THE RELATIONSHIP BETWEEN EXTERNAL BODY DIMENSIONS AND BODY WEIGHT OF MALE SAKUB SHEEP AT DIFFERENT PHYSIOLOGICAL AGES

Denis Agita Meliana, Agustinah Setyaningrum*, Ari Dwi Nurasih
Faculty of Animal Science, Universitas Jenderal Soedirman, Purwokerto, Indonesia

*Email: agustinah.setyaningrum@unsoed.ac.id

Abstract. Sakub sheep are a type of local Indonesian livestock which is starting to be widely cultivated in Brebes Regency. The productivity of Sakub sheep can be assessed based on the appearance of livestock production, namely external body dimensions (chest girth, body length, shoulder height) and body weight. Therefore, it is necessary to conduct research on the relationship between external body dimensions and body weight of male Sakub sheep. The research was conducted using 118 male Sakub sheep (59 lambs and 59 rams) with purposive random sampling at October-December 2023 in Pandansari Village, Paguyangan District and Wanareja Village, Sirampog District, Brebes Regency, Central Java. The number of research samples was determined using the Harry King Nomograph formula. The research data were analyzed using multiple linear regression analysis. External body dimensions (chest girth, body length, shoulder height) have a very strong and significant relationship, can be used as predictors in estimating body weight of male Sakub sheep. Chest girth and body length are significant body measurements in explaining and predicting body weight of male Sakub sheep, while shoulder height is not significant. Body length is the most significant body measurement in explaining and predicting body weight of male Sakub sheep at lambs, while chest girth at rams.

Keywords: chest girth, body length, shoulder height, body weight, male sakub sheep, brebes regency.

A. Introduction

In Indonesia, livestock is mostly raised by small farmers who use traditional techniques [11]. Sheep are a type of livestock belonging to the ruminant group that can reproduce quickly and have the potential to meet meat production needs. The local sheep population in Indonesia is increasing along with public awareness of the need for animal protein [19].

Sakub sheep are a type of local Indonesian livestock which is starting to be widely cultivated in Brebes Regency. Sakub sheep are a local livestock breed that has historical, socio-economic, socio-cultural value, and has been integrated with community life and contributes to the income of breeders in Brebes Regency, Central Java. The Sakub Sheep has been formally designated by the government through Decree of the Minister of Agriculture of the Republic of Indonesia Number 882/KPTS/PK.010/M/12/2022 concerning the Determination of the Sakub Sheep Group. This sheep is the result of a cross between Dormer sheep, Dormas sheep and Sufas sheep with local sheep and then crossed with Texel sheep [9].

The productivity of Sakub sheep can be assessed based on external body dimensions (chest girth, body length, shoulder height) and body weight. Sakub sheep external body dimensions and body weight have different values which are effect by physiological age (hormones) and maintain management. Somatotropin (Growth Hormone) is a hormone that has the main activity

in bone and muscle growth, stimulates protein synthesis, and effects lipid metabolism [12]. Therefore, it is necessary to conduct research on the relationship between external body dimensions and body weight of male Sakub sheep at different physiological ages.

B. Methods

The research was carried out using 118 male Sakub sheep, consisting of 59 lambs and 59 rams. Lambs is male Sakub sheep aged 4-11 months and rams is male Sakub sheep aged more than 12 months [7]. The research was conducted using purposive random sampling in October-December 2023 in Pandansari Village, Paguyangan District and Wanareja Village, Sirampog District, Brebes Regency, Central Java. The number of research samples was carried out using the Harry King Nomograph formula.

The research data were then tabulated and analyzed by multiple linear regression using SPSS software and Microsoft Excel to determine the relationship between external body dimensions and body weight of male Sakub sheep at different physiological ages. Multiple linear regression analysis was carried out simultaneously and partially on the relationship between external body dimensions and body weight based on different physiological ages. Simultaneous multiple linear regression analysis tested the relationship of the three components of external body dimensions, namely chest girth, body length and shoulder height, together or overall, on the body weight of male Sakub sheep at different physiological ages. Partial multiple linear regression analysis, namely testing the relationship of the three components of external body dimensions, chest girth, body length and shoulder height, respectively, to the body weight of male Sakub sheep at different physiological ages.

The research data is then classified based on the level of relationship based on the table for determining the level of relationship [17].

