Birth Weight and Linear Body Measurements of Saburai Goats: Influence of Sex and Birth Type

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Abstract. This study aimed to evaluate the effects of sex and birth type on birth weight and linear body measurements of Saburai Goats at different age groups (0, 3, 6, 9, and 12 months of age). The study used secondary data from 76 Saburai Goats raised in Lampung Province. Data were obtained from farm records and included birth weight, chest circumference, body length, ear length, and withers height. The data were analyzed using an independent t-test to compare differences between groups. The results showed that male goats had significantly ($P<0.05$) higher birth weight (3.99 ± 1.62 kg) than females (2.76 ± 0.44 kg). In single births, male goats (5.26 ± 1.40 kg) had significantly ($P<0.05$) higher birth weight than females (3.79 ± 0.79 kg), while in twin births, no significant difference was observed ($P>0.05$). Birth weight in single births was significantly higher than in twin births for both sexes ($P<0.05$). Body size measurements, including chest circumference, body length, ear length, and withers height, were generally higher in males than in females across age groups. In conclusion, sex and birth type significantly affected the birth weight of Saburai goats, with males and single-born kids showing higher birth weight than females and twins, respectively. The independent t-test analysis revealed that the effect of sex on linear body measurements was parameter- and age-dependent. Specifically, body length and withers height were consistently greater in males across all age groups, while chest circumference and ear length showed significant differences between sexes only at certain ages. These findings suggest that sex and birth type are important factors to consider in selection and breeding programs for Saburai Goat.

Keywords: age group, birth weight, body size, birth type, Saburai Goat

Abstrak. Penelitian ini bertujuan untuk mengevaluasi pengaruh jenis kelamin dan tipe kelahiran terhadap bobot lahir dan ukuran linear tubuh kambing Saburai pada berbagai kelompok umur (0, 3, 6, 9, dan 12 bulan). Penelitian ini menggunakan data sekunder dari 76 ekor kambing Saburai yang dipelihara di Provinsi Lampung. Data diperoleh dari catatan peternakan (farm records) yang meliputi bobot lahir, lingkar dada, panjang badan, panjang telinga, dan tinggi pundak. Data dianalisis menggunakan uji t independen untuk membandingkan perbedaan antarkelompok. Hasil penelitian menunjukkan bahwa kambing jantan memiliki bobot lahir yang signifikan lebih tinggi ($P < 0,05$) sebesar 3,99 ± 1,62 kg dibandingkan dengan kambing betina, yaitu 2,76 ± 0,44 kg. Pada tipe kelahiran tunggal, kambing jantan (5,26 ± 1,40 kg) memiliki bobot lahir yang lebih tinggi secara signifikan ($P < 0,05$) daripada kambing betina (3,79 ± 0,79 kg), sedangkan pada kelahiran kembar (kembar dua), tidak ditemukan perbedaan yang signifikan ($P > 0,05$). Bobot lahir pada kelahiran tunggal secara signifikan lebih tinggi dibandingkan dengan kelahiran kembar untuk kedua jenis kelamin ($P < 0,05$). Ukuran dimensi tubuh, yang meliputi lingkar dada, panjang badan, panjang telinga, dan tinggi pundak, secara umum lebih tinggi pada kambing jantan dibandingkan dengan kambing betina di seluruh kelompok umur. Kesimpulannya, jenis kelamin dan tipe kelahiran berpengaruh signifikan terhadap bobot lahir kambing Saburai, di mana kambing jantan dan anak kambing yang lahir tunggal menunjukkan bobot lahir yang lebih tinggi masing-masing dibandingkan dengan kambing betina dan kembar. Analisis uji-t independen mengungkapkan bahwa pengaruh jenis kelamin terhadap ukuran linear tubuh bergantung pada parameter dan umur. Secara khusus, panjang badan dan tinggi pundak secara konsisten lebih besar pada kambing jantan di semua kelompok umur, sementara lingkar dada dan panjang telinga menunjukkan perbedaan yang signifikan antara jenis kelamin hanya pada umur-umur tertentu. Temuan ini menunjukkan bahwa jenis kelamin dan tipe kelahiran merupakan faktor penting yang perlu dipertimbangkan dalam program seleksi dan pemuliaan kambing Saburai.

