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The Carcass and Non-carcass Percentage of Bligon Goats Slaughtered with Different age and Weight in Bantul, Indonesia

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ABSTRACT

This study observed the carcass and non-carcass percentage of Bligon goats slaughtered with different ages and weights at Bantul slaughterhouse. The research was observed 64 male Bligon goats of different slaughter ages and weights. The data consists of percentages of carcass and non-carcass components (skin, legs, head, liver, lungs, heart, digestive tract, and blood). Data were analyzed using a completely randomized design of factorial (3x3), three groups of age (< 1 year, 1-1.5 years, and 1.5-2 years) and three groups of slaughter weight (SW1=11-15 kg, SW2= 16-20 kg, and SW3= 21-25 kg). The results showed that the carcass percentage of Bligon goats was 43.44%, while percentages of skin, legs, head, heart, liver, lungs, digestive tract and blood were 7.01%; 2.84%; 7.41%; 0.56%; 2.12%; 1.36%; 7.98% and 2.83%, respectively. Different ages did not significantly affect carcass, skin, legs, heart, liver, lungs, digestive tract, and blood percentages. Age was significantly influenced ($P<0.05$) the percentages of the head. Slaughter weight was significantly influenced ($P<0.05$) the percentages of carcass, skin, legs, head, heart, digestive tract, and blood, but it does not significantly affect liver and lung percentages. It was concluded that the percentage of carcass, skin, legs, heart, liver, lungs, digestive tract, and blood in Bligon goat at different slaughter ages was the same. The lower the slaughter weight of the Bligon goat resulted in a higher percentage of carcass, skin, legs, head, heart, digestive tract, and blood.

Key words: *Bligon goat, Carcass, Non-carcass, Slaughter age, Slaughter weight*

Introduction

Goat is a leading livestock commodity in Yogyakarta. Statistical data in 2017 and 2018 shows the goat population increased by 8% (375.557 heads to 405.948 heads) (Central Statistical Agency of D.I. Yogyakarta Province, 2019). Goats have a strategic role in the lives of farmers in Yogyakarta. Goats act as savings and insurance for farmers, quality manure providers, and the use of natural resources around the yard. The number of goat farmers' households in Yogyakarta has increased in 40 years, which shows reasonably high interest. In addition, goats were widely used as poverty alleviation assistance programs (Budisatria and Udo, 2013). Bantul Regency is one of the regions with a high goat population. Bligon goat is currently getting much attention in Bantul Regency. Data on the population dynamics of the goat in Bantul Regency Based (Central Statistical Agencyof Bantul Regency, 2019) showed a significant increase in population since 2012-2016 of 63%. However, it is followed by a high slaughter rate with an average of more than 30% of the population annually. According to (Central Statistical

Agencyof D.I. Yogyakarta Province, 2018), the number of slaughtered goats recorded in the Bantul Regency slaughterhouse reached 24,880 heads, with a composition of 62% male and 38% female. It is also suspected that the number of unrecorded the slaughtered goats was still very high because the activity was made at the household level, and neither recording nor reporting was carried out. One factor in the high level of goat slaughter is goat meat as the main ingredient for "*klatak*" satay, which is very well known in Yogyakarta as a culinary tourism destination.

The purpose of slaughtering livestock is to obtain carcasses and meat as products that will determine economic value. In general. the slaughter results can be divided into two parts, namely carcass and non-carcass (Soeparno, 2005). The carcass is expressed in the percentage of the carcass by comparing carcass weight with slaughter weight. The carcass is a body component with high economic value and can be used as a predictive unit to assess livestock production's success criteria (Siamtiningrum *et al*., 2016). Non-carcass components in Indonesia result from slaughtering livestock which also has a selling price and economic value (Widiarto *et al*., 2009; Sriyani *et al*., 2016). The non-carcass (offals) consists of the edible and non-edible parts. In Indonesia, non-carcass components that are edible, such as skin, head, tail, liver, heart, lungs and digestive tract, are also of high economic value. It was food items that the consumers prefer. The non-carcass components that are not edible but processed with high technology can provide significant financial benefits (Elvanuddin *et al*., 2016). Widiarto *et al*. (2009) reported that non-carcass components (skin, head, feet, lungs and digestive tract) contributed 22.70% of the total income for every slaughtering of goat in Yogyakarta Regency.

