The Use of Saponification of Animal and Vegetable Oils in The Rations on The Physical Quality of Sheep Meat on Bicepsfemoris Muscles

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Abstract. Acceptance and level of preference for sheep meat is influenced by the physical quality of the meat. This study aimed to know the effect of the use of animal oil saponification (lemuru fish oil: LFO) and vegetable oil (palm oil: PO) which was added to the ration on the physical quality of sheep meat. Twelve male local sheep were randomly divided into 3 ration treatments; P0: control ration (40% king grass : 60% concentrate), P1: 40% king grass + 57% concentrated + 3% saponified LFO and P2: 40% grass king + 57% concentrate + 3% saponified PO. Each treatment consisted of 3 replications. The observed variables were physical quality of meat (pH, cooking losses, tenderness, collagen). The data obtained were analyzed by variance analysis and real difference test between treatments. The results showed that the use of LFO and PO was not significant effect (P>0.05) on the physical quality of meat (pH, cooking losses, tenderness, collagen). It can be concluded that the use of animal and vegetable oil saponification cannot improve the physical quality of sheep meat.

Keywords: saponification, physical quality, sheep meat

1. Introduction

Improvements in livestock performance can be done through improved feed, both through improved composition and a touch of technology to manipulate nutritional processes in the rumen of livestock. Meat of ruminants, contains high saturated fatty acids, so that the consumption of ruminant meat, especially lamb, begins to decline for people at high risk (hypertension and atherosclerosis). This situation requires thinking to increase the content of unsaturated fatty acids in lamb and reduce cholesterol levels.

The target of the program to accelerate the achievement of self-sufficiency in meat proclaimed by the government in 2014 is the government's national program to meet meat needs by optimizing local /
people's resources towards high performance through fattening and breeding. The meat self-sufficiency program is targeted to supply 90-95% in the country, the remaining 5-10% can be met from imports [1]. With the fact that the average rate of increase in meat consumption is 5.2% per year and is not balanced with the rate of increase in production which only grows around 2% per year, so sheep fattening can be developed as one of the sources of animal protein. Efforts to accelerate sheep fattening cannot be separated from the provision of quality feed. Generally giving concentrations of 70% of the feed given in addition to the impact of rapid growth but a negative impact of reducing the quality of meat such as high levels of fat and cholesterol meat and low levels of unsaturated fatty acids. This often makes the community, especially the elderly, reduce consumption of lamb.

Meat is all animal tissue and all its processing products are suitable for eating and do not cause health problems for those who eat them [2] [3], composed of a number of nerve and fat tissues and blood vessels [4], and also composed of connective and epithelial networks [3]. The main component of constituent meat is muscle. Skeletal muscle is the main source of meat tissue [5]. The nutritional value of meat is closely related to the nutritional content of meat. The biggest component of dry matter from meat is protein. Meat is a source of high quality protein in the form of proteins that contain essential amino acids, high biological value, and very easily digested and absorbed [3]. According to Simonsen et al. [6] the caloric value of meat is largely determined by the intramuscular fat content or marbling and the amount of meat eaten. According to AMLC [7] states that every 100 grams of meat can contain as much as 5.7-6.7 fat, 663-804 kJ calories, 2.8-3.9 iron, 4.2-5.2 zinc, and cholesterol 62-82 mg.

Soeparno [3] and Soeparno [8] say that the delicacy and acceptability of meat consumed is determined by the appearance of color, the binding capacity of water by protein of meat, the impression of juice or juiceness, texture, tenderness, taste or flavor, aroma, and pH. While the level of preference for meat is closely related to the level of tenderness and flavor. This study aims to determine the effect of saponification of Lemuru Fish Oil (MIL) and Palm Oil (MS) in rations on the physical quality of lamb meat in the Biceps femoris muscle in terms of pH, cooking losses, tenderness, and collagen.

2. Methodology

Time and place of research
This research was conducted at the Jatikuwung Experiment Cage, Department of Animal Husbandry, Faculty of Agriculture, Universitas Sebelas Maret, for 3 (three) months for livestock raising. Proximate analysis of experimental material was carried out at the Laboratory of Animal Nutrition and Food Science, Department of Animal Husbandry, Faculty of Agriculture, Universitas Sebelas Maret, Laboratory of Nutrition Biochemistry, Faculty of Animal Sciences, Universitas Gadjah Mada, Laboratory of Food Technology and Agricultural Products, Faculty of Agricultural Technology, Universitas Gadjah Mada.

