

Carcass and Non-carcass Components of Priangan and Javanese Fat-tailed Rams Slaughtered at Mature Live Weight

M. Baihaqi* & R. Herman

Department of Animal Production and Technology, Faculty of Animal Science, Bogor Agricultural University
Jln. Agatis, Kampus IPB Darmaga Bogor 16680 West Java, Indonesia
(Received 31-10-2012; Reviewed 16-12-2012; Accepted 31-01-2013)

ABSTRACT

Twenty-three of indigenous Priangan and Javanese Fat-tailed (JFT) ram breeds were used to evaluate its carcass and non carcass components slaughtered at mature live weight. Five Priangan rams and six JFT rams were slaughtered at 32.5 kg of live weight while six other rams of each breeds were also slaughtered at 40 kg of live weight. Before the rams were slaughtered, they were fattened using pellet ration which was formulated according to NRC for fattening 10 kg of lamb, containing 73.3% TDN and 16% protein in dry matter bases. Feed and water were given *ad libitum*. Rams were slaughtered and dissected when they reached their assigned slaughter weight (32.5 and 40 kg). The results showed that both breeds had high percentage of carcass (53%-55%) with no significantly different between breeds ($P>0.05$) either were slaughtered at 32.5 kg or 40 kg. However, carcass of Priangan rams had significantly more muscle, but less fat than Javanese Fat-tailed rams at mature live weight ($P<0.05$). Non-carcass components were not significantly different between breeds ($P>0.05$) except for head, tail and testes ($P<0.01$) and liver ($P<0.05$). The edible and inedible portion of non-carcass ranged from 30%-32% and 12%-15% of slaughter weight, respectively.

Key words: Priangan, Javanese Fat-tailed Sheep, carcass, non-carcass, mature live weight

ABSTRAK

Dua puluh tiga domba jantan Priangan dan Ekor Gemuk (DEG) digunakan pada penelitian ini untuk mengevaluasi komposisi karkas dan non karkasnya pada bobot dewasa tubuh. Masing-masing enam domba Priangan dan DEG disembelih ketika mempunyai bobot 40 kg, sementara lima ekor domba Priangan dan enam ekor DEG disembelih ketika mempunyai bobot 32,5 kg. Sebelum disembelih, domba digemukkan menggunakan pakan berbentuk pellet yang mengandung 73,3% TDN dan 16% protein. Domba kemudian dipotong ketika memasuki bobot hidup 32,5 kg dan 40 kg. Komponen non karkas diukur untuk mengetahui *edible portion* dari masing-masing bangsa domba. Hasil penelitian menunjukkan bahwa kedua bangsa domba tidak menunjukkan perbedaan yang nyata dengan persentase karkas yang tinggi (53%-55%). Meskipun demikian, domba Priangan mempunyai komposisi daging yang signifikan lebih tinggi dan lemak yang lebih rendah daripada DEG ($P<0,05$). Komponen non-karkas tidak menunjukkan perbedaan antar kedua bangsa domba kecuali kepala, ekor dan testis ($P<0,01$) dan hati ($P<0,05$). *Edible portion* dan *inedible portion* non-karkas masing-masing mencapai 30%-32% dan 12%-15% dari bobot potong domba.

Kata kunci: priangan, domba ekor gemuk, karkas, non-karkas, dewasa tubuh

INTRODUCTION

Sheep is one of the important livestock commodities in Indonesia, playing an important role in the context of agriculture. Although the consumption of sheep meat is still low compared to chicken and beef, but the annual

growth of the sheep population from 2005 to 2010 had been increasing at 4.9% with a population of 8.3 to 10.7 millions. Most of the sheep population is in Java Island (92.7%) spread in West Java (58.5%), Central Java (20.0%) and East Java (7.0%) (DGLAH, 2011).

Non-carcass components generally are considered as by-product in slaughtering process. However, the economic value of non-carcass is enough to cover the cost during slaughter (da Silva *et al.*, 2011). Moreover, leather is a non-carcass component that has high eco-

*Corresponding author:
e-mail: baihaqi@ipb.ac.id

nomical value as a primary source of profit for sheep butcher (Herman, 2005). Offals are favorite food in some countries including in Indonesia.

