + sample after oven

#### **Determination of water holding capacity**

Water holding capacity (DIA) by meat protein was determined using the Hamm method (1972) modified by Suardana and Swacita (2009), namely 5 grams of local pork was finely chopped and then wrapped in blotting paper, then pressed into two glass plates with a weight

of 35 kg for 10 minutes. The weight of the meat after being pressed was weighed again. The water holding capacity is calculated using the formula:

$$\text{DIA (\%)} = \frac{\text{Weight after pressing (g)}}{\text{Initial weight (g)}} \times 100\%$$

#### **Determination of meat pH**

The pH analysis of pork was determined according to SNI (2009), with the following steps:

Local pork was weighed as much as 5 grams then ground in a mortar until smooth, added 5 ml of distilled water. Then poured into a 100 ml beaker. The electrode of the pH meter is dipped into a beaker which has been filled with pork extract that has been prepared. The pH reading is done with a pre-calibrated pH meter. Measurements were made twice and the results were averaged.

#### **Health testing of local pork meat and organs**

The meat and organs of local male and female pigs slaughtered at the TPB are tested for health by (a). Inspection by carefully observing the color of local pork meat and organs and the possibility of abnormalities or diseases in the pork meat and organs. Pork with abnormalities or disease is pale, mushy, and watery (PSE: pale soft, exudative), has a deviant/rotten aroma, and the presence of pork tapeworm

larvae or other parasites is found. (b) Palpate by feeling the consistency of pork by squeezing it. Healthy pork: the consistency is soft, while the consistency is very soft or very chewy (if it contains a lot of worm larvae). (c). Incisi by slicing the outside and inside of the meat and the lymph nodes in the meat. Healthy meat has a smooth texture and its lymph nodes are yellow-brown in color, while meat with abnormalities/diseases is rough and hard in texture and enlarged, shrinking or inflamed lymph nodes and black in color.

### Data Analysis

The research data obtained were tabulated, searched for the mean and

standard deviation, then explained descriptively and displayed in the form of tables or graphs.

### III.RESULTS AND DISCUSSION

The local pork used as the research sample is pork that will be used as pork guling, because in TPB there is no local pork slaughter that specifically sells pork, so the sample of this study used male and female local pork for babi guling which has a relative age. the same, i.e. between 6-8 months. The results of the research on the average nutrition of local pork are presented in the table below.

**Table 1.** Average Nutrition and Quality of Local Pork from Different Location

Meat Location	Gender	Water Content (%)	Ash (%)	Crude Protein (%)	Crude Fat (%)	pH Value	DIA (%)
Back	Male	74,5	1,2	20,2	4,1	5,5	89,45
	Female	74,9	1,1	19,8	4,2	5,6	88,89
Thigh	Male	74,3	1,2	20,2	4,3	5,3	89,12
	Female	75,3	1,0	18,1	5,6	5,4	88,67
Stomach	Male	74,7	1,2	18,6	5,5	5,3	88,99
	Female	74,5	1,4	18,5	5,6	5,4	88,63

The results of the research on the health analysis of local pork which were directly examined at the Pig Slaughterhouse (TPB) by inspection, palpation, and inches were obtained as follows. All of the local pork carcasses examined were in normal (healthy)

condition, no abnormalities or worm larvae were found (Figure 1).



**Figure 1.** Carcasses of local pigs

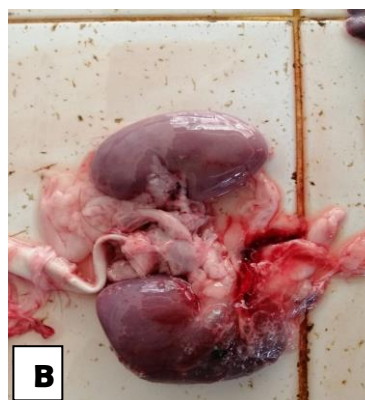
On examination of the internal organs (offals) of local pigs, the following results were obtained. On examination of the liver, it was found that one had a white spot out of 10 samples examined (Figure 2). The presence of a white spot on the liver of a local pig indicates that the pig had been infected with *Streptococcus* bacteria but had already undergone a healing phase so that he died of liver injury (Suardana and Soejoedono, 2005). Similarly, examination of the lungs of local pigs found that one had slight necrosis of the 10 samples examined (Figure 3). The presence of necrosis in the lungs of local pigs was also found in pigs slaughtered at the Pesanggaran abattoir, Denpasar (Swacita et al., 2021a). Necrosis of the lungs showed that the pig's lungs had been infected with microbes, but had recovered. On examination of other internal organs such as the heart, kidney, and spleen of the local pig, all were in normal (healthy) condition (Figs 2,3,4).



