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Carcass composition of fat tailed sheep at different slaughter weight

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Abstract. Sheep is one of the important livestock commodities in Indonesia. Production of lamb is still low compared to beef and chicken meat. The objective of the research was to evaluate carcass characteristics and composition of fat tail sheep at different slaughter weight. This research was conducted using a total of twenty three fat tailed sheep rams. Six sheep were slaughtered at 17.5 kg of live weight, five sheep were slaughtered at 25 kg of live weight, seven sheep were slaughtered at 32.5 kg of live weight and five sheep were slaughtered at 40 kg of live weight. The data was analysed by *Analysis of variance* (ANOVA). The result showed that slaughter weight, empty body weight, weight and percentage of carcass DEG slaughtered at 40 kg is higher than others slaughter weight ($P < 0.01$). Percentage of fat tissue of fat tailed sheep rams slaughtered at 40 kg, 32.5 kg, and 25 kg was higher than slaughtered at 17.5 kg ($P < 0.01$). Percentage carcass of fat tailed sheep was slaughtered at 40 kg, 32.5 kg, 25 kg, and 17.5 kg was 55.12%, 54.91%, 52.28%, and 48.74%.

1. Introduction

The population and awareness of the importance of animal protein is increasing every year. This problem makes need of meat is increase in Indonesia, but the production of meat is still low. Production of beef meat is 518 484 tons and 67 844 tons of sheep meat [1]. We can supply the high demand of meat needs with genetic local animals. One of them is fat tailed sheep.

Fat-tailed sheep (DEG) is one of sheep that is found in many areas of Madura, East Java and Eastern Indonesia such as Lombok, Sumbawa, Kisar and Sawa [2]. Fat tailed sheep have larger bodies than thin-tailed sheep [2]. This sheep is resistant in dry and hot environment. The characteristic of these sheep are long ear shape, un-horned and white wool [3], has a long tail and a large tail that can accumulate much fat as an energy reserve. The long and large tail like this tail is not preferred by traders market because it can reduce the quality of carcass [4].

Production carcass of animal is one of the parameters that determine the quality of a livestock. Carcass production can be affected by many factors, such as the breed, age, gender, growth rate, slaughter weight, and nutrition [5]. The slaughter weight is one of the factor that affects the quality of carcass, especially is on the percentage of carcasses. Research conducted by [6] showed that fat tailed sheep (DEG) which slaughter on adult weights can produce up to 55% carcass of it's slaughter weight.

The consumers usually like the young meat which have low fat, but the weight is not optimal because the tenderness of traditional food [7]. The low slaughter weight have low edible portion, whereas sheep with high slaughter weight have high edible portion. Production of edible portion can illustrate the



success of fattening as it shows the overall productivity of a livestock that is economically viable. The research of carcass composition of fat tailed sheep on different slaughter weights is still rare, therefore the research is doing for determine the carcass composition of fat tailed sheep associated with edible portion production of this sheep. The objective of the research was to evaluate carcass characteristics and composition of fat tail sheep at different slaughter weight.

2. Materials and methods

2.1 Animals

This research was conducted using a total of twenty three fat tailed rams. Six sheepes were slaughtered at 17.5 kg of live weight, five sheepes were slaughtered at 25 kg of live weight, seven sheepes were slaughtered at 32.5 kg of live weight and five sheepes were slaughtered at 40 kg of live weight. The animals were selected from farmers with average live weight of 10 kg and the animals were collected from Central Java (Tegal). The animals were fattened using pellet ration formulated according to [8] fat fattening 10 kg of lambs, containing 16% protein and 73.3% TDN in dry matter. The feed and the water were given ad libitum.

