Growth Pattern of Different Body Dimensions in Female Kacang Goats

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Abstract. The purpose of this study was to determine the growth patterns of female Kacang goats Growth Pattern of Different Body Dimensions in Female Kacang Goats. We measured 23 female goats for variables including body weight, chest circumference, shoulder height, and body length. The results showed that body weight followed the sigmoid curve pattern (S) with a regression equation y = 0.0005x3-0.0837x2 + 3.0707x + 0.119 with a coefficient of determination of 88.99%, while body size for chest circumference, body length, and shoulder height follows a polynomial pattern with regression equations $y = -0.0627x^2 + 3.1156x + 40.333$, $y = -0.033x^2 + 1.6941x + 43.125$, and $y = -0.0418x^2 + 2.1168x + 39.089$, respectively and the coefficient of determination was 85.26%, 82.46%, and 68.53%, respectively. The research concluded that the growth of body dimensions in livestock has fluctuated. The increase of body dimensions in female-goat goats peaked at the age of 21-30 months, then started to decline during 31-40 months. It is correlated with the fact that age greatly affects the dimensions of the animal body. The highest coefficient determination value was observed in body weight, namely 88.89%.

Keywords: Female Kacang Goat, growth pattern, body dimensions

Abstrak. Tujuan dari penelitian ini adalah untuk mengetahui pola pertumbuhan Kambing Kacang Betina. Materi yang digunakan adalah Kambing Kacang betina sebanyak 23 ekor. Variabel yang ukur meliputi bobot badan, lingkar dada, tinggi pundak dan panjang badan. Hasil penelitian menunjukkan bahwa bobot badan mengikuti pola kurva sigmoid (S) dengan persamaan regresi $y = 0{,}0005x^3-0{,}0837x^2+3{,}0707x+0{,}119$ dengan nilai koefisien determinasi sebesar 88,89%, sedangkan ukuran tubuh lingkar dada, panjang badan, dan tinggi pundak mengikuti pola polynomial dengan persamaan regresi berturut – turut $y=-0{,}0627x^2 +3{,}1156x +40{,}333$; $y=-0{,}033x^2+ 1{,}6941x+ 43{,}125$; $y=-0{,}0418x^2+ 2{,}1168x + 39{,}089$ dengan nilai koefisien determinasi berturut turut sebesar 85,26%; 82,46% dan 68,53%. Simpulan dari penelitian ini adalah pertumbuhan dimensi tubuh pada ternak mengalami peningkatan dan penurunan, semakin tua umur ternak maka semakin lambat pertumbuhannya. Puncak tertinggi peningkatan ukuran dimensi tubuh pada ternak Kambing Kacang Betina pada umur 21-30 bulan, hal ini berkaitan bahwa umur sangat berpengaruh pada ukuran dimensi tubuh ternak. Nilai Koefisien determinasi tertinggi diperoleh pada Bobot Badan, yaitu sebesar 88,89%.

Kata Kunci: Kambing Kacang betina, pola pertumbuhan, dimensi tubuh

Introduction

Goats are small livestock that provides benefits to fulfill meat demand. Kacang goats are reared by a broader community for their beneficial properties, such as easy to breed, quick to reach sexual maturity, relatively easy maintenance, low-space requirement, low capital for breeding, easy to develop, adaptable to unfavorable conditions, and tolerant to almost all types of food from leaves and grass to fruit skins and agricultural waste. Kacang goat livestock is adaptive to barren land with limited feed availability and resistant to disease (Sodiq et al., 2010; Budiarto et al., 2021). According to Sutama (2005), biologically, goats are generally productive and comfortable to develop and produce in unfavorable environments.

It is important to pay attention to body weight gain of female Kacang goat because female livestock plays a significant role in increasing the livestock population. The importance of knowing the growth curve in female-born goats is having the knowledge whether the livestock is suitable for development and for breeding. In case of non-optimum growth curve in adult cattle with mature sex, it is necessary to follow up on

maintenance management and take measures to improve contributing factors during the maintenance period. However, if cattle growth has increased optimally, the livestock is suitable for development and breeding.

This study aims to determine the growth patterns of female Kacang goats, determine the growth rate from pre-weaning to adulthood, and contribute to the wealth of data recording of female Kacang goats in UPT Agri Science Technopark UNISLA.