Kata kunci: kelompok umur, bobot lahir, ukuran tubuh, jenis kelamin, Kambing Saburai

Introduction

Goats are one of the most important small ruminants in Indonesia, particularly in Lampung Province, where they contribute significantly to meat production and rural livelihoods. One of the locally developed breeds is the Saburai goat, a cross between Boer males and Peranakan Etawa (PE) females. This breed is known for its

adaptability, disease resistance, and relatively high productivity compared to local goats (Sulastri et al., 2018).

The population of Saburai goats has steadily increased, indicating their potential for further development. However, improving productivity remains a key challenge, particularly in terms of growth performance and body development. Birth weight and body size are important indicators of livestock productivity, as they are closely related to growth rate, survival, and future reproductive performance.

Several factors influence birth weight, including genetics, maternal nutrition, litter size, and environmental conditions. Previous studies have reported that male kids generally have higher birth weight than females, and single-born kids are heavier than twins. However, most studies have focused only on general comparisons without providing detailed growth patterns across different ages or linking birth characteristics to subsequent body size development.

In addition, limited information is available regarding the growth performance of Saburai goats under local management conditions in Lampung, especially using field recording data. Understanding how birth weight varies with sex and birth type, and how these factors relate to body size development at different ages, is important for improving selection criteria in breeding programs.

Therefore, this study was conducted to evaluate the effect of sex and birth type on birth weight and body size of Saburai Goats, as well as to describe their growth performance from birth to 12 months of age. The results of this study are expected to provide practical information for breeders in selecting superior animals, particularly in prioritizing male and single-born kids for breeding and fattening programs.

Materials and Methods

This study was conducted in May 2024 in Lampung Province using secondary data obtained from Saburai Goat farm records. A total of 76 goats aged 0 to 12 months were included in the study. The animals were raised under semi-intensive management systems. Figure 1 shows the adult and kids of the Saburai Goat.

Data collected included birth weight (kg), chest circumference (cm), body length (cm), ear length (cm), and withers height (cm). Body measurements were recorded at ages 0, 3, 6, 9, and 12 months. Chest circumference is measured by wrapping a measuring tape around the chest, just behind the shoulder, and is usually expressed in centimeters (cm). Body length is measured from the base of the shoulder (tuber humeri) to the tip of the sitting bone (tuber ischii) using a measuring stick and expressed in centimeters (cm).

Figure 1. Adults and kids of Saburai Goats

Ear length is measured from the base of the ear near the head to the tip of the hanging ear and expressed in centimeters (cm). Withers height is measured from a flat surface to the highest part of the withers passing through the scapula perpendicularly using a measuring stick expressed in centimeters (cm) (SNI, 2015).

Data were grouped based on sex (male and female) and birth type (single and twin). Statistical analysis was performed using an independent t-test to compare differences between groups. The significance level was set at 5% (P<0.05). Data analysis was conducted using Minitab 14 software.

Results and Discussion

Statistical analysis revealed a significant difference (P<0.05) in birth weight of Saburai Goats based on sex, with an average birth weight of 3.99 kg in males and 2.76 kg in females. The birth weights of male and female Saburai Goats are presented in Table 1.

Sex differences affect the birth weight of goats. Male goats generally have higher birth weight than females. This difference is attributed to hormonal influences: male fetuses produce testosterone, which promotes the growth of body tissues and results in higher birth weight. According to Satriawan et al. (2024), testosterone stimulates faster growth in male goats, whereas female goats produce estrogen, a catabolic hormone that suppresses bone resorption and consequently slows growth.

Birth type also significantly affected birth weight in Saburai Goats across sexes. In single births, males (5.26 kg) were significantly (P<0.05) heavier than females (3.79 kg). In twin births, no significant difference was observed between males (2.72 kg) and females (2.55 kg) (P>0.05). The results of statistical tests can be seen in Table 2.

Birth type had a significant effect (P<0.05) on birth weight within each sex. In male Saburai Goats, single-born kids had higher birth weight (5.23 kg) than twins (2.72 kg). Similarly, in female Saburai Goats, single-born kids were heavier (3.79 kg) than twins (2.55 kg). The results of the statistical tests are presented in Table 3.