2.2 Procedure of slaughtering and parameters measurement

The slaughtering of the sheepes were done according to standard halal methods at a slaughter house in Laboratory of Small Ruminant, Department of Animal Science, Bogor Agricultural University. The animal was skinned after the blood was out off from the body and weighted as blood weight, the other parts of the body were weighed in hot condition before its chilled. Carcass was weighed and recorded as hot carcass weights. Dressing percentage was calculated from slaughter weight. After carcasses were chilled at 5°C for 24 h, carcass was split along vertebral column in two half. The left side was dissected and recorded for carcass tissue (muscle, fat and bone). The weight of the gastro-intestinal tract contents was estimated by subtracting the weight of the empty digestive tract from the weight of full gastro-intestinal tract. Empty body weight was calculated by subtracting the weight of gastro-intestinal contents from slaughter weight. The weight of the head, skin, liver, spleen, lungs (including trachea), heart, genitals, testes, kidney, pancreatic, stomach, small intestine, large intestine, tail, feet (cut at tarsal-metatarsal and carpal-metacarpal articulations), omental fat and fat-thorax each weighed as edible portion of non-carcass components. Inedible portion was calculated by sum up weight of blood and gastro-intestinal tract contents.

2.3 Statistical analyses

The data of carcass were expressed in average value and standard deviation (SD) in weight (g) and percent (%) of slaughter weight. The data were analysed by ANOVA (Analysis of Variance) especially the Tukey test [9].

3. Results and discussion

3.1 Characteristic of carcass

The average of slaughter weight, empty body weight, and carcass weight are greatly affect the percentage of carcass produced from an animal. The result of characteristic carcass of fat tailed sheep with different slaughter weight (17.5 kg, 25 kg, 32.5 kg, and 40 kg) is shown in Table 1.

The results shows that increasing of the slaughter weight makes increasing of the empty body weight. It can be seen from the average of empty body weight in slaughter weight 17.5, 25, 32.5, and 40 kg respectively are 15.41 kg, 22.62 kg, 29.35 kg and 36.16 kg.

Study conducted by [10] resulted that the higher slaughter weight of Sungei Putih sheep and local Sumatra sheep, have the high of empty body weight and the percentage of carcass. This is also reinforced by [11] by using eleven month old sheep reported that high slaughter weight have high empty body weight too.

Table 1. Carcass performance of Fat-tailed sheep at different slaughter weight

Carcass performance	Slaughter weight (kg)			
	17.5 (n=6)	25 (n=5)	32.5 (n=7)	40 (n=5)
Empty body weight (g)	15.41 ^D	22.62 ^C	29.35 ^B	36.16 ^A
Carcass weight (g)	8.53 ^D	13.04 ^C	17.94 ^B	21.61 ^A
Non carcass weight (g)	6.04 ^D	8.76 ^C	10.64 ^B	13.05 ^A
Percentage of carcass (%)	48.74 ^B	52.28 ^{AB}	54.91 ^A	55.12 ^A
Percentage of non-carcass (%)	39.19	38.70	36.34	36.09
Percentage of muscle (%)	60.81 ^A	53.76 ^B	53.13 ^B	50.91 ^B
Percentage of fat (%)	17.83 ^B	28.04 ^A	30.83 ^A	33.44 ^A
Percentage of bone (%)	18.58 ^A	16.50 ^{AB}	14.46 ^{BC}	13.99 ^C

Note: The numbers on the same line followed by the capital letters indicate significantly differ ($P < 0.01$)

3.2 Composition of Carcass

Carcass is part of the body of a healthy sheep that has been slaughtered with halal process according to LPPOM-MUI procedure, has been skinned, has been removed the offal, separated of head and feet from tarsus /carpus, reproductive organs and udder, tail and excess fat [12]. The weight and percentage of fat tailed sheep carcasses on high slaughter weight will produce a high carcass ($P < 0.01$). Research from [13] reported that the higher of the slaughter weight will be increasing of weight and percentage of carcass. It was caused by the increasing growth of animal mostly occurs on the carcass, with the increasing of the body weight will be make the increasing of slaughter weight followed by the increasing of weight and the percentage of carcass [13].

The percentage of fat tailed sheep carcass that produced in this study was not too different from research from [7] slaughter weight of 17.5 kg and 25 kg have 48.76% and 52.39% carcass. The percentage of carcass from this research were 48.74 % and 52.28%, as well as at weights 32.5 kg and 40 kg, the percentage of carcass were 54% and 55%. The weight and percentage of carcass in this research was not too different from previous research because the weight of sheep which used were not so different relatively, so it has the same animal growth status [14].