Research materials and methods
This study uses 12 sheep divided into 3 feed treatments, namely:
P0: Basal feed (Forage and Concentrate) as control
P1: Basal feed + Protected Lemuru Fish Oil
P2: Basal feed + Protected Palm Oil

Basal ration as control consists of king grass and concentrates with a ratio of 40: 60 (base of dry matter). LFO and PO supplementation as much as 3% of dry matter (DM) ration. Palm oil protection (PO) and lemuru fish oil (LFO) were carried out using the saponification method referring to Widiyanto [9] in the following manner: to avoid the process of biohydrogenation of Poly Unsaturated Fatty Acids (PUFA) in experimental feed ingredients, Palm oil is protected through saponification
with KOH which is then transformed into Ca salt using CaCl₂. The frequency of feeding was done 2 times per day, each for concentrate and forage. Maintenance begins with a preliminary period of 2 weeks. Weighing body weight was done every 2 weeks. Sheep slaughter was done as a sample to determine the quality of meat chemical. Meat preparation was done by homogenizing the condition of the meat with freezer storage. The part of meat taken in the biceps femoris.

| Table 1. Nutrient content of research feed ingredients (% DM) |
|-------------------------------------------------------------|
| Feed ingredients  | DM  | CP  | EE  | CF  | Ash | NFE |
| King grass        | 87.09 | 14.28 | 1.23 | 22.23 | 6.88 | 55.38 |
| Concentrate       | 85.93 | 14.59 | 6.48 | 7.31 | 9.39 | 62.23 |
| LFO               | 91.19 | 3.70  | 70.40 | 0.75  | 8.54 | 17.63 |
| PO                | 93.32 | 1.48  | 60.41 | 0.19  | 9.53 | 30.84 |

Note: LFO : Lemuru fish oil  EE : Extract ether  PO : Palm oil  CF : Crude fiber  DM : Dry matter  NFE : Nitrogen free extract  CP : Crude protein

| Table 2. Composition and nutrient content of the treatment ration |
|---------------------------------------------------------------|
| Feed ingredients  | P0  | P1- LFO | P2-PO |
| King grass        | 40  | 40      | 40    |
| Concentrate       | 60  | 57      | 57    |
| Lemuru fish oil   | 0   | 3       | 0     |
| Palm oil          | 0   | 0       | 3     |
| Total             | 100 | 100     | 100   |

Nutrient content of the treatment ration (% DM)

|                | P0     | P1- LFO | P2-PO |
|----------------|--------|---------|-------|
| Crude protein (CP) | 14.47  | 14.15   | 14.08 |
| Extract ether (EE)| 4.38   | 6.62    | 6.35  |
| Crude fiber (CF)  | 13.28  | 13.30   | 13.28 |
| Ash              | 8.39   | 8.66    | 8.70  |
| Nitrogen free extract (NFE) | 59.49  | 60.02   | 60.41 |

Note: LFO : Lemuru fish oil  EE : Extract ether  PO : Palm oil  CF : Crude fiber  DM : Dry matter  NFE : Nitrogen free extract  CP : Crude protein

Research parameters:
The parameters observed in the study were the physical quality of sheepmeat which was pH, cooking losses, tenderness, collagen.

Data analysis
The data obtained were analyzed statistically using a Completely Randomized Design (CRD) variance analysis with a One-way. The mean difference from each application was tested by Duncan's New Multiple Range test (DMRT) [10], with the help of Statistical Product and Service Solution (SPSS) personal computer software version 15.0.