The factors influencing the slaughter results were sex, slaughter weight, breed, age, nutrition level, and health status (Soeparno, 2005; Kaic *et al*., 2012; Dager and Toplu, 2014; Assan, 2015). Age of livestock will determine slaughter weight, and the slaughter weight will affect carcass weight, including the meat bones ratio (Park *et al*., 2002; Soeparno. 2005; Subekti, 2007). Panjono *et al*. (2009) stated that it is crucial to know the relationship between slaughter aged and carcass trait to develop the strategy for improving the quantity and quality of meat. Research on goat carcass and non-carcass has been carried out in controlled conditions. Meanwhile, most of the goats come from traditional management systems by smallholder farmers and causing many variations. These variations will affect the results of slaughter in terms of carcass and non-carcass. Thus, the phenomenon will be interesting to be seen and researched, especially at different ages and slaughter weights. This study was aimed to observe the carcass and non-carcass percentage of Bligon goats slaughtered with different ages and weights at Bantul slaughterhouse, Yogyakarta.

Materials and Methods

The study was conducted under ethical clearance No 0034/EC-FKH/ Eks./2020. The research observed 64 male Bligon goats with different slaughter ages and weights at Bantul slaughterhouse in Bantul Regency, Yogyakarta province, Indonesia.The Bligon goats were grouped according to slaughter ages (SE), namely age 1 (<1 year), age 2 (1-1.5 years), and age 3 (> 1.5 years). Determination of age was based on the change of incisors, namely not changing (<1 year), changing one pair 1-1.5 years), changing two pairs (1.5-2 years), changing three pairs (2-3 years), changing four pairs (3-4 years) (Budisatria *et al*., 2013). The slaughter weights (SW) were grouped based on slaughter weight at 5 kg intervals, namely slaughter weight 1 (11-15 kg), slaughter weight 2 (16-20 kg), and slaughter weight 3 (21-25 kg). Before the slaughtering was carried out, the goat was introduced to the fasting stage for 12 hours to obtain the slaughter weight.

The slaughter procedure was carried out in an Islamic slaughtering procedure. After being slaughtered, the blood was removed as much as possible. The head was separated, skinned, removal of internal organs, and separated four legs until the carcass was obtained. The internal organs were cleaned and separated, respectively. The carcass and non-carcass components were all weighed by digital scales (Camry© with a capacity of 40 kg and 0.01 kg accuracy). The percentage is calculated by comparing the component with the slaughter weight multiplied by 100%. The data consisted of percentages of carcass and non-carcass components (skin, legs, head, liver, lungs, heart, digestive tract, and blood). The data were statistically analyzed using a completely randomized design of factorial (3x3), three age groups, and three groups of slaughter weight.

Results

Carcass percentage of Bligon goat in Bantul Regency slaughtered with different age and weight shown in Table 1. The slaughter age did not have a significant effect, while slaughter weight has a significant effect (P<0.05) on carcass percentage. The percentage of Bligon goat carcass based on slaughter age was the same between the three age groups and an average of 43%. While the percentage of carcasses of Bligon goat based on slaughter weight showed that the greater the slaughter weight produced the smaller carcass percentage, namely 41.83±1.79, 42.76±3.31, and 46.28±2.64% respectively in the slaughter weight groups SW3, SW2 and SW1. Based on statistical analysis in this study, there is no interaction between age and slaughter weight on carcass percentage.