Table 1. Classification of relationship levels

Coefficient Interval	Relationship Levels
0,00 – 0,199	Very Low
0,20 – 0,399	Low
0,40 – 0,599	Medium
0,60 – 0,799	Strong
0,80 – 1,000	Very Strong

C. Results And Discussion

Based on the research that has been carried out, the research results obtained are as follows:

Table 2. Average external body dimensions (CG, BL, and SH) and body weights of male Sakub sheep at different physiological age

Category	Physiological Age		Average male Sakub sheep
	Lambs	Rams	
Chest Girth (cm)	74,39 ± 7,20	92,49 ± 9,28	83,44 ± 21,66
Body Length (cm)	65,02 ± 7,55	77,34 ± 6,35	71,18 ± 17,95
Shoulder Height (cm)	66,90 ± 6,12	75,59 ± 5,61	71,25 ± 21,64
Body Weight (kg)	32,41 ± 11,59	55,69 ± 10,91	44,05 ± 22,66

Notes: CG = Chest Girth, BL = Body Length, SH = Shoulder Height, cm = centimeter, kg = kilogram.

Table 3. Average external body dimensions (CG, BL, and SH) and body weight of male Sakub sheep in Pandansari villages.

Category	Pandansari Village		Average
	Lambs	Rams	
Chest Girth (cm)	72,59 ± 7,35	91,38 ± 9,11	81,99 ± 12,53
Body Length (cm)	62,38 ± 7,01	76,85 ± 4,52	69,62 ± 9,34
Shoulder Height (cm)	64,26 ± 6,39	75,11 ± 4,67	70,18 ± 7,26
Body Weight (kg)	28,03 ± 10,19	53,29 ± 9,53	40,67 ± 16,05

Notes: CG = Chest Girth, BL = Body Length, SH = Shoulder Height, cm = centimeter, kg = kilogram.

Table 4. Average external body dimensions (CG, BL, and SH) and body weight of male Sakub sheep in Wanareja villages.

Category	Wanareja Village		Average
	Lambs	Rams	
Chest Girth (cm)	77,92 ± 5,51	94,65 ± 9,41	86,28 ± 11,42
Body Length (cm)	70,15 ± 5,82	78,31 ± 8,99	74,23 ± 8,54
Shoulder Height (cm)	69,54 ± 4,62	76,07 ± 6,99	73,33 ± 6,98
Body Weight (kg)	40,92 ± 9,29	60,37 ± 12,13	50,65 ± 14,51

Notes: CG = Chest Girth, BL = Body Length, SH = Shoulder Height, cm = centimeter, kg = kilogram.

Table 5. Nutritional composition of feed ingredients

Village	WA (%)	DI (%)	DI (%)				
			CP	CFA	CF	Ash	EMWM
Pandansari	81,66	18,34	11,52	6,87	24,08	2,28	55,26
	81,36	18,64	12,66	6,85	25,42	2,69	52,37
Average	81,51	18,49	12,09	6,86	24,75	2,48	53,82
Wanareja	83,50	16,50	13,12	7,58	21,01	2,01	56,29
	83,90	16,10	13,04	7,52	22,86	2,14	54,44
Average	83,70	16,30	13,08	7,55	21,93	2,07	55,37

Notes: WA = Water Content, DI = Dry Ingredients, CP = Crude Protein, CFA = Crude Fat, CF = Crude Fiber, EMWM = Extract Material Without Nitrogen.

1. General Condition

Male Sakub sheep have a fairly high average body weight, namely 44.05 ± 22.66 kg (lambs = 32.41 ± 11.59 kg and rams = 55.69 ± 10.91 kg). The average body weight value is greater than the average body weight value of local sheep, local male sheep have an average final body weight of 20.12 ± 4.55 kg [3]. The body weight of male Sakub sheep at young physiological age (32.41 ± 11.59 kg) is slightly greater than the average body weight of male Wonosobo sheep in the same age group, namely 30.35 ± 6.32 kg [18]. The average values for chest girth, body length and shoulder height of male Sakub sheep were 83.44 ± 21.66 cm, 71.18 ± 17.95 cm, and 71.25 ± 21.64 cm. This value is greater than the average values for chest girth, body length, and shoulder height of male Klowoh sheep, namely 79.03 ± 5.85 cm, 60.93 ± 4.95 cm, and 62.73 ± 2.94 cm [15]. The average values for chest girth, body length, and shoulder height of male Sakub sheep at lambs were 74.39 ± 7.20 cm, 65.02 ± 7.55 cm, and 66.90 ± 6.12 cm. This average value is greater than the average value of chest girth, body length, and shoulder height of male Wonosobo sheep in the same age group, namely 70.03 ± 6.97 cm, 59.93 ± 6.28 cm, and 56.63 ± 5.05 cm [5].