3. Result and Discussion
Data obtained from the physical quality of sheepmeat with the addition of lemuru fish oil saponification and palm oil in feed during maintenance can be seen in Table 3 below.
**Table 3. Effect of LFO and PO saponification in ration on the physical quality of sheepmeat**

|            | P0       | P1-LFO   | P2-PO    |
|------------|----------|----------|----------|
| pH         | 5.59     | 5.68     | 5.75     |
| Cooking losses (%) | 28.12   | 27.87    | 28.08    |
| Terderness (g/cm²) | 1.97    | 2.25     | 1.95     |
| Collagen (%)  | 1.90     | 1.92     | 1.65     |

*ns: non-significant*

The results of statistical analysis showed that the addition of lemuru fish oil and saponified palm oil in feed gave no significant effect (P> 0.05) on the acidity (pH) of lamb meat. The pH level of lamb meat in BF muscle was the result of the study for treatment P0 of 5.59, P1-MIL of 5.68 and P2-MS of 5.75. Based on Table 3 above it can be seen that the highest pH level of lamb in P2-MS treatment (5.75%) compared to pH levels in other treatments (5.59 and 5.68). This shows that the addition of MIL and MS saponification cannot increase or decrease the pH level of lamb because the three treatments show unrealistic differences.

The degree of acidity or pH of meat is the value used to indicate a measure of the acidity and basicity of a substance including meat [2] [11]. The change in the value of meat can affect the physical quality of meat and the stability of meat. The ultimate pH increase in meat will increase the impression of meat juices and water binding capacity and decreasing cooking shrinkage [12] [3].

**Cooking losses**

The results of statistical analysis showed that the addition of lemuru fish oil and saponified palm oil in feed gave no significant effect (P> 0.05) on the cooking shrinkage of lamb meat. The cooking shrinkage of lamb in BF muscle results of the study for PO treatment was 28.12%, P1-MIL 27.87%, and P2-MS was 28.08%. Based on the results of the study it can be seen that the addition of MIL and MS saponification cannot increase or decrease the cooking shrinkage of lamb because the three treatments show unrealistic differences.

Cooking shrinkage is the value of meat quality expressed by the amount of weight lost or the amount of weight shrinking of meat samples during boiling, cooking shrinkage is a function of the boiling time and temperature, cooking losses are also called Cooking Loss. Intra-muscular fat can inhibit or reduce meat fluids lost during boiling [12] [3]. The strong level of fatty marbling will act as a lubricant during mastication of the meat so that it can increase apparent tenderness and facilitate meat ingestion [13].

**Terderness**

The results of statistical analysis showed that the addition of lemuru fish oil and saponified palm oil in feed gave no significant effect (P> 0.05) on tenderness of lamb. The tenderness of lamb from the research results for treatment P0 was 1.97 g / cm², P1-MIL 2.25 g / cm², and P2-MS was 1.95 g / cm². Based on these data there is a tendency for the highest tenderness in the P1-MIL treatment but among the three treatments it was not significantly different because there was no increase or decrease in tenderness.

Meat tenderness is a measure of the quality of meat after boiling based on the ease of breaking muscle fibers without losing much of the tissue properties that are fit to be eaten [3]. Acceptance and consumer satisfaction and comfort in eating meat are largely determined by the level of tenderness of meat [11]. Tenderness can determine the level of acceptance or eating satisfaction meat [14]. The difference in intra-muscular fat of meat and the amount of tissue fat can produce meat with different tenderness levels [15]. With increasing intra-muscular fat levels, meat tenderness increases [16] [17].
Collagen
The results of statistical analysis showed that the addition of lemuru fish oil and saponified palm oil in feed gave no significant effect (P > 0.05) on collagen in lamb meat. Lamb collagen results of the study for treatment P0 were 1.90%, P1-MIL 1.92%, and P2-MS were 1.65%. Based on these data, there is a tendency for the highest collagen in P1-MIL treatment but among the three treatments it was not significantly different because there was no increase or decrease in collagen.

The main component of collagen is hydroxyproline protein, so that high levels of hydroxyproline can be used as an indication of high levels of collagen [4]. The amount and strength of cross-linking of muscle connective tissue increases with increasing age so that collagen also increases as long as the animal experiences growth and development. High fat content in a muscle is thought to be able to dissolve collagen so that the muscle with high fat content tends to contain low levels of collagen.

4. Conclusions
This research can be concluded that there was a tendency to improve physical quality of sheep meat on biceps femoris muscles given LFO in rations.

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