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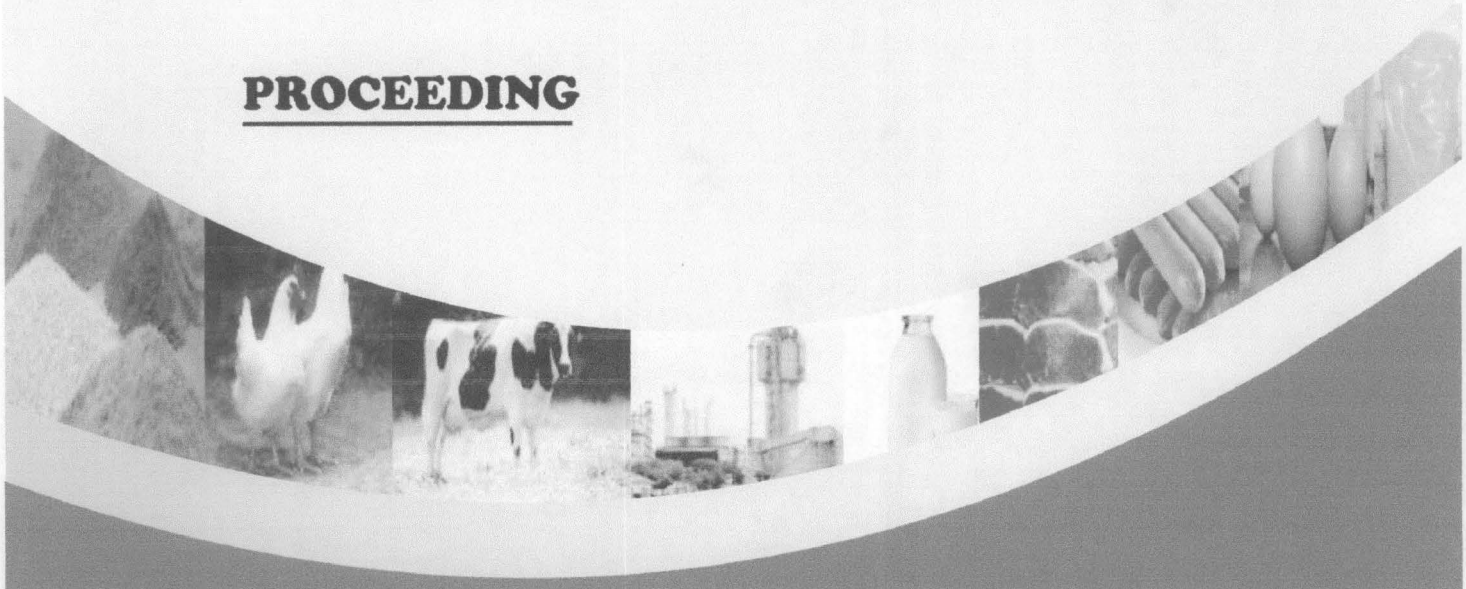

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Morphometric Performances of Thin Tail Sheep with Differences *Calpastatin* (Cast-1) Genotipees

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Abstract

Calpastatin (CAST) is an indigenous inhibitor of calpain that involved in regulation of protein turn over and growth. The objective of this research was to compare the morfometric performances of thin tail sheep with difference of CAST genotipees. PCR-RFLP method was carried out to identify genetic variation of CAST gene. Based on the identification, variation of CAST gene that found were MM and MN with the single Calpain genotype variation, TT. Nine thin tail sheeps from Jonggol were used for this research. The sheeps clustered based on the variation CAST gene, 5 sheeps were MM genotype and 4 sheeps were MN genotype. Variation of CAST gene gave significantly differences in morfometric performances. Sheeps with MM genotype have longer body length, heart girth, wither depth, and rump width than sheep with MN genotype. Sheeps with MM genotype had longer Ossa vertebrae cervicales Ossa vertebrae thoracicaeOssa vertebrae lumbales, Os vertebrae sacrales and Os scapulae.

Keywords: calpastatin, thin tail sheep, morfometric performances

Introduction

Thin tail sheep is one of the Indonesian native sheep that have potential to be developed. Although the adult animal's body weight is relatively small compared with sheep tail fat, but thin tail sheep are well adaptable to the limited availability of food and high temperature and child sheep mortality are relatively low (Subandriyo, 2003).

