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Bone Distribution in Commercial Cuts of Local Sheep Carcasses Given Indigofera Flour with Different Rearing System

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ABSTRACT

This study aims to evaluate bone distribution in commercial cuts of local sheep carcasses fed indigofera flour, taking into account differences in rearing systems. This study used 20 local female sheep aged 1 year with an average initial weight of around 18.3 ± 2.01 kilograms. These sheep were reared for 4 months with two types of rearing systems, namely intensive and semi-intensive. Indigofera flour and commercial concentrate were given at 07.00 in the morning, and at 11.00 grass were given in a ratio of 40:60%. This research used four different treatments, namely five sheeps that were reared semi-intensively by feeding commercial concentrates (P1SI), five sheeps were reared semi-intensively by feeding indigofera flour (P2I), five sheeps were reared intensively by feeding commercial concentrate and grass (P1SI), and five sheeps housed with indigofera flour and grass (P2I). This study used a completely randomized design with a 2x2 factorial pattern and 5 replications, and initial weight as a correction factor. The results of the study showed that sheep fed indigofera flour had a lower bone weight in commercial carcass cuts than sheep fed commercial concentrate. However, with a semi-intensive rearing system, sheep bone weight does not appear to be different.

Keywords: indigofera flour, rearing system, local sheep

ABSTRAK

Penelitian ini bertujuan untuk mengevaluasi distribusi tulang pada potongan komersial karkas domba lokal yang diberi pakan tepung indigofera, dengan memperhatikan perbedaan dalam sistem pemeliharaan. Penelitian ini menggunakan 20 ekor domba betina lokal berusia 1 tahun dengan rata-rata berat awal sekitar 18.3±2.01 kilogram. Domba-domba ini dipelihara selama 4 bulan dengan dua jenis sistem pemeliharaan yaitu secara intensif dan semi intensif. Pemberian pakan tepung indigofera dan konsentrat komersil dilakukan pada jam 07.00 pagi, dan pada jam 11.00 diberikan rumput dengan perbandingan 40:60%. Penelitian ini menggunakan empat perlakuan yang berbeda, yaitu lima domba yang dipelihara secara semi intensif dengan pemberian pakan konsentrat komersil (P1SI), lima domba yang dipelihara secara semi intensif dengan pemberian pakan tepung indigofera (P2I), lima domba yang dipelihara secara intensif dengan pemberian pakan konsentrat komersil dam rumput (P1SI), dan lima domba yang dikandangkan dengan pemberian pakan tepung indigofera dan rumput (P2I). penelitian ini menggunakan rancangan acak lengkap pola faktorial 2x2 dan 5 ulangan, dan berat awal sebagai faktor koreksi. Hasil penelitian menampilkan bahwa domba dengan pemberian pakan tepung indigofera memiliki berat tulang pada potongan komersial karkas yang lebih rendah daripada domba yang diberi konsentrat komersil. Akan tetapi, dengan sistem pemeliharaan semi intensif berat tulang domba terlihat tidak berbeda.

Kata kunci: tepung indigofera, sistem pemeliharaan, domba lokal

INTRODUCTION

In an effort to increase the productivity and quality of local sheep meat, it is important to pay attention to aspects of proper feeding and optimal rearing systems. Both play a crucial role in achieving this goal. One potential feed source that is being explored is Indigofera flour, a type of legume plant that has a high protein content and important nutrients (Abdullah *et al.* 2010), and shows potential in contributing to livestock productivity and health (Herdiawan 2013)

The level of productivity in livestock is a complex matter, influenced by various things such as biological, economic factors, natural resources and social factors such as community views regarding the livestock business (Inouno and Soedjana 1997). Therefore, research was continuously carried out to understand how to increase livestock productivity so that the quality and quantity of carcasses and meat can be increased in line with consumer preferences by understanding the growth and development of the carcasses of the livestock concerned (Mawardi *et al*. 2018). where the growth of bones, meat and fat has a pattern that goes hand in hand with the general growth of livestock, where bone growth is the earliest, followed by meat and fat (Berg and Butterfield 1976; Aberle *et al*. 2001) changes in carcass tissue composition and Wholesale cuts are influenced by muscle, fat and bone growth patterns (Hafid and Priyanto 2006)

Bone is an important component in livestock carcasses which has a significant role in determining commercial value and consumer satisfaction with meat products. Bone is a carcass component that is closely related to the amount of meat, because the bone is where the meat is attached (Hilmawan *et al.* 2016). The proportion of bones in a carcass also has an influence on the percentage of other carcass components, such as meat and fat (Pulungan and Ramkuti 1981). where the ideal proportion of carcass components is one that has leaner meat, low bone and balanced fat (Maruyama 2014).