Rams have average values of external body dimensions (chest girth, body length, shoulder height) and body weight that are greater than male Sakub sheep at lambs. This condition occurs generally because physiological age reflects the growth process of livestock. The higher the level of physiological age, the higher the livestock growth process which is correlated with the performance of livestock production. Growth is an increase in weight and body dimensions that occurs due to an increase in the number of cells (hyperplasia) or an increase in cell size (hypertrophy) [16]. Male Sakub sheep at different physiological ages in Wanareja Village have average values of external body dimensions (chest girth, body length, shoulder height) and body weight that are greater than male Sakub sheep at different physiological ages in Pandansari Village. One of the reasons this condition occurs is because the quality of feed differs between villages, the most important thing is the protein content of the feed. The crude protein content in feed in Pandasari Village is 12.09 percent while in Wanareja Village it is 13.08 percent (Table 5). Higher feed protein content causes greater daily body weight growth in livestock. This is because protein is a feed substance that functions to efficiently use energy into muscle [6].

The shoulder height of male Sakub sheep at lambs and rams has the lowest correlation value and determination coefficient compared to chest girth and body length. Shoulder height

is effected by the growth of the leg bones. In addition, there is less muscle tissue attached to the legs compared to the amount of muscle tissue attached to the chest area and along the bones that make up the length of the body, so shoulder height has the lowest correlation value.

2. The relationship between external body dimensions and body weight of male sakub sheep at lambs

The relationship between external body dimensions and body weight of male Sakub sheep at lambs will be presented in tabular form and explained in the discussion as follows:

Table 6. Simultaneous multiple linear regression analysis

Regression Statistics	Value
Multiple R (R)	0,93
Adjusted R Square (R²)	0,8569 / 85,69%
Significant F (F)	0,000775
Significant F Table = 0,05	
T Stat Test (t)	CG = 4,284
T Test Table = 1,672	BL = 5,448
	SH = -1,026
P Value (P)	CG = 0,007426
P Value Table = 0,05	BL = 0,000123
	SH = 0,309316
Regression Equation (Y)	Y = -68,132 + 0,665 X2 + 0,981 X2 - 0,191 X3
	Y = -68,132 + 0,665 CG + 0,981 BL - 0,191 SH

Notes: CG = Chest Girth (cm), BL = Body Length (cm), SH = Shoulder Height (cm).

Table 7. Partial multiple linear regression analysis

Regression Statistics	Value
Multiple R (R)	CG-BW = 0,88
	BL-BW = 0,91
	SH-BW = 0,77
Adjusted R Square (R²)	CG-BW = 0,7691 / 76,91%
	BL-BW = 0,8157 / 81,57%
	SH-BW = 0,5848 / 58,48%
Significant F (F)	CG-BW = 0,00522
Significant F Table = 0,05	BL-BW = 0,00082
	SH-BW = 0,01839
T Stat Test (t)	CG-BW = 13,94
T Test Table = 1,672	BL-BW = 16,06
	SH-BW = 9,094
P Value (P)	LD-BW = 0,00522
P Value Table = 0,05	BL-BW = 0,00082
	SH-BW = 0,01839
Regression Equation (Y)	Y = -72,951 + 1,416 CG
	Y = -57,894 + 1,389 BL
	Y = -65,114 + 1,458 SH

Notes: CG = Chest Girth (cm), BL = Body Length (cm), SH = Shoulder Height (cm), BW = Body Weight.

Male Sakub sheep at a young physiological age have a body weight whose increase can be assessed based on the growth of external body dimensions (chest girth, body length, and shoulder height). Simultaneously, external body dimensions provide a correlation value of 0.93 and a coefficient of determination value of 85.69 percent of the livestock body weight value. This value indicates that chest girth, body length, and shoulder height have a very strong (significant) relationship with a coefficient of determination of 85.69 percent (14.31 percent comes from other factors) in explaining and predicting livestock body weight. Body dimensions (chest girth, body length, and shoulder height) have a correlation with the body weight of male Sakub sheep [14]. Therefore, external body dimensions (chest girth, body length, and shoulder height) can be used as predictors in estimating sheep body weight values.