Progress in molecular biology allow livestock selection efforts can be done at the gene level, ie by looking for the diversity of genes that control livestock productivity. One marker genes associated with weight gain in the local sheep genes is gene that controlling regulation of calpain and calpastatin synthesis (Sumantri *et*

al., 2008). According to Camau *et al.* (2007), calpain and calpastatin are included in the calpain system. Calpain system is enzymes that contribute in meat tenderness by proteolytic post-slaughter. Calpain system has three members of the protein that is μ-calpain, m-calpain and calpastatin. Activity of μ-calpain and m-calpain is affected by Ca^{2+} ions. The functions calpain enzyme on live animal is to degrade proteins in the myofibril myofibrillar structure formation (Scanes, 2003).

Calpastatin is an enzyme to inhibit protein degradation muscle cells by the enzyme μ-calpain and m-calpain. Increased calpastatin activity can increase muscle mass (hypertrophy) accompanied by a decrease in meat tenderness. Calpastatin associate with myostatin regulate muscle growth rate, so the diversity of calpastatin gene is expected to affect the local sheep growth properties, and therefore variations in calpain system genes in sheep will not only influence the rate of postmortem meat tenderness but also expected to influence muscle growth.

The objective of this research was to study the comparative morphometry performance of thin tail sheep in the different variations of calpastatin genotypes.

Materials and Methods

This research used thin tail sheep from the Jonggol Animal Science Teaching and Research Unit (JASTRU). Based on the preliminary research for the detection of calpain and calpastatin gene diversity obtained calpastatin gene variations, that should have 3 variations of the genotypes MM, MN and NN, obtained only 2 variations genotipee, MM and MN, and NN gene variation was not found. M denotes the normal calpastatin allele, whereas N indicates that mutation calpastatin allele. Samples taken from sheep that had calpastatin genotypes MM and MN with the same calpain genotype (TT). Sheep with MM calpstatin genotype obtained of 5 samples, while for sheep with MN genotype obtained 4 samples. Sheep selected were male with a thin tail sheep ready for slaughter age is in the range of 1 to 1.5 years (I1).

The study was conducted in April to August 2011 at the Outdoor Laboratory of Small Ruminants, Animal Production and Technology Department, Faculty of Animal Science, Bogor Agricultural University.

Measurements on live animals were body weight and morphometrics performances. The morphometrics performances were measured body frame conformation. Body frame conformation Measurement used tuberosity and the processus that clearly visible in live sheep. This measurement was carried out to study the pattern of development and growth of both overall and per body part of sheep. Parameters observed in measurements of morphometry were:

a. Primary Morphometrics
   - Body length
   - Body height
   - Wither depth
   - Wither widhth

- Hips leight
- Hearth girth
- Rump width

b. Part of *Columna vertebralis*
   - *Ossa vertebrae cervicales*
   - *Ossa vertebrae thoracicae*
   - *Ossa vertebrae lumbales*
   - *Os vertebrae sacrales*

c. Extrimity Length
   - *Os scapula*
   - *Os humerus*
   - *Ossa radius-ulna*
   - *Ossa metacarpalia*
   - *Os femoris*
   - *Ossa tibia-fibula*
   - *Ossa metatarsalia*

The data obtained were analyzed using Student's t test, two-tailed hypothesis to compare differences of calpastatin gene variations between MM and MN. Mathematical model according to Steel and Torrie (1991) was:

$$t = \frac{(Xa - Xb) - (\mu a - \mu b)}{Sxa - xb}$$

explanation :

t : T value to be compared with the t table to determine the acceptance of the hypothesis

$(Xa - Xb)$: The average difference in sample a and b

$(\mu a - \mu b)$: Difference in the average of population a and b

$Sxa - xb$: Standard error value

Results and Discussion

Morphometric measurements used to determine rate of livestock growth. Morphometric performance of sheep with differences of calpastatin genotypes are presented in Table 1. Body weight, daily body weight gain, height, chest height and width of the hips did not show significant differences. Body length of thin tail sheep MM genotype significantly longer than MN genotype. The main components that affect body length are the joints of the spine (vertebrae Columna). Columna vertebre arranged from *Ossa vertebrae cervicales, Ossa vertebrae cervicales, Ossa vertebrae lumbales* and *Os vertebrae sacrales*. Based on the measurement, all part of *Columna vertebralis* of MM genotype thin tail sheep significantly longer than the MN genotype, so muscle formed on a commercial cuts of neck, rack and loin will be longer when compared with the MN genotype.