Non-carcass components percentage of Bligon goat in Bantul Regency slaughtered with different age and weight shown in Table 2. The slaughter age did not have a significant effect on non-carcass components percentage, except the head percentage. Meanwhile, slaughter weight has a significant effect (P<0.05) on non-carcass components, namely skin, legs, head, liver, digestive tract and blood percentage. The head percentage of Bligon goat slaughtered in the < 1 years, 1-1.5 years, and >1.5 years were 7.51±0.90, 6.93±1.08, and 8.02±2.27% respectively. The percentage of non-carcass component of Bligon goat based on slaughter weight showed that the smaller the slaughter weight produced the lower non-carcass components percentage. The skin, legs, head, liver, digestive tract and blood percentage in the slaughter weight groups SW3, SW2 and SW1were 7.83±1.04, 6.81±0.86, and 6.54±0.55%; 3.40±0.42, 2.74±0.40, and 2.46±0.52%; 9.01±1.73, 7.19±0.49, and 6.31±8.02%; 0.67±0.09, 0.54±0.08, and 0.47±0.06%; 9.31±0.92, 7.50±0.64, and 7.41±0.56%; 3.66±0.45, 2.72±0.37, and 2.26±0.27% respectively. Based on statistical analysis in this study, there was no interaction between age and slaughter weight on non-carcass components percentage, except the percentage of the head.

Discussion

The slaughter age did not have a significant effect, while slaughter weight has a significant effect (P<0.05) on carcass percentage. These results were in line with the theory that says the slaughter weight will determine the carcass obtained. The slaughter weight will affect carcass weight (Park *et al*. 2002; Soeparno. 2005; Subekti, 2007). Madraguna *et al*. (2000) stated that slaughter age and weight affect carcass quality. Many studies stated that the slaughter age could affect the quality of the carcass. Carcass weight increases with age (Panjono *et al*., 2009) but does not significantly affect carcass percentage (Rajkumar *et al*., 2010; Amri and Iskandar, 2014; Wahyudi *et al*., 2017).

Rajkumar *et al*. 2010, reported that Sirohi goats in India were slaughtered at the age of 9 and 12 months had significantly different slaughter weights of 24.52 and 28.14 kg. However, the carcass percentage produced was not different, namely, 45.77 and 45.53%, respectively. While the results of Wahyudi *et al*. (2017) showed the same results, that the older the slaughtering age (based on the change of incisors 1, 2, 3, and 4 pairs) of local goats in East Java does not produce a different carcass percentage, the carcass percentage was 48-49%. Alexandre *et al*. (2009) reported that Creole goat slaughtered at the age > 18 months had a higher carcass percentage than < 12 months, namely 51.90 vs 54.20%, respectively. The carcass percentage did not differ at the slaughter age because it was relatively constant when it reached body maturity. The nutritional intake was diverted

Table 1. Carcass percentage of Bligon goat in Bantul Regency slaughtered with different age and weight

Slaughter weight (SW)	Age			Average
	< 1 years	1-1.5 years	> 1.5 years	
SW1 (11-15 kg)	46.12±3.07	46.44±0.60	46.73±2.59	46.28±2.64[a]
SW2 (16-20 kg)	41.25±3.01	44.31±3.08	44.31±3.74	42.76±3.31[b]
SW3 (21-25 kg)	41.72±0.06	42.47±1.99	40.77±1.14	41.83±1.79[c]
Average[NS]	43.83±3.74	43.23±2.64	43.21±3.44	

[a,b,c]; Means between a column with different superscripts differ significantly (P<0.05); NS = not significant; SW = slaughter weight

Table 2. Non-carcass components percentage of Bligon goat in Bantul Regency slaughtered with different age and weight