Carcass and non-carcass characteristics are affected by live weight of mature sheep (Lambe *et al.*, 2007), slaughter weight (Pena *et al.*, 2005) and sheep breeds (Yilmaz *et al.*, 2009). A study conducted by Herman (2005) reported that 17.5 and 25 kg of Priangan sheep and Javanese Fat-tailed sheep significantly different on non-carcass components between breeds particularly of head and tail. Unfortunately, characteristic data of carcass and non-carcass components of these breeds on mature live weight are rarely found. Whereas, identification of carcass and non-carcass components at optimal live weight between breeds is needed to obtain the genetic potential for edible portion production of sheep. The objective of this study was to evaluate the different characteristic of carcass and non-carcass components between Priangan and Javanese Fat-Tailed rams breeds slaughtered at mature live weight.

MATERIALS AND METHODS

Animals and Fattening Procedure

The study was conducted using a total of twenty-three male lambs from two breeds, Priangan (11 heads) and Javanese Fat-tailed rams (12 heads). The animals were selected from farmers with average live weight of 10 kg. Priangan were collected from Garut Regency, West Java, while Javanese Fat-tailed were collected from Central Java. Each of animals remained in individual indoors cage for fattening process.

Lambs were fattened using pellet ration formulated according to NRC (1985) for fattening 10 kg of lambs, containing 73.3% TDN and 16% protein in dry matter. Feed and water were given *ad libitum*. The daily body weight gain of Priangan sheep and Javanese Fat-tailed rams were 123 and 144 g, respectively. Animals were weighed once a month. After they reached the live weight 33.9, 33.8, and 38.9; 39.8 kg, respectively for Priangan sheep and Javanese Fat-tailed rams, then fasted for 24 h (water was allowed). Fasted rams of each breed were weighed at average of 32.6 and 32.5 kg as slaughter weight 32.5 while at average of 36.8 and 38.3 kg as slaughter weight 40 kg, respectively. Rams were slaughtered when they reached their assigned slaughter weight (32.5 and 40 kg).

Slaughtering Procedure and Parameters Measurement

Slaughtering was done according to standard halal methods at a slaughter house plant in Laboratory of Small Ruminant, Department of Animal Production and Technology, Faculty of Animal Science, Bogor Agricultural University. Blood was collected, weighed and recorded as blood weight. After the animal was skinned, 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.

Statistical Analyses

Data of carcass and each parts of non-carcass were expressed in average values and standard deviation (SD) in weight (g) and percent (%) of slaughter weight. In order to determine the differences of carcass and non carcass components between breeds (Priangan and Javanese Fat-tailed Sheep), the data were analyzed by *t*-test (Steel & Torrie, 1980).

RESULTS AND DISCUSSION

Carcas Performance

Dissection processes of animals were done precisely, with the total weight percentage value after the dissection were 97.34% and 96.69% of slaughter weight, or there were decreased of 2.66% and 3.3% of slaughter weight for Priangan and Javanese Fat-tailed rams slaughtered at weight 32.5 kg, respectively. The total weight percentage values of slaughter weight 40 kg were 96.57% and 98.49% or decreased of 3.43% and 1.51%, respectively.

There were no significant differences of slaughter weight between Priangan and Javanese Fat-tailed rams either at slaughter weight 32.5 or 40 kg ($P > 0.05$) (Table 1). Likewise, carcass weight between the two breeds had similar percentage of the carcass (53.58%-55.58%). Live weight, carcass weight and dressing percentage were intercorrelated. Pena *et al.* (2005) mentioned that dressing percentage has positive correlation to slaughter weight. The slaughter process at present study was conducted at the same body weight between breeds, therefore it resulted no differences of carcass weight and dressing percentage. It indicates that at mature live weight, Priangan and Javanese Fat-tailed rams produced a similar carcass quantity, although the carcass tissue components of each breeds could be different which shows the carcass quality.