**Figure 2.** Local pig liver (white spot)



**Figure 3.** Local pig lung (necrosis)



**Figure 4.** Healthy local pig heart, kidney and spleen (A, B, C)

The results of the quality inspection of local pork which were examined subjectively obtained the following results. The color of the local pork, both male and female, is reddish brown, smells of fresh blood with a soft consistency and smooth texture. The quality of local pork is in accordance with the results of research by Swacita et al. (2021a). This indicates that the pork samples used are still fresh.

The nutrition of male local pork has an average moisture, ash, crude protein, and crude fat content of 74.5%, 1.2%, 19.7% and 4.6%, respectively, while the average nutrition for female local pigs is followed by 74.9%, 1.2%, 18.8%, and 5.1%. The nutritional variation of male and female local pork looks almost the same. This may be suspected because the age of male and female local pigs is almost the same, which is about 6-8 months and is included in the growth period. In general, the meat component consists of a solid component and a water component. The solid component contains protein, fat, glycogen, minerals, and vitamins, while the water component contains free water, tightly bound water, and immobile water. The higher the solid content of a meat, the better the quality (Suardana and Swacita, 2009). From the results of this study, it was found that the average solid material component of male local pork was 25.5% and the average water content was 74.5%.

Meanwhile, for female local pigs, the average solid material component is 25.1% and the average water content is 74.9%. The nutrition of this local pig is in accordance with quality standards for meat, which has an average moisture content of 75%, ash content of 0.1-1%, protein content of 16-22%, and fat content of 1.5-15% (Soeparno, 2009). The results of this study on the nutrition of local pork were higher than those of Suandita et al. (2016) which has a water content of 72.2%, an ash content of 0.4%, a protein content of 14.8%, except for a higher fat content (11.1%). This may be due to the older age of the pigs used, and possibly different rearing management.

The average pH value of male local pork is 5.37, while female local pork is 5.47. The pH value, both male and female local pork, is included in the optimum pH category, which is the lowest pH value that occurs because glycogen in meat undergoes an anaerobic glycolysis process which produces lactic acid which causes acidic meat conditions. Meat that has an optimum pH indicates the quality of this local pork is good, because it can inhibit the growth of microbes present in the meat. The average pH of local pigs is in accordance with the results of research by Swacita et al. (2021b) which ranged from 5.56-5.88. This shows that the pork samples used are of good quality.

The average water holding capacity of male local pigs was 89.19%, while female local pigs were 88.73%. Water holding capacity of meat is the ability of meat to bind its own water to external influences, such as the cooling process and others (Soeparno, 2009). The water contained in the meat is free water, tightly bound water and immobile water will be strongly bound by the protein structure of the meat. In conditions of good quality meat, the ability of the protein structure of the meat to hold/bind the water contained in the meat will be stronger, so that if the water holding capacity is tested using the Hamm method (press method), only free water will come out, while water tightly bound and the immobile water remains in the intact protein structure of the meat. The higher the water holding capacity of the meat, the better the quality of the meat, because the meat is still fresh (Suardana and Swacita, 2009). The average water holding capacity (DIA) of local pork was higher than the results of Sriyani et al. (2015) (DIA 60.6%) and Rinaldi et al. (2021) (DIA 71.82%). Water holding capacity is closely related to the condition of the meat samples used in the study. The longer the age of the sample used, the lower the water binding ability. It is suspected that the age of the Balinese pork samples used by the two researchers above is longer, resulting in a lower DIA.

## V. CONCLUSION

Based on the results of the study, it can be concluded that the nutrition and quality of local pork are in accordance with meat quality standards in general, and the nutrition between male and female pork is not so different. Likewise, the health of the carcass and the body organs of female and male local pigs looked normal (healthy). No abnormalities were found, except for one white spot in the liver of the male pig.

It is recommended to carry out further research on the nutrition, quality, and health of local pork according to the age of the pig, so that the basic data on local pork is more complete as information for science.

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