Slaughter weight (SW)	Age			Average
	< 1 years	1-1.5 years	> 1.5 years	
Skin				
SW1 (11-15 kg)	7.72±0.87	8.74±1.79	7.37±0.51	7.83±1.04[a]
SW2 (16-20 kg)	6.51±0.86	6.91±0.63	7.10±1.18	6.81±0.86[b]
SW3 (21-25 kg)	6.60±0.43	6.45±0.62	6.67±0.48	6.54±0.55[c]
Average[NS]	7.14±1.01	6.91±1.06	6.96±0.82	
Legs				
SW1 (11-15 kg)	3.28±0.32	3.49±0.66	3.76±0.22	3.40±0.42[a]
SW2 (16-20 kg)	2.72±0.04	2.76±0.14	2.75±0.21	2.74±0.40[b]
SW3 (21-25 kg)	2.46±0.42	2.47±0.16	2.45±0.17	2.46±0.52[c]
Average[ns]	2.99±0.42	2.71±0.40	2.81±0.52	
Head				
SW1 (11-15 kg)	8.17±0.49	9.28±0.90	12.09±2.20	9.01±1.73[a]
SW2 (16-20 kg)	6.99±0.51	7.08±0.37	7.69±0.29	7.19±0.49[b]
SW3 (21-25 kg)	5.91±0.54	6.23±0.45	6.56±0.56	6.31±8.02[c]
Average	7.51±0.90[a]	6.93±1.08[b]	8.02±2.27[c]	
Liver				
SW1 (11-15 kg)	0.66±0.12	0.70±0.09	0.68±0.05	0.67±0.09[a]
SW2 (16-20 kg)	0.53±0.05	0.55±0.12	0.55±0.05	0.54±0.08[b]
SW3 (21-25 kg)	0.53±0.06	0.49±0.06	0.44±0.06	0.47±0.06[c]
Average[ns]	0.60±0.11	0.54±0.11	0.53±0.10	
Lung				
SW1 (11-15 kg)	1.47±0.22	1.48±0.14	1.20±0.16	1.43±0.22
SW2 (16-20 kg)	1.44±0.18	1.31±0.29	1.40±0.09	1.38±0.16
SW3 (21-25 kg)	1.29±0.06	1.28±0.33	1.28±0.14	1.28±0.12
Average[ns]	1.44±0.19	1.32±0.15	1.31±0.14	
Heart				
SW1 (11-15 kg)	2.09±0.51	2.41±0.14	2.05±0.33	2.13±0.45
SW2 (16-20 kg)	2.16±0.38	2.24±0.29	2.24±0.47	2.21±0.36
SW3 (21-25 kg)	2.14±0.27	1.90±0.33	2.10±0.09	1.99±0.28
Average[ns]	2.12±0.43	2.10±0.35	2.14±0.31	
Digestive tract				
SW1 (11-15 kg)	9.15±0.99	9.40±1.00	9.84±0.54	9.31±0.92[a]
SW2 (16-20 kg)	7.58±0.43	7.48±0.80	7.43±0.72	7.50±0.64[b]
SW3 (21-25 kg)	7.41±0.30	7.34±0.71	7.53±0.30	7.41±0.56[c]
Average[ns]	8.38±1.11	7.64±0.99	7.92±1.07	
Blood				
SW1 (11-15 kg)	3.68±0.49	3.68±0.59	3.55±0.28	3.66±0.45[a]
SW2 (16-20 kg)	2.69±0.40	2.82±0.37	2.61±0.31	2.72±0.37[b]
SW3 (21-25 kg)	2.72±0.21	2.22±0.19	2.19±0.29	2.26±0.27[c]
Average[ns]	3.66±0.45	2.72±0.37	2.26±0.27	

[a,b,c]; Means between a column with different superscripts differ significantly (P<0.05); NS = not significant; SW = slaughter weight

for reproduction and not for the formation of muscle. It means, with the increasing age, the growth rate of the carcass tissue remains in line with the growth of body tissue. Based on the study of Panjono *et al*. (2009), the extension of the slaughter age (> 24 months) did not automatically increase the carcass quality and quantity due to maximum yield and carcass quality that have been reached at 24 months.