Materials and Methods

This research was conducted at UPT Agri Science Technopark, Islamic University of Lamongan. The research used 23 female Kacang goats that consisted of four pre-weaned kids, six weaned kids, and 13 adult goats. The goats were selected through purposive sampling with parameters of age, body weight measurements, shoulder height, chest circumference, and body length.

Data on Body Length (BL), Body Weight (BW), Shoulder Height (SH), and Chest Circumference (CC) on the growth patterns of female Kacang goats were analyzed by multiple linear regression. The data obtained were then tabulated and analyzed quantitatively with polynomial regression analysis using the Microsoft Excel 2010 program.

Results and Discussion

Body Weight Growth Pattern

The average body weights of female Kacang goats from different age groups in UPT Agri Science Technopark UNISLA are presented in Table 1.

Table 1 Weight measures of female goat goats

Age (month)	Frequency	Average body weight (Kg)
1-10	8	12.88±6.71
11-20	6	29.5±5.01
21-30	5	32.8±4.5
31-40	4	26.75±2.63

Source: Processed Primary Data (2020)

Based on Table 1, the bodyweight of female Kacang goats in the younger age groups has a more significant coefficient of variation than the older ones. In other words, younger Kacang goats have a more diverse body weight than the older one. The older the female Peanut Goat's age at UPT. Agri Science Technopark, Body weight diversity is getting smaller or more uniform. Less variety of body weight at the age of 30 to 40 months is indicative of a constant or slowing growth rate after achieving adult body weight. According to Sampurna and Ketut (2010), growth has fast and slow stages. The faster stage occurs when the livestock is sexually immature, and the slow stage occurs when the body has reached maturity.

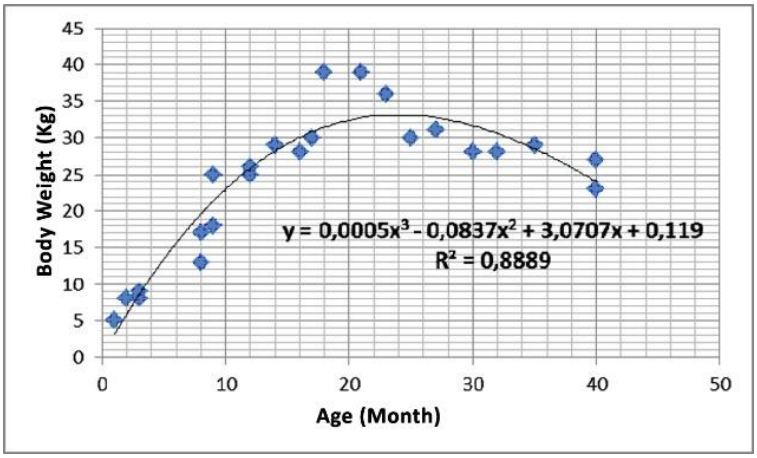

Figure 1. Growth pattern curve of female Kacang Goat body weight

Based on the results of the analysis, the growth pattern of female Kacang goat body weight follows the polynomial regression equation, namely $y = 0.0005x^3-0.0837x^2 + 3.0707x + 0.119$ with a coefficient of determination of 88.99%. In other words, 88.89% of the bodyweight of female Kacang goats in UPT Agri Science Technopark UNISLA is influenced by age and other body dimensions. The research results of Abadi et al. (2015) explained that the growth pattern of body weight of female Kacang goats in the Grobogan Regency formed the equation $y = -0.00215x^2 + 0.61764x + 6.91315$ with a determination coefficient value of 92.8%.

Bodyweight of female Kacang goats at the age of 1-3 and 4-6 months shows that the body weight gain of female Kacang goats is experiencing rapid growth because at that age female Kacang goats are sexually immature. Body weight gain starts to slow on 7-12 months, but increases again on 12-18 months and 18-30 months, and then slow down on 30-40 months, the growth has slowed down. Siregar (1994) stated that rapid growth occurs in the period of birth to weaning and puberty, but after puberty to adulthood, the growth rate begins to decline and will continue to decline until adulthood when the cattle stop growing.

Growth pattern of the chest circumference

The growth patterns of chest circumference of female Kacang goats in UPT. *Agri Science Technopark* UNISLA is presented in Table 2.