Table 1. Birth weight by sex

Aspect	Sexes		Sig.
	Male	Female	
Number of samples (head)	38	38	
Birth weight (kg)	3.99 ± 1.62^{a}	2.76 ± 0.44^{b}	0.000

Notes: ^{a,b}: Different superscripts in the same row indicate significant differences (P<0.05)

Table 2. Birth weight by sex in different birth types

Aspect	Sexes		Sig.
	Male	Female	
Number of samples (head)	19	19	
Birth weight of single birth type (kg)	$5.26 \pm 1.4^{a}0$	3.79 ± 0.79^{b}	0.000
Birth weight of twin birth type (kg)	2.72 ± 0.26^{ns}	2.55 ± 0.38^{ns}	0.100

Notes: ^{a,b}: Different superscripts in the same row indicate significant differences (P<0.05); ns: No-significant

Table 3. Birth weight by sex in different birth types

Aspect	Sexes		Sig.
	Single	Twin	
Number of samples (head)	19	19	
Birth weight of male (kg)	5.23 ± 1.40^{a}	2.72 ± 0.26^{b}	0.000
Birth weight of female (kg)	3.79 ± 0.79^{a}	2.55 ± 0.38^{b}	0.000

Notes: ^{a,b}: Different superscripts in the same row indicate significant differences (P<0.05); ns: No-significant

Table 4. Body size of males and females at different ages

Aspect	Sexes		Sig.
	Male (n=18)	Female (n=23)	
Age 0 months			
Chest circumference (cm)	38.83 ± 5.99[a]	31.48 ± 2.50[b]	0.00
Body length (cm)	32.39 ± 3.91[a]	29.09 ± 2.81[b]	0.01
Ear length (cm)	14.28 ± 2.43[a]	11.83 ± 1.40[b]	0.00
Withers height (cm)	37.17 ± 4.07[a]	33.22 ± 1.44[b]	0.00
Age 3 months			
Chest circumference (cm)	51.92 ± 5.23[a]	47.83 ± 4.91[b]	0.02
Body length (cm)	42.83 ± 4.49[a]	39.93 ± 3.38[b]	0.03
Ear length (cm)	18.17 ± 1.34[a]	16.28 ± 1.59[b]	0.00
Withers height (cm)	47.44 ± 3.88[a]	44.76 ± 3.91[b]	0.04
Age 6 months			
Chest circumference (cm)	54.25 ± 2.65[ns]	53.67 ± 3.25[ns]	0.53
Body length (cm)	46.17 ±3.63[a]	44.00 ± 2.71[b]	0.04
Ear length (cm)	18.83 ±1.47[a]	17.41 ± 1.64[b]	0.01
Withers height (cm)	51.89 ± 3.34[a]	49.37 ± 3.91[b]	0.03
Age 9 months			
Chest circumference (cm)	58.53 ± 4.66[ns]	57.96 ± 3.70[ns]	0.67
Body length (cm)	50.08 ± 3.67[a]	47.30 ± 3.28[b]	0.02
Ear length (cm)	19.83 ± 1.59[ns]	19.00 ± 1.95[ns]	0.14
Withers height (cm)	55.4 ± 3.60[a]	52.13 ± 4.34[b]	0.01
Age 12 months			
Chest circumference (cm)	63.14 ± 2.81[ns]	61.26 ± 4.44[ns]	0.11
Body length (cm)	53.33 ± 3.04[a]	50.50 ± 2.62[b]	0.00
Ear length (cm)	21.36 ±1.98[a]	19.89 ± 2.02[b]	0.03
Withers height (cm)	62.06 ± 5.26[a]	54.48 ± 4.35[b]	0.00

Notes: [a,b]: Different superscripts in the same row indicate significant differences (P<0.05); ns: No-significant

Single-born Saburai Goats had higher birth weight than twins for both sexes (males: 5.26 vs. 2.72 kg; females: 3.79 vs. 2.55 kg). In single births, kids receive all maternal nutrition during gestation. In twin births, nutrients are distributed among fetuses, reducing the amount available to each individual. Adriani (2014) identified key factors affecting birth weight as litter size, sex, maternal nutrition during pregnancy, and season. Nurgiartiningsih et al. (2006) and Nasich (2011) stated that single births consistently produce higher birth weight than twins or triplets.

Quantitative characteristics can be reviewed based on several parameters, including chest circumference, body length, ear length, and withers height. These body measurements can describe whether the livestock has a normal body shape, and can reflect livestock performance.