Dressing percentage of Priangan rams in this study was higher compare to that reported by Zubir *et al.* (2011) that was 46.09% of carcass from Priangan's slaughter weight. Study conducted by Rianto *et al.* (2006) resulted percentage of hot carcass of Thin-tail sheep was

Table 1. Carcass performance of Priangan and Javanese Fat-tailed rams in slaughter weight 32.5 kg and 40 kg

Carcass performance	Slaughter weight (32.5 kg)			Slaughter weight (40 kg)		
	Priangan	JFT	Sig.	Priangan	JFT	Sig.
Slaughter weight (g)	32,460 ± 55	32,483 ± 75	ns	36,708 ±3,088	38,292 ±2,375	ns
Empty body weight (g)	29,339 ± 95	28,873 ± 63	ns	33,910 ±2,571	35,285 ±1385	ns
Hot carcass weight (g)	17,380 ±228	17,683 ±673	ns	20,142 ±1,716	21,258 ± 967	ns
Dressing percentage (%)	53.6± 0.7	55.4± 2.1	ns	54.9± 4.7	55.6± 1.4	ns
Muscle (g)	4,849 ± 68	4,493 ±170	*	5,701 ± 475	5,031 ± 224	*
Fat (g)	2,277 ± 31	2,727 ±104	ns	2,656 ± 224	3,696 ± 167	*
Bone (g)	1,261 ± 16	1,162 ± 38	*	1,369 ± 114	1,317 ± 54	ns

Note: JFT= Javanese Fat-tailed Sheep, Sig.= significance differ between breeds, *= significant differ ($P<0.05$), ns= not significant differ ($P>0.05$).

lower at 39.06%, it could be caused by slaughter weight of their study was lower at 25.45 kg, while the percentages of fats, meat and bone of carcass were 9.71%, 69.03%, and 21.27%, respectively. Kheri sheep which have almost a similar phenotypic with Priangan sheep that was maintained intensively also produced percentage of carcass at 57% (Karim *et al.*, 2007).

However, this study showed that at a similar slaughter live weight, muscle tissue weight of Priangan rams was significantly higher from Javanese Fat-tailed rams for both different weights ($P<0.05$). Sheep breeds affect the amount of muscle tissue (Yilmaz *et al.*, 2009). Priangan produced more muscle than Javanese Fat-tailed rams. This conclusion also supported by Herman

Table 2. Carcass and non carcass components of Priangan and Javanese Fat-tailed rams (g)

Parameters	Slaughter weight (32.5 kg)			Slaughter weight (40 kg)		
	Priangan	JFT	Sig.	Priangan	JFT	Sig.
Animals (heads)	n= 5	n= 6		n= 6	n= 6	
Slaughter Weight (g)	32,460± 55	32,483± 75	ns	36,708±3,088	38,292±2,375	ns
Inedible portion						
Blood (g)	1,291±162	1,115±152	ns	1,516±105	1,367± 62	ns
Gastric tract content (g)	3,121±350	3,610±840	ns	2,798±501	3,007± 718	ns
Edible portion						
Head (g)	2,182±200	1,718±155	**	2,581± 301	1,809± 189	**
Skin (g)	2,257± 40	2,198±137	ns	2,783± 395	2,719± 340	ns
Carcass (g)	17,380±228	17,683±673	ns	20,142±1,716	21,258± 967	ns
Liver (g)	502± 73	588± 55	*	500± 77	644± 115	*
Lymph (g)	46± 3	40± 9	ns	54± 9	48± 9	ns
Lungs (g)	310± 28	302± 29	ns	326± 33	301± 34	ns
Heart (g)	119± 8	112± 7	ns	134± 6	133± 15	ns
Genitals (g)	110± 55	54± 10	ns	45± 6	44± 5	ns
Testes (g)	326± 13	216± 22	ns	333± 39	225± 51	**
Kidney (g)	98± 44	78± 14	ns	88± 13	103± 31	ns
Pancreas (g)	44± 6	53± 17	ns	47± 8	54± 9	ns
Stomach (g)	798±117	843± 93	ns	770± 121	855± 71	ns
Small intestine (g)	369±100	458± 4	ns	325± 94	553± 196	ns
Large intestine (g)	336± 62	317± 26	ns	525± 100	475± 88	ns
Omental Fat (g)	1,468±551	1,009±288	ns	2,066± 385	1,705± 528	ns
Tail (g)	217± 63	1,041±203	**	241± 91	1,081± 125	**
Shank (g)	723± 9	713± 46	ns	762± 74	841± 80	ns
Thorax Fat (g)	53± 26	96± 49	ns	109± 30	112± 26	ns

Note: JFT= Javanese Fat-tailed Sheep, Sig.= significance differ between breeds, **= very significant ($P<0.01$), *= significant ($P<0.05$), ns= not significant ($P>0.05$).