The growth pattern of female goat's breast circumference can be explained by the polynomial regression equation $y = -0.0627x^2 + 3.1156x +40.333$ with a coefficient of determination of 85.26%. Findings by Bukhori et al. (2017) explain that the growth pattern of Kacang goat in the South Konawe Regency has a polynomial regression equation $y = 31.84 + 1.512x + 0.0231x^2$ with a determination coefficient of 75.6%. It is suspected that the differences in the study results were caused by different sexes, feeding, and seeds, and hence, different growth speed.

The growth in the chest circumference refers to the development of the muscles attached to the ribs (Permatasari et al., 2013) or the body's size with the closest relationship with body weight (Malewa, 2009).

Table 2. Size of the goat's chest circumference

Age (month)	Frequency	average chest circumference (cm)
1-10	8	51.43±11.65
11-20	6	73.67±5.54
21-30	5	76.40±4.72
31-40	4	69.75±3.39

Source: Processed Primary Data (2020)

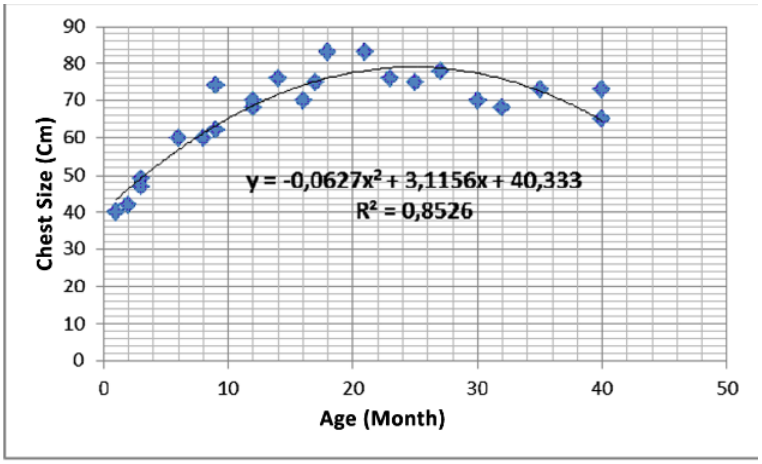

Figure 2. Chest circumference pattern curve for female Kacang goat

According to Sutiyono et al. (2006), chest circumference has grown sideways. (Rahardian et al., 2014) on female Kacang goats, in which fast-growth occurs when the cattle are 0-12 months old.Syawal et al. (2013) stated that feed factor is crucial. The size of the chest circumference increases with the growth and development of muscle tissue in the chest. Differences in body dimensions are influenced by fat and muscle deposition in body dimensions such as circumference, thickness, and body weight (Semakula et al., 2010; Setiatin et al., 2021).

Shoulder Height Growth Pattern

The growth pattern of shoulder height of female Kacang goats in UPT. Agri Science Technopark UNISLA is presented in Table 3. The growth of shoulder height of female Kacang goats increases rapidly at the age of 11-20 months, then slow down on 21-30 months.

The research results on the height growth pattern of female Kacang goats at UPT Agri Science Technopark UNISLA can be explained by the polynomial linear regression equation $y = -0.0333x^2 + 1.6941x + 43.125$ with a coefficient of determination of 82.46%. It means that 82.46% of female Kacang goats' shoulder height in the cattle's age influences UPT. Agri Science Technopark UNISLA. The results of the research by (Bukhori et al., 2017) explain that the growth pattern of the height of the male Kacang goat in South Konawe Regency has a polynomial regression equation, namely $y = 31.84 + 1.512x + 0.0231x^2$ with a coefficient of determination of (Septian et al., 2015) 71.7%. It is because the bones that make up the forelegs are more related to the shoulders' height experience initial growth compared to other components. This bone experiences the fastest growth according to its function to support the body.

While head and feet develop earlier, the body, especially the back, develops slowly and is the last part growing to reach adult size. Sutiyono et al. (2006) stated that relatively fast bone growth occurs in the bones of the head, thighs, front and hind legs. Meanwhile, relatively moderate bone growth occurs in the thoracic cavity and shoulders bones, and somewhat slow bone growth is observed in the lumbar, chest and hips.