Hearth girth and wither depth are parameters that indicate the dimensions of rib cage (rib cage). Based on the measurements, MM genotype of thin tail sheep had significantly larger hearth girth and longer wither depth than the MN genotype. It showed that MM genotype of the thin tail sheep had rib cage dimensions larger

than the MN genotype. MM genotype of Thin tail sheep had a longer *Os scapulae* compared with MN genotype. Os scapula sizes would give a influence of shoulder percentage.

Tabel 1. Morphometric performance of sheep with differences of calpastatin genotypes

Parameters	Calpastatin Genotypes			
	MM (n=5)	CV (%)	MN (n=4)	CV (%)
Primary Morphometrics				
Body weight (kg)	20.56 ± 2,27	12.77	19.12 ± 2.09	10.93
Body length (cm)	54.13 ± 2.83^{a}	5.22	51.28 ± 2.22^{b}	4.32
Body height (cm)	56.46 ± 2.54	4.50	55.81 ± 1.67	2.99
Hips height (cm)	57.69 ± 1.95	3.38	57.30 ± 2.28	3.98
Heart girth (cm)	63.17 ± 2.76^{A}	4.36	59.86 ± 2.30^{B}	3.84
Wither depth (cm)	26.18 ± 1.17^{a}	4.49	25.04 ± 1.19^{b}	4.74
Wither width (cm)	14.64 ± 0.38	2.57	14.59 ± 0.47	3.22
Ramp width (cm)	13.03 ± 0.73^{A}	5.62	11.83 ± 0.58^{B}	4.91
Part of *Columna vertebralis*				
Ossa vertebrae cervicales (cm)	11.59 ± 0.64^{a}	5.48	11.01 ± 0.49^{b}	4.47
Ossa vertebrae cervicale (cm)	18.48 ± 0.96^{a}	5.22	17.51 ± 0.75^{b}	4.28
Ossa vertebrae lumbales (cm)	11.32 ± 0.59^{a}	5.20	10.73 ± 0.45^{b}	4.16
Os vertebrae sacrales (cm)	7.99 ± 0.41^{a}	5.18	7.58 ± 0.34^{b}	4.46
Part of Extrimity				
Os scapula (cm)	21.72 ± 0.96^{A}	4.40	20.64 ± 0.84^{B}	4.07
Os humerus (cm)	15.82 ± 0.70	4.40	15.64 ± 0.47	2.99
Ossa radius-ulna(cm)	14.98 ± 0.67	4.45	14.82 ± 0.44	2.96
Ossa metacarpalia (cm)	10.05 ± 0.44	4.39	9.93 ± 0.30	3.05
Os femoris (cm)	13.09 ± 0.38	2.92	12.94 ± 0.39	2.99
Ossa tibia-fibula (cm)	20.74 ± 0.93	4.49	20.50 ± 0.64	3.11
Ossa metatarsalia (cm)	15.93 ± 0.54	3.37	15.92 ± 0.47	2.97

Different superscript letters on the same lines suggested a significant difference between treatments ($P < 0.05$), superscript capital letter stating the difference highly significant ($P < 0.01$), n = number of samples (tail), KK= coefficient of variance (standard deviation / average x 100%).

Hips Width indicate the distance between the pubis (O*s pubis*) to the hip band (*Ossa membri pelvini*). This parameter indicate the distance between the feet, which is the stifle area muscle deposition. Hips Width of

MM genotype of thin tail sheep were larger than that of MN genotype. Based on the overall data, thin tail sheep with MM genotype had larger morphometri performance than MN genotype. It suggested that calpastatin had potential to influence the growth of bones, especially in body axis. It was closely related to the function of calcium as bone formation and calpain enzyme whose activity is influenced by the concentration of ions Ca^{2+}.

Conclusions

Thin tail sheep with MM genotype had larger morofometri performance than MN genotype. It suggested that calpastatin had potential to influence the growth of bones, especially in body axis.

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