(2004) who mentioned that Priangan had heavier carcass muscle weight than others local breeds particularly in the neck and thorax parts. Priangan rams have masculine characteristics which traditionally are used as fighter animals contest. Masculinity is correlated to testosterone level in blood which is to be testicular hormone responsible for lean production (Zubir *et al.*, 2011).

In contrast, fat tissue of Javanese Fat-tailed rams slaughtered at 40 kg was heavier than Priangan rams ($P<0.05$). This result indicated that Priangan rams were assumed to be less physiological mature than Javanese Fat-tailed sheep. Maturity of animals determines for increasing growth of fat instead of muscle. Priyanto & Johnson (2012) reported the pattern differences of carcass fat were determined by cattle breeds. The differences of maturity type of sheep breeds might impact on pattern of fat deposition (McPhee *et al.*, 2008). In general, total lean and bone decreased while total fat of carcass increased with increasing sheep weight (Abdullah & Qudsieh, 2008). The same result was concluded by Herman (2001) that mentioned generally Javanese Fat-tailed Sheep had a higher fat tissue than Priangan sheep. Freking & Leymaster (2004) also mentioned distribution of carcass fat was determined by sheep breeds.

Non Carcass Components

The weight and percentages of all non carcass component organs between Priangan and Javanese Fat-tailed rams at similar live weight were not significantly different ($P>0.05$), except for the weight of head, liver and tail (Table 2). The tail of Javanese Fat-tailed sheep was heavier ($P<0.01$) due to the weight of the tail as fat deposits as its reported by Herman (2005). In contrast, head weight of Priangan was heavier due to their large horns ($P<0.01$). Djajanegara & Rangkuti (1989) mentioned that Priangan rams have large curled horns. Weight of testes for Priangan sheep slaughtered at 40 kg weight was heavier compared to Javanese Fat-tailed sheep ($P<0.01$). Priangan rams were indicated have high level of blood testosterone which determine masculinity and testes size. The difference of liver and head weight also mentioned by Zgur *et al.* (2003) who used different sex of lambs, but in general their study did not result different significant of non carcass component.

In the present study, the contribution of total non-carcass components as a percentage of slaughter weigh represented between 44.8%-46.4%, with no differences between breeds. Herman (2005) also concluded that there

Table 3. Carcass and non carcass components of Priangan and Javanese Fat-tailed rams (% slaughter weight)

Parameters	Slaughter weight (32.5 kg)			Slaughter weight (40 kg)		
	Priangan	JFT	Sig.	Priangan	JFT	Sig.
Animals (heads)	n= 5	n= 6		n= 6	n= 6	
Inedible portion						
Blood (%)	3.97±0.50	3.57±0.47	ns	4.13±0.29	3.72±0.24	ns
Gastric tract content (%)	9.60±1.08	11.11±2.59	ns	7.65±1.36	7.79±1.96	ns
Edible portion						
Head (%)	6.72±0.62	5.29±0.17	**	7.03±0.63	4.93±0.51	**
Skin (%)	6.95±0.12	6.77±0.42	ns	7.58±1.08	7.41±0.93	ns
Liver (%)	1.55±0.22	1.81±0.17	*	1.36±0.21	1.68±0.24	*
Lymph (%)	0.14±0.01	0.12±0.03	ns	0.15±0.02	0.13±0.02	ns
Lungs (%)	0.96±0.07	0.93±0.09	ns	0.89±0.09	0.82±0.09	ns
Heart (%)	0.37±0.02	0.37±0.02	ns	0.37±0.02	0.36±0.04	ns
Genitals (%)	0.34±0.17	0.17±0.03	ns	0.12±0.02	0.12±0.01	ns
Testes (%)	1.00±0.04	0.66±0.07	ns	0.91±0.11	0.61±0.14	**
Kidney (%)	0.30±0.14	0.24±0.04	ns	0.24±0.04	0.28±0.08	ns
Pancreas (%)	0.14±0.02	0.16±0.05	ns	0.13±0.02	0.15±0.02	ns
Stomach (%)	2.46±0.36	2.60±0.29	ns	2.10±0.33	2.23±0.19	ns
Small intestine (%)	1.14±0.31	1.40±0.01	ns	0.89±0.26	1.47±0.53	ns
Large intestine (%)	1.04±0.19	0.98±0.08	ns	1.43±0.27	1.29±0.24	ns
Omental fat (%)	4.52±1.69	3.13±0.89	ns	5.63±1.05	4.64±1.44	ns
Tail (%)	0.67±0.19	3.20±0.62	**	0.66±0.25	2.94±0.34	**
Shank (%)	2.23±0.03	2.19±0.14	ns	2.08±0.20	2.29±0.22	ns
Thorax fat (%)	0.20±0.08	0.29±0.15	ns	0.36±0.08	0.31±0.07	ns