Quantitative characteristics of Saburai Goats, including chest circumference, body length, ear length, and withers height, were measured directly in the field. Data were analyzed at a significance level of 5% (P<0.05). Data were collected from goats aged 0, 3, 6, 9, and 12 months and are presented in Table 4.

Chest Circumstance

The study found that the chest circumference of male Saburai Goats at the ages of 0, 3, 6, 9, and 12 months was, respectively, 38.83 ± 5.99 cm; 51.92 ± 5.23 cm; 54.25 ± 2.65 cm; 58.53 ± 4.66 cm; and 63.14 ± 2.81 cm. The chest circumference of female Saburai Goats at the ages of 0, 3, 6, 9, and 12 months was,

respectively, 31.48 ± 2.50 cm; 47.83 ± 4.91 cm; 53.67 ± 3.25 cm; 57.96 ± 3.70 cm, and 61.26 ± 4.44 cm. At the age range of 0 and 3 months, the chest circumference of male Saburai Goats in this study was larger compared to the study by Omelia et al. (2023), which obtained results of 29.23 ± 3.83 cm and 48.00 ± 3.84 cm. Chest circumference is influenced by genetic and environmental factors. Genetic factors are inherited from their ancestors, and each breed of livestock has its own characteristics, while environmental factors include feed, climate, maintenance management by farmers, health, and others (Hamdani et al., 2017).

Table 4 shows that the chest circumference of male and female Saburai Goats continues to increase in size along with the age of the livestock. This is in accordance with Purwanti's statement (2019) that changes in chest circumference can be influenced by two things, namely the increase in the size of the chest ribs and the growth of muscle tissue. As age increases, the size of the chest circumference will change. Chest circumference can be used to estimate body weight, and can be used as an estimate of the size of livestock, and has a close relationship with the live weight of the livestock. The size of the chest circumference will continue to increase until it reaches the point of body maturity (the highest point of the sigmoid curve).

Chest circumference in males aged 0 and 3 months had a significant difference with females in the same age range ($p < 0.05$), then no significant difference ($P > 0.05$) between male and female livestock in the age range of 6, 9, and 12 months. Chest circumference in male livestock had a more rapid increase in size compared to female livestock at a young age of 0 and 3 months. This is due to differences in birth weight. The data in Tables 1, 2, and 3 show that the birth weight of male goats is higher than that of females. High body weight affects the body size of livestock. The higher the weight of the livestock, the higher the body size. This is in accordance with the research of Sutopo et al. (2022), which reported that body weight is positively correlated with chest circumference in thin-tailed sheep. The higher increase in chest circumference in young male livestock is in accordance with the statements of Parakkasi (1999) and Pikan et al. (2018) that the body size of livestock is also influenced by sex, because this factor plays a role in stimulating growth and providing clues to distinguish the growth of males and females. Males Saburai Goats have faster growth compared to females, so this affects the size of the chest circumference of males, which is larger than that of females.

Body Length

According to Ramdani et al. (2016), body length is the outcome of a continuous growth process involving all other body parts. Table 4 shows that body length in male and female Saburai Goats differed significantly ($P<0.05$) across all age groups and increased consistently with age. This is consistent with Purwanti et al. (2019), who reported that bone growth continues until the point of body maturity. Furthermore, Soeparno (1992) noted that androgen hormones in male livestock stimulate growth, causing males to grow faster than females, resulting in greater body length in male Saburai Goats compared to females.

The body length of male Saburai Goats in this study at the ages of 0, 3, 6, 9, and 12 months was, respectively, 32.39 ± 3.91 cm, 42.83 ± 4.49 cm, 46.17 ± 3.63 cm, 50.08 ± 3.67 cm, and 53.33 ± 3.04 cm. In female Saburai goats, the results of body length measurements at the ages of 0, 3, 6, 9, and 12 months were, respectively, 29.09 ± 2.81 cm, 39.93 ± 3.38 cm, 44.00 ± 2.71 cm, 47.30 ± 3.28, and 50.50 ± 2.62 cm. The measurement results in this study are different when compared to the study conducted by Omelia et al. (2023), namely, the body size of male Saburai goats at the ages of 0, 3, and 12 months was 25.77 ± 2.31 cm, 45.89 ± 4.40 cm, and 63.39 ± 4.64 cm, respectively. In the age range of 0

months, the results of the study showed greater results compared to the results of the study by Omelia et al. (2023), while in the age range of 3 and 12 months, the results obtained were smaller. This is influenced by various factors, one of which is the provision of different feed and maintenance management by farmers. Providing feed with high protein content can affect body length in goats because protein supports bone growth and muscle formation.