Weight of carcass showed a very significant differ ($P < 0.01$) on each different slaughter weight. The high slaughter weight will produce a high carcass weight. The weight of all carcass components including muscle, fat and bone showed very significantly differ (Table. 1). The highest percentage on the component of the carcass tissue was the percentage of muscle, bone, and the last was fat. This is reinforced by research of [13], reported that if there was one of the compositions or components of the proportion (percentage) is greater than the composition or other component will have less proportion (percentage).

The result showed that the high slaughter weight will produce the high of muscle weight. It is also reinforced by the study result of [13] reported that with the increase of body weight causes increased slaughter weight, so that will be followed by increased carcass weight. Muscle is one part of the carcass, therefore increasing the weight of the slaughter weight can also make increasing of muscle weight.

The highest percentage of muscle was found at 17.5 kg slaughter weight with mean of 60.81%, while the lowest percentage was slaughter weight at 40 kg with mean of 50.91%. Average percentage of muscle will decrease with increasing slaughter weight. This is caused by the growth rate of the muscle. The rate of muscle growth occurs after bone growth and decreases as the animal get older. [15] reported that the proportion of muscle components increases with increasing of slaughter weight but not significant with adult animal. Growth occurring at 40 kg slaughter weight is already dominated by growth of fat, therefore the percentage of muscles on 40 kg slaughter weight becomes lower. This is reinforced by the results of research conducted by [16] reported that the percentage of muscle in fat tailed sheep decreases with increasing carcass weight.

According to Table 1, there was a very significant difference ($P < 0.01$) on the weight and percentage of fat produced on carcass of fat tailed sheep. The higher slaughter weight will produce the high of weight and percentage of fat ($P < 0.01$). The highest percentage of fat was found on carcass that slaughter

at 40 kg with mean of 33.44%. Percentage of fat at 17.5 kg slaughter weight was 17.83%. This is because the growth of fat on this slaughter weight was not too dominant.

Fat growth occurs most recently after bone and muscle, therefore the percentage of fat in low slaughter weight becomes lower and will increase with increasing body weight and slaughter weight. This is reinforced by the results of [17] which states that with the older age of an animal, the increase of body weight is caused by fat deposits. [18] also reported that the growth of fat occurs most recently after the growth of bone and muscle.

The weight and bone percentage in this study showed significantly different results ($P < 0.01$) at different slaughter weight (17.5 kg, 25 kg, 32.5 kg, and 40 kg). The higher slaughter weight will produce high bone weight. This is also reinforced by the statement of [13] which reported that with the addition of body weight causes increasing of slaughter weight so that will be followed by increasing of carcass weight. Bone is one part of the carcass, therefore increasing the slaughter weight also makes increasing of bone weight. The average result of bone percentage in this study is the opposite of the bone weight, that was increasing of slaughter weight makes the percentage of bone become lower. This was related to bone growth. The rate of bone growth occurs at the beginning of the growth period so that the highest bone percentage occurs at low slaughter weights of 17.5 kg with mean of 18.58% and will decrease along with increasing body weight and slaughter weight. This is supported by research conducted by [18]. The result showed that bone growth occurs at early growth. The proportion of bone from carcasses will decrease with increasing of slaughter weight [15].

3.3 Non carcass components

The results in this study showed that the non carcass weight of fat tailed sheep were significantly different at different slaughter weight, the increasing of the slaughter weight will produce increasing of non carcass weight ($P < 0.01$) according to Table 1.