Note: JFT= Javanese Fat-tailed Sheep, Sig.= significance differ between breeds, **= very significant ($P<0.01$), *= significant ($P<0.05$), ns= not significant ($P>0.05$).

were no differences of total non carcass composition between local sheep breeds that ranged from 48%-51% of slaughter weight. Bonvillani *et al.* (2010) mentioned that generally different feed management did not affect non carcass percentage that ranged between 40%-43%.

Table 3 shows that based on the percentage of non-carcass components, at 32.5 kg slaughter weight, Priangan ram produce 8.95% head and shank, 6.95% skin, 14.79% offal, 3.97% blood and 9.60% gut content, while Javanese Fat-tailed ram produce 55.44% carcass, 7.48% head and shank, 6.77% skin, 16.03% offal, 3.57% blood and 11.11% gut content. At 40 kg slaughter weight, Priangan ram produce 9.11% head and shank, 7.58% skin, 15.15% offal, 4.13% blood and 7.65% gut content, while Javanese Fat-tailed ram produce 55.58% carcass, 7.22% head and shank, 7.41% skin, 17.25% offal, 3.72% blood and 7.79% gut content.

Total edible portion of non carcass of both ram breeds ranged from 30-32% of slaughter weight. The edible portion from offal and omental fat ranged from 11.7%-13.7%, testes and genitalia ranged 0.7%-1.3%. Meanwhile, total inedible portion ranged from 12%-15% of slaughter weight. Akhmadi *et al.* (2005) who conducted a trial of different feed on Javanese Thin-tailed sheep resulted percentage of non-carcass edible portion 16% of slaughter weight. The difference in the percentage value of non carcass edible portion could be caused by the amount of gastrointestinal contents of each animal.

CONCLUSION

Priangan and Javanese Fat-tailed rams slaughtered in mature live weight were different in the composition of muscle and fat tissue. Priangan was leaner and the tail was lighter than Javanese Fat-tailed rams, but the head and testes of Priangan were heavier than Javanese Fat-tailed rams. The edible and inedible portion of non-carcass ranged from 30%-32% and 12%-15% of slaughter weight, respectively.