In line with changes in public consumption trends which are increasingly selective towards meat products and their derivatives, it is important for the livestock industry to continue to optimize local lamb meat production. One of the steps taken is through feeding Indigofera flour. However, to achieve the desired results, a deep understanding of how Indigofera meal feeding and different rearing systems can affect bone distribution in commercial carcass cuts is required. Therefore, the research aims to fill this knowledge gap and contribute valuable information to the livestock industry, with the hope of improving the production efficiency and quality of local sheep meat products in a sustainable manner.

MATERIAL AND METHODS

Material

This research used Indigofera flour and commercial concentrate as well as 20 female thin-tailed sheep with an average starting weight of 18.3 ± 2.01 kg and less than one year old. The nutritional composition of the feed in this study is listed in Table 1.

Table 1. Nutrient composition of Indigofera zollingeriana and commercial concentrates

Nutritional Content	P1	P2
	---%---	---%---
Dry Ingredients	84.33	89.92
Ash	11.61	8.34
Crude protein	13.03	13.59
Crude Fat	1.18	0.53
Crude Fiber	15.15	22.6
BETN	43	45
TDN	54.8	59.3

Description : P1: commercial concentrate, P2: indigofera flour

Equipment

This research used 20 experimental pen units for each sheep. The cage used is 1.5 × 0.75 meters with a place for feeding and drinking. Apart from that, the tools used include hanging scales, digital scales, knives, saws for cutting carcasses, and sheep carcass hangers.

Research Procedure

Preparation

At this stage, a series of activities carried out include preparation of pens and pastures, as well as selection of research sheep. This research used a monitor cage made from wood and a roof made from asbestos. This cage was equipped with well-designed doors and ventilation. The left and right sides of the pen were reinforced with iron wire to provide optimal air circulation, with the aim of creating a comfortable environment for the sheep. There was a total of 20 individual pen units prepared for each sheep, in a stilt pen type. This makes it easier to carry out treatment, provide feed, and weigh the remaining feed. Before the sheep are kept, the pen has also been cleaned using lime all over.

Pasture preparation involves repairing fences or partitions to keep sheep out and avoid disturbance from livestock or other animals. The pasture was divided into 3 paddocks planted with *Brachiaria humidycola* grass, with the aim of implementing a rotation-based grazing model during the sheep rearing period. Before the sheep arrive at the UP3J pen, *Indigofera zollingeriana* and commercial concentrate feed are procured. During the rearing period, *Indigofera zollingeriana* and concentrate feed are given in the form of flour according to the sheep's needs. The criteria for the sheep selected had an initial weight ranging from 16-21 kg and had never been pregnant.

Methods

The sheep were kept for 4 months at UP3J, where in the first month an adaptation to the new feed and environment is carried out, with the provision that 40% of *Indigofera zollingeriana* flour and commercial concentrate is given at 07.00 in the morning and 60% grass at 11.00 for intensively reared sheep. while sheep that were raised semi-intensive are released for 6 hours in the pasture. The medicines used in this study included eye drops (cendo), worm medicine (kalbazen), skin medicine, flea medicine (intermectin), and Vitamin B12. After passing the adaptation phase, the next intensive and semi-intensive feed treatment and maintenance system is carried out for 3 months which is arranged as follows:

P1SI. 5 sheeps were fed commercial concentrate feed which was reared semi-intensively

P2SI. 5 sheeps were fed *Indigofera zollingeriana* which was raised semi-intensively

P1I. 5 sheeps were fed commercial concentrate feed which was reared intensively

P2I. 5 sheeps were fed *Indigofera zollingeriana* which was reared intensively

Sheep Slaughtering and Carcass Break Down

At this stage, the slaughtering processwas carried out for 2 days following the MUI (2009) and Herman (1993) guidelines for carcass decomposition. Slaughter begins at the neck with a focus on the carotid artery, jugular vein and trachea, and the head was separated from the body at the atlanto-occipital joint area. Then the front legs were cut at the carpo-metacarpal joint area and the hind legs at the tarsometatarsal area, then the sheep was hung by the tendon of the hind legs (Achilles tendon) then the skin was cut from the anus to the neck area, including the area of the hind legs, front legs, abdomen and chest. The internal organs are removed from the stomach to the chest, then the carcass is placed in a chiller for 24 hours at a temperature of 4°C, and then the carcass was split along the spine into two parts, namely the left and right carcasses. Next, the right carcass was cut into several commercial cuts such as neck, shoulder, rack, breast, shank, leg, loin and flank, then weighed and broken down into bone, muscle and fat, then the weight of the bones in these commercial cuts was measured and recorded.