Table 2. Non carcass components of Fat Tailed Sheep at different slaughter weight

Parameters	Slaughter weight (kg)			
	17.5 (n=6)	25 (n=5)	32.5 (n=7)	40 (n=5)
Head (g)	1125.40 ^d	1442.40 ^c	1681.40 ^b	1878.10 ^a
Skin (g)	1224.70 ^d	1742.40 ^c	2181.90 ^b	2832.30 ^a
Feet	472.62 ^c	619.06 ^b	702.14 ^b	854.38 ^a
Tail (g)	350.30 ^c	717.80 ^b	1036.80 ^a	1106.40 ^a
Pancreas (g)	29.56 ^b	34.84 ^b	47.59 ^a	54.82 ^a
Omental fat (g)	252.70 ^c	469.00 ^c	1061.20 ^b	1770.00 ^a
Kidney (g)	52.93 ^b	72.76 ^b	77.69 ^b	108.10 ^a
Liver (g)	361.00 ^c	485.74 ^b	582.27 ^{ab}	664.10 ^a
Lymph (g)	26.27 ^c	32.84 ^{bc}	39.71 ^{ab}	49.48 ^a
Lungs (g)	209.77 ^b	276.74 ^a	298.24 ^a	306.54 ^a
Heart (g)	72.72 ^d	94.30 ^c	112.86 ^b	136.80 ^a
Stomach (g)	540.22 ^c	681.56 ^b	833.47 ^a	868.94 ^a
Testes (g)	52.77	53.50	51.57	45.14

Note : The numbers on the same row followed by lowercase letters show significant differ ($P < 0.05$)

The average weight of non-carcass components in this study is found in Table 2. The results of the analysis in the table showed that almost all non-carcass components were significantly different ($P < 0.05$) at each different slaughter weight, except for the genitals (testes) whose results did not show significantly differ. The average of genitals (testes) weight at four different slaughter weight 17.5 kg, 25 kg, 32.5 kg and 40 kg were 52.77 g, 53.50 g, 51.5 g and 45 g (Table 2).

Table 3. Percentage of non carcass components of fat tailed sheep at different slaughter weight

Parameters	Slaughter weight (kg)			
	17.5 (n=6)	25 (n=5)	32.5 (n=7)	40 (n=5)
Head (%)	7.30 ^a	6.39 ^b	5.75 ^{bc}	5.18 ^c
Skin (%)	7.95	7.72 ^c	7.45 ^b	7.82 ^a
Feet (%)	3.07 ^a	2.74 ^b	2.39 ^c	2.36 ^c
Tail (%)	2.28	3.18	3.54	3.06
Pancreas (%)	0.19	0.16	0.16	0.15
Omental fat (%)	1.64 ^c	2.08 ^{bc}	3.61 ^{ab}	4.89 ^a
Kidney (%)	0.34	0.32	0.26	0.29
Liver (%)	2.34	2.15	1.99	1.83
Lymph (%)	0.17	0.14	0.14	0.14
Lungs (%)	1.36	1.23	1.02	0.84
Heart (%)	0.47	0.42	0.38	0.38
Stomach (%)	3.51	3.02	2.85	2.39
Testes (%)	0.34	0.24	0.18	0.12

Note : The numbers on the same row followed by lowercase letters show significant differ (P <0.05)

According to the Table 3, there were significantly differ (P <0.05) on the non carcass components at different slaughter weight, especially in the components of the head, feet, omental fat and genital (testes). It means that the head and feet are the body parts of animals that early mature. This was reinforced by the result of [19], which states that the head and feet are components that growth in early mature and the growth will be decrease at the end of life.

Different results were obtained in omental fat, the higher of slaughter weight make the percentage of fat become higher. This can be related to the growth rate of an animal. Fat growth occurs most recently when compared to earlier bone growth, followed by muscle and finally fat. The highest percentage of omental fat was found at 40 kg slaughter weight with an average of 4.89%. This was not too different from the research conducted by [6] that the average percentage of the highest omental fat was found at 40 kg slaughter weight with mean of 4.64%.

4. Conclusions

Fat tailed sheep that slaughter at different slaughter weight have different composition of carcass and non carcass. The highest percentage of carcasses was found on 40 kg slaughter weight with value of 55.12%. The highest percentage of muscle and bone carcass was found on 17.5 kg slaughter weight with 60.81% muscle value and 18.58% bone value, while the highest fat carcass was found at 40 kg slaughter weight with 33.44%.

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