A higher slaughter weight produced a smaller carcass percentage (P<0.05), this is similar to the study by Ngadiyono *et al*. (2014); Koesmara *et al*. (2019), which stated that an increase in slaughter weight might increase carcass weight, but not al-

ways increase carcass percentage. Afkari *et al*. (2017) stated a positive and significant correlation between slaughter weight and carcass weight (edible portion) of 50% in Bligon goat. According to Shehata (2013), an increase in slaughter weight did not change the percentage of meat but reduces the percentage of bone and increases fat. The carcass percentage of local male goats obtained by Sodiq (2011) with slaughter weight ranges from 10 to 23.5 kg, an average of 44.09%. Panjono *et al*. (2014) obtained a Bligon goat with a slaughter weight of 19.76 kg resulting in a carcass percentage of 36.97%. Whereas in Sari *et al*. (2016), the research found that the carcass percentage of Kacang goat was 38.79% with a slaughter weight of 14.60 kg and aged 1.5 years. Another factor determining carcass weight is the difference in the size of the digestive tract, internal organs, and livestock condition. The method of skinned can also determine the carcass percentage. There is no interaction between age and slaughter weight on carcass percentage. This result happened because the age groups 2 and 3 experienced decreased carcass percentage at the increasing slaughter weight, namely SW2 and SW3. Bodyweight has a close relationship with body composition. Variations in body composition or carcass were mainly dominated by bodyweight variations and a slight influence by age (Soeparno, 2005).

Non-carcass components in goats still have economic value and can affect the income from slaughtering goats. Several studies reported no effect of age on the percentage of non-carcasses, aged 1-1.5 years > 3 years, namely 40.58 and 40.57% (Amri and Iskandar, 2014). Koesmara *et al*. (2019) reported that a higher slaughter weight would produce a higher non-carcass percentage. The skin was not affected by age but was influenced by body size. There was no interaction between the two factors. In the legs, the highest percentage was at the age of less than one year. The legs are an organ (of the body shape) that matured early so that with increasing age, the proportion will decrease due to an increase in the proportion of tissue and muscle in the body (Soeparno, 2005). In terms of slaughter weight, SW1 has the most significant percentage. In this condition, the livestock is still young and still growing. The early period of leg growth is relatively more significant and will reach a proportional size at maturity. There was no interaction between the two factors.

Age has a significant effect on increasing the head percentage. Slaughter weight also affects the head percentage, the greater of slaughter weight, resulting in a lower head percentage. There is an interaction between the two factors on the percentage of the head. The liver, lungs, and heart percentages showed no effect on age, but there was an effect on slaughter weight. The organs such as the liver, lungs, and heart have growth and development following the bodyweight of livestock and will decrease after reaching adult body weight. There was no interaction between the two factors on the percentage of the three organs. There was no effect of age, but there is an effect of slaughter weight on the digestive tract percentage. The level of nutrition greatly influences the digestive tract percentage because nutrition affects the rumen, reticulum, omasum, and intestine development. There was no interaction between the two factors on the percentage of the digestive tract. There was no effect of age, but there is an effect of slaughter weight on the blood percentage, decreasing the slaughter weight and getting smaller. There was no interaction between the two factors on the blood percentage.

In line with Amri and Iskandar (2014), it was stated that with increasing age, there are changes in the development of body parts, head, legs, lungs, and viscera, which become relatively weight. Sriyani *et al*. (2016) stated that genetic and environmental factors influenced the difference in the percentage of non-carcass components of livestock. Soeparno (2005) stated that nutrition affects the percentage of non-carcasses to live weight. The carcass percentage to live weight increases in line with increasing live weight, but the percentage of non-carcass components such as skin, blood, stomach, small intestine, and liver decreases. Thus, young cattle are primarily composed of these body parts in comparison to older and larger cattle. The factors that determine the economic value of livestock include carcass production with a high proportion of meat and low bones and fat (Das and Rajkumar, 2010). It concluded that the percentage of carcass, skin, legs, heart, liver, lungs, digestive tract, and blood in Bligon goats at different slaughter ages was the same. The lower slaughter weight of the Bligon goat resulted in a higher percentage of carcass, skin, legs, head, heart, digestive tract, and blood.

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Conflict of interests

The authors declared have not any conflict of interests.

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