The body length of an observed Saburai Goat is interrelated with the body frame, where the size and components of the body are in a biological balance. The growth of body length is influenced by the growth of the spine, which continues to increase, consisting of the backbone (thoracic vertebrae), the lumbar vertebrae, and the sacral vertebrae (Mardhianna et al., 2015).

Ear Length

Ear length is not an indicator for estimating body weight, but ear length is a characteristic of a goat breed, so ear length is one of the body measurements used in selection (Sulastri et al., 2012). Ear size in goats can be a reference for distinguishing a breed, and it will continue to grow longer with age. Saburai Goats themselves are the crossbreeding between the female Peranakan Etawa (PE) goats and the male Boer Goats.

The research data, as presented in Table 4, shows that there is a significant difference ($p<0.05$) between the ear length of male and female Saburai Goats at the ages of 0, 3, 6, and 12 months, while at the age of 9 months, the ear length was not significantly different ($p>0.05$). This is because the quantitative size of the livestock body can be influenced by feed and environmental conditions. According to Azmidaryanti et al. (2017), the body size of livestock can be influenced by the conditions of the area where the livestock is kept. In addition, Lorato et al. (2015) stated that genetic and environmental factors can affect the ear length of livestock. The percentage of ear length genes inherited from male and female parents can vary between individuals due to genetic factors that influence it, while the environmental factors that influence it are the geographical conditions where the livestock are kept.

Subagyo et al. (2017) stated that the average ear length of male and female PE Goats was 33.2 ± 4.43 and 29.3 ± 3.62 cm at the age of 12 months. Sulastri et al. (2014) stated that the average ear length of 3-month-old Boer Goats was 13.50 ± 1.30 cm. Based on a comparison of the ear length of the two Saburai Goat parents, the ear length of the male and female Saburai Goats whose data were taken in this study was between those of the two parents, namely PE goats, which have the characteristic of long ears, and Boer goats, which have the characteristic of shorter ears.

Withers Height

The height of the withers is one of the parameters that determines the performance of livestock. The withers are measured by stretching a measuring tape from a flat surface perpendicular to the highest point of the withers, which is at the third and fourth vertebrae. The growth of the withers height shows that the bones that make up the legs experience growth according to their function to support the livestock's body (Septian et al., 2015).

The average height of the withers of male Saburai Goats at the ages of 0, 3, and 12 months in this study were respectively 37.17 ± 4.07 cm; 47.44 ± 3.88 cm; and 62.06 ± 5.26 cm, while the height of the withers of female at the ages of 0, 3, and 12 months were respectively 33.22 ± 1.44 cm; 44.76 ± 3.91 cm; and 54.48 ± 4.35 cm. This withers height is different from the results of the study conducted by Omelia et al. (2023), who obtained the average shoulder height of male Saburai Goats at the ages of 0, 3, and 12 months were 29.08 ± 3.43 cm, 46.44 ± 1.13 cm, and 63.52 ± 1.31 cm, respectively. Widi et al. (2016) stated

that the body size of livestock can be influenced by sex, and in general, male goats have a bigger body size.

The height of the withers of male and female Saburai Goats at various age ranges (0, 3, 6, 9, and 12 months) showed a significant difference ($p<0.05$) with a higher withers height in males than females. This is influenced by the activity of androgen hormones in male livestock. Androgen hormones in male goats make the growth of male livestock faster than that of female livestock. This is in accordance with the statement of Yunus et al. (2016) that the body size of goats will continue to increase, and the optimal body size in goats occurs at an age of over 24 months.

Conclusions

This study concluded that sex and birth type significantly affected the birth weight of Saburai Goats. Male kids consistently exhibited higher birth weight than females, and single-born kids were heavier than twins across both sexes. Body length and withers height were greater in males than females across all age groups (0, 3, 6, 9, and 12 months). Chest circumference showed significant differences between sexes only at 0 and 3 months, with no significant difference observed at 6, 9, and 12 months. Ear length also displayed significant sex differences at most age groups, with the exception of 9 months. These findings underscore the importance of considering sex and birth type in the selection and breeding programs for Saburai Goats in Lampung.

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