Table 3. Size of shoulder height of female kacang goats

Age (month)	Frequency	Average shoulder height (Cm)
1-10	8	51±7.41
11-20	6	61.67±.72
21-30	5	62±1.22
31-40	4	60.80±3.10

Source: Processed Primary Data (2020)

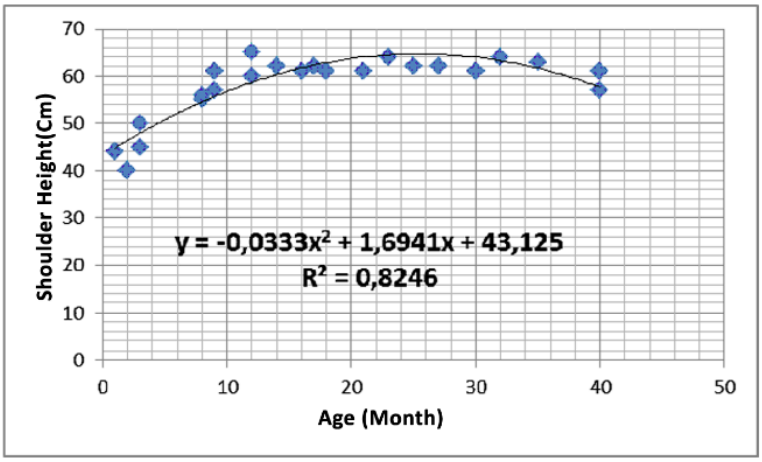

Figure 3. Curves of Height Patterns of Shoulder Height of Female Kacang Goats.

Growth Pattern of Body Length

The observations of the growth pattern of body length of female Kacang goat in UPT Agri Science Technopark UNISLA is presented in Table 4. The growth of body length of female Kacang goats increases rapidly at the age of 11-20 months, then slightly slows down on 21-30 months, and much slower on 30-40 months.

The results of this study were the growth patterns of male Kacang goat body length at UPT. Agri Science Technopark UNISLA can be explained by multiple linear regression equations, namely $y = -0.0418x^2 + 2.1168x + 39.089$ with a determination coefficient of 68.53%. This means that the cattle's age influences 68.53% of the body length of female Kacang goats at the UPT Agri Science Technopark UNISLA. The research results by Septian et al., (2015) explain that the growth pattern of male Kacang goat body length in Grobogan Regency has a polynomial regression equation, namely y = -0.020x2 + 1.293x + 37.07 with a determination coefficient value of 70.1%. The present findings are different from Rahardian et al., (2014) in which male Kacang goat body length experienced experienced rapid growth at the age of 3-6 months. Meanwhile, Wahyono, (2013) stated that different environmental conditions, animal health, and feeding are the contributing factors to varied growth experience.

Table 4. Body length measures of female Kacang Goat

Age (Month)	Frequency	Average body length (Cm)
1-10	8	48.86±8.04
11-20	6	63.17±2.48
21-30	5	63.80±8.41
31-40	4	60.25±2.99

Source: Processed Primary Data (2020)

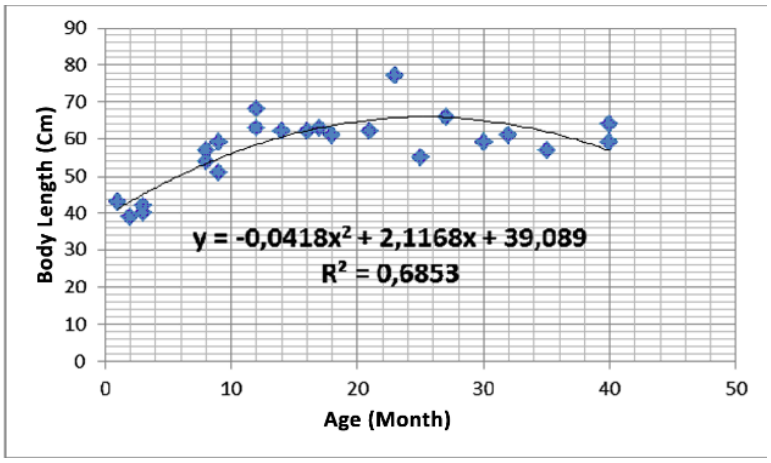

Figure 4. The curve of growth pattern of body length of female Kacang Goat

Conclusions

The growth of Kacang goats in UUPTpt Agri Science Technopark, Lamongan Islamic University follows the sigmoid curve(s) pattern with multiple linear regression equations. This pattern shows that livestock growth peaks at the age of 21-30 months, then starts to decelerate on 31-40 months because age greatly affects the body dimensions of livestock. From the results of data processing, body weight has the highest regression coefficient, namely 88.89%.

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