Observed Variables

The variable observed in this study was the bone weight of commercial carcass cuts at the neck, shoulder, rack, breast, shank, leg and loin cuts.

Data Analysis

This research used a Completely Randomized Design (CRD) with a 2 × 2 factorial pattern involving 5 replications. The first factor was the type of feed (*Indigofera zollingeriana* and commercial concentrate). Meanwhile, the second factor was the maintenance system (intensive and semi-intensive maintenance system). The following was the mathematical model used in this research.

$$Yijk = \mu + \alpha i + \beta j + (\alpha\beta) ij + X ij + \varepsilon ijk$$

Information:

Yijk	:	Results of monitoring the effect of the i-th feed treatment with the j-k repetition of the rearing system treatment
μ	:	General mean
αi	:	Effect of treatment I-i; i = 1.2
β j	:	Effect of treatment II to j; j = 1.2
(αβ) ij	:	The interaction effect of treatment I-i with treatment II-j-th replication
Xij	:	Measurement of initial weight variables of sheep resulting from treatment I-i and treatment II-j-k repetitions
εijk	:	Effect of treatment error on treatment I-i and treatment II on j-k repetitions

The data in this research were analyzed using *Analysis of* Covariance where the correction factor used was the initial weight of the sheep. If the analysis results show a real effect then it was tested further using the *Least Squares Means Test* (Kaps and Lamberson 2004).

RESULTS AND DISCUSSION

Bone is the body tissue that grows earliest, followed by muscle and lastly fat during the growth period. The results of the analysis of variance in Table 2 show that sheep fed indigofera flour generally appear to have a lower bone weight compared to sheep fed commercial concentrates, but statistically the feed treatment does not show an influence (P>0.05) on bone weight in commercial cuts of carcass neck, shank, leg and loin. This is thought to be due to differences in the weight of sheep bones during the study. These results are in line with those obtained by Jatnika (2019) in thin-tailed sheep fed *Indigofera zollingeriana* with commercial concentrate, that sheep fed commercial concentrate produced higher total bone weight.

Based on the data in Table 2, it shows that there was an interaction between feed treatment and maintenance system on bone weight in *shoulder*, *rack* and *breast pieces.* Bone distribution in the three sections had the same interaction pattern between treatments. The interaction pattern between treatments on bone weight in *the shoulder* , *rack* and *breast pieces was* shown in Figure 1.

Based on the data in Figure 1, it can be seen that the weight of the highest *shoulder, rack* and *breast bones* in the P1I treatment was significantly different (P<0.05) from P2I, but not significantly different from P1SI and P2SI. Meanwhile, the weight of *the shoulder, rack* and *breast bones* was lowest in P2I and was not significantly different from P1SI.

This result was thought to be caused by the process of absorbing feed nutrients in the P2I treatment being less than optimal, due to the high crude fiber content in indigofera flour (Table 1). Pangestu *et al.* (2018) explained that high levels of crude fiber in feed can result in low absorption of feed nutrients, resulting in low bone weight. Thomson *et al.* (1979) suggested that the earliest growth of carcass tissue is bone, followed by muscle and finally fat. Apart

Table 2. Distribution of bones in commercial cuts of sheep carcasses with different feeding and maintenance systems