REFERENCES

- Abdullah, A. Y. & R. I. Qudsieh. 2008. Carcass characteristics of Awassi ram lambs slaughtered at different weight. *Lives. Sci.* 117:165-175. <http://dx.doi.org/10.1016/j.livsci.2007.12.020>
- Akhmadi, D., E. Purbowati, & R. Adiwanti. 2005. Edible portion percentage of rams fed different levels of diet tofu by-product. *J. Indon. Trop. Anim. Agric.* 30:248-253.
- Bonvillani, A., F. Pena, G. de Gea, G. Gomez, A. Petryana, & J. Perea. 2010. Carcass characteristics of Criollo Cordobés kid goats under an extensive management system: Effects of gender and live weight at slaughter. *Meat Sci.* 86:651-659. <http://dx.doi.org/10.1016/j.meatsci.2010.05.018>
- da Silva, A.S., D. A. Furtado, A. N. De Medeiros, R. G. Costa, M. F. Cezar, & J. M. P. Filho. 2011. Characteristics of carcass and non-carcass components in feedlot native goats in the Brazilian semiarid region. *R. Bras. Zootec.* 40:1815-1821. <http://dx.doi.org/10.1590/S1516-35982011000800027>
- DGLAH (Directorat General Livestock and Animal Health). 2011. Livestock and Animal Health Statistic. Ministry of Agriculture, Republic of Indonesia, Jakarta.
- Djajanegara, A. & M. Rangkuti. 1989. Sheep Production and Development in Indonesia. C. Devendra & PS. Faylon (Eds.). Book Series No 80/19E9. International Development Res. Center, Los Banos. Philippines. pp. 126-137.
- Freking, B. A. & K. A. Leymaster. 2004. Evaluation of Dorset, Finnsheep, Romanov, Texel and Montadale breeds of sheep: IV. Survival, growth and carcass traits of F1 lambs. *J. Anim. Sci.* 82: 144-153.
- Herman, R. 2005. Produksi karkas dan non karkas domba Priangan dan Ekor Gemuk pada bobot potong 17,5 dan 25.0 Kg. *Med. Pet.* 28:8-12.
- Herman, R. 2004. Carcass composition and muscle distribution of mature Priangan rams. *J. Indon. Trop. Anim. Agric.* 29:57-64.
- Herman, R. 2001. Komposisi karkas domba Priangan dan Ekor Gemuk jantan muda yang dipotong pada bobot yang berbeda. *J. Pet. dan Lingk.* 08: 49-56.
- Karim, S. A., K. Porwal, S. Kumar, & V. K. Singh. 2007. Carcass traits of Kheri lambs maintained on different system of feeding management. *Meat Sci.* 76: 395-401. <http://dx.doi.org/10.1016/j.meatsci.2006.06.008>
- Lambe, N. R., E. A. Navajas, K. A. McLean, G. Simm, & L. Bünger. 2007. Changes in carcass traits during growth in lambs of two contrasting breeds, measured using computer tomography. *Lives. Sci.* 107:37-52. <http://dx.doi.org/10.1016/j.livsci.2006.09.001>
- McPhee, M. J., D. L. Hopkins, & D. W. Pethick. 2008. Intramuscular fat levels in sheep muscle during growth. *Aus. J. Exp. Agric.* 48: 904-909. <http://dx.doi.org/10.1071/EA08046>
- NRC (National Research Council). 1985. Nutrient requirements of sheep. 6 ed. National Academy, Washington, D.C.
- Pena, F., T. Cano, V. Domenech, Ma. J. Alcalde, J. Martos, A. Garc'ia-Martinez, M. Herrera, & E. Rodero. 2005. Influence of sex, slaughter weight and carcass weight on "non-carcass" and carcass quality in segureña lambs. *Small Rum. Res.* 247-254.
- Priyanto, R. & E. R. Johnson. 2012. The growth and distribution of carcass fat in fattening steer of different breeds. *Med. Pet.* 35: 45-48. <http://dx.doi.org/10.5398/medpet.2012.35.1.45>
- Rianto E., E. Lindasari, & E. Purbowati. 2006. Pertumbuhan dan komponen fisik karkas domba ekor tipis jantan yang mendapat dedak padi dengan aras berbeda. *J. Prod. Ternak.* 8: 28-33
- Steel, R. G. D. & J. H. Torrie. 1980. Prinsip dan Prosedur Statistika. Terjemahan: B. Sumantri. Gramedia Pustaka Utama, Jakarta.
- Yilmaz, A., B. Ekiz, M. Ozcan, C. Kaptan, H. Hanoglu, I. Erdogan, & O. Kocak. 2009. Carcass traits of improved and indigenous lamb breeds of North-Western Turkey under an intensive production system. *Ital. J. Anim. Sci.* 8:663-675.
- Zgur, S., A. Cividini, D. Kompan, & D. Birtie. 2003. The effect of live weight at slaughter and sex on lambs carcass traits and meat characteristics. *Agric. Cons. Sci.* 68:155-159
- Zubir, R. Priyanto, E. Gurnadi, W. Manulu, & H. M. Winugroho. 2011. Production and physical composition of Priangan male sheep carcass supplemented by Pasak Bumi peptide (*Eurycoma longifolia* Jack). *JITV* 16: 184-193