Bone within commercial cut (gram)	Rearing system	Feed		Average
		P1	P2	
			Average ± SD	
Neck	SI	74.76±12.64	81.31±12.30	78.03±8.77
	I	101.95±12.45	91.16±12.30	96.56±8.77
	Average	88.36±8.70	86.23±8.70	
Shoulders	SI	172.00±12.38ab	175.73±12.05b	173.87±8.60
	I	188.58±12.20b	139.19±12.05a	163.88±8.60
	Average	180.29±8.53	157.46±8.53	
Rack	SI	83.89±9.25ab	95.05±9.00b	89.47±6.42
	I	100.11±9.11b	69.05±9.00a	84.58±6.42
	Average	92.00±6.37	82.05±6.37	
Breasts	SI	93.45±5.87ab	97.50±5.71b	95.47±4.07
	I	98.54±5.78b	77.34±5.71a	87.94±4.07
	Average	95.99±4.04	87.42±4.04	
Shank	SI	94.43±5.96	97.20±5.80	95.81±4.13
	I	107.93±5.87	86.68±5.80	97.31±4.13
	Average	101.18±4.10	91.94±4.10	
Legs	SI	300.59±15.30	328.33±14.89	314.46±10.62
	I	340.14±15.07	299.55±14.89	319.85±10.62
	Average	320.37±10.54	313.94±10.54	
Loins	SI	55.78±11.54	58.53±11.23	57.16±8.01
	I	78.97±11.36	58.16±11.22	68.56±8.01
	Average	67.38±7.94	58.34±7.94	

Note: P1 = commercial concentrate; P2: Indigofera flour, SI = semi-intensive; I = intensive. Different lowercase letters in the same row or column indicate significantly different (P<0.05), data corrected based on the initial mean weight of 18,320 grams.

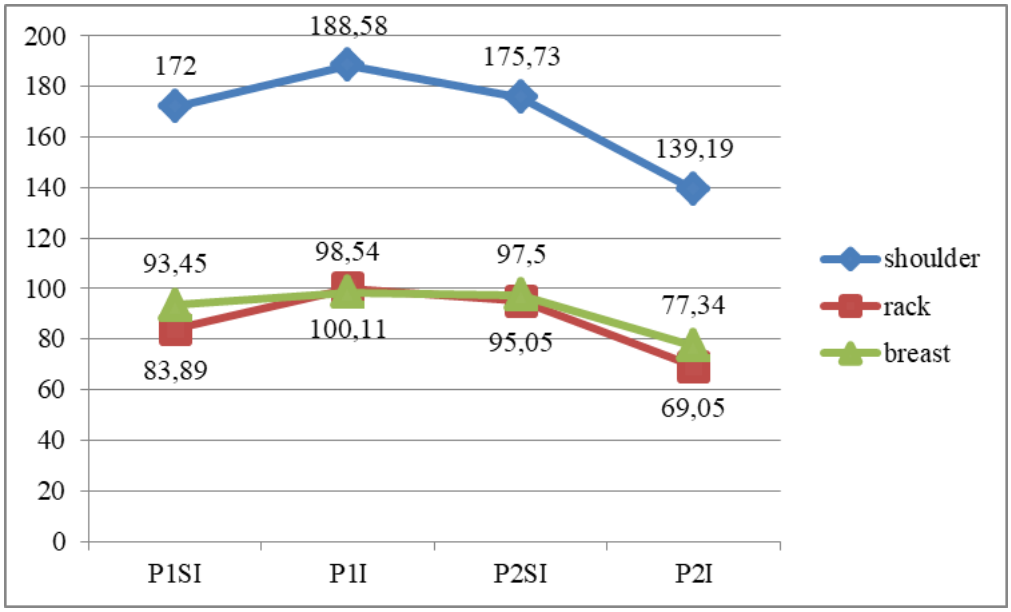

Figure 1. Interaction of the influence of feed and different rearing systems on the weight of the shoulder, rack and breast bones

from that, this condition was also thought to be related to the weight of commercial cuts of sheep carcasses. These results were in line with research by Jatnika (2019) that sheep fed intensively reared indigofera had the lowest slaughter weight and commercial slaughter weight compared to those fed commercial concentrate feed. This shows that the weight of the bones in the commercial cut of the carcass was closely related to the weight of the cut and the weight of the commercial cut of the sheep carcass. Ashari *et al.* (2018) stated that increasing or decreasing slaughter weight affects the weight of carcass tissue. Apart from that, the age of the sheep after slaughter was still in the growth period and the relatively short rearing period is also the cause of the high response to each treatment. Zubir *et al.* (2011) that length of maintenance, absorption of nutrients and achievement of maximum bone mass can determine bone density. The highest average bone weight was in the *leg section*, namely 317.15 grams, while the lowest was in the *flank section* where there were no bones. Thiswas because the *leg* has a fairly high bone size and there were no bones on the *flank*.

CONCLUSION

Sheep fed *Indigofera zollingeriana* flour showed lower bone weight in the shoulder, rack and breast sections than sheep fed commercial concentrate feed. However, with a semi-intensive rearing system, the bone weight obtained is relatively the same as sheep that are reared intensively.

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