Based on the results of simultaneous analysis, chest girth and body length had a significant effect in explaining and predicting body weight of male Sakub sheep at lambs, while shoulder height was not significant. Partially, body length has a correlation value of 0.91 and a coefficient of determination value of 81.57 percent in explaining and predicting the body weight of male Sakub sheep at lambs. This value is higher than the correlation value for chest girth, which is 0.88 and the coefficient of determination for chest girth, which is 76.91 percent, in explaining and predicting the body weight of male Sakub sheep at lambs. Body length can explain the body weight of sheep at lambs with correlation values and coefficients of determination that are greater than other age groups [18]. The percentage of body length due to growth varies based on age group. This starts slowly and progresses faster, then gradually stops after reaching maximum age or body dimensions [2].

Based on the results of partial analysis, the values of chest girth, body length, and shoulder height have a correlation value of 0.88 (very strong), 0.91 (very strong), and 0.77 (strong) to the increase in body weight of male Sakub sheep in lambs. The results of the analysis also show that external body dimensions (chest girth, body length, and shoulder height) have a significant effect in explaining and predicting the body weight of male Sakub sheep at lambs. Body length is better used together with chest girth in estimating body weight of male Sakub sheep at a lambs [5]. Livestock body dimensions can increase accuracy in estimating livestock body weight [10].
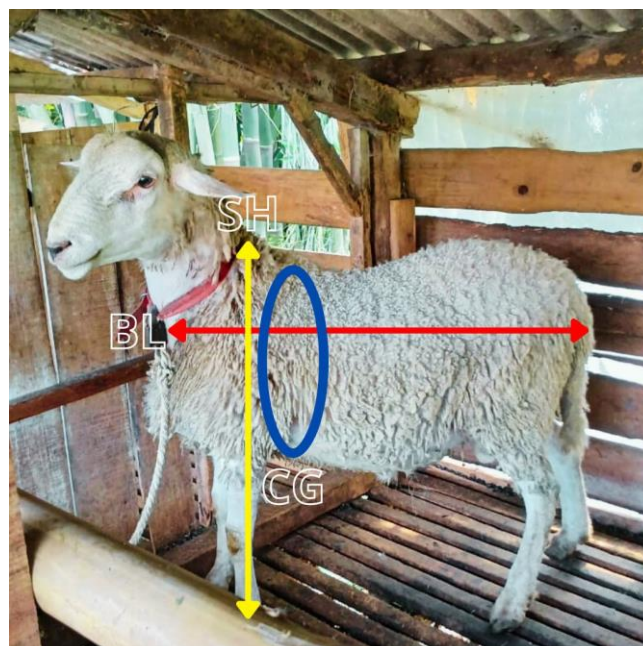

Figure 1. Male Sakub sheep (Lamb).

3. The relationship between external body dimensions and body weight of male Sakub sheep at rams

The relationship between external body dimensions and body weight of male Sakub sheep at lambs will be presented in tabular form and explained in the discussion as follows:

Table 8. Simultaneous multiple linear regression analysis

Regression Statistics	Value
Multiple R (R)	0,90
Adjusted R Square (R²)	0,8002 / 80,02%
Significant F (F)	0,000734
Significant F Table = 0,05	
T Stat Test (t)	CG = 5,619
T Test Table = 1,672	BL = 1,411
	SH = 0,826
P Value (P)	CG = 0,000657
P Value Table = 0,05	BL = 0,163965
	SH = 0,412417
Regression Equation (Y)	Y = -56,389 + 0,726 X1 + 0,384 X2 + 0,201 X3
	Y = -56,389 + 0,726 CG + 0,384 BL + 0,201 SH

Note: CG = Chest Girth (cm), BL = Body Length (cm), SH = Shoulder Height (cm).

Table 9. Partial multiple linear regression analysis

Regression Statistics	Value
Multiple R (R)	CG-BW = 0,88
	BL-BW = 0,84
	SH-BW = 0,76
Adjusted R Square (R²)	CG-BW = 0,7755 / 77,55%
	BL-BW = 0,6953 / 69,53%
	SH-BW = 0,5634 / 56,34%
Significant F (F)	CG-BW = 0,00023
Significant F Table = 0,05	BL-BW = 0,00149
	SH-BW = 0,00463
T Stat Test (t)	CG-BW = 14,19
T Test Table = 1,672	BL-BW = 11,55
	SH-BW = 8,709
P Value (P)	CG-BW = 0,00023
P Value Table = 0,05	BL-BW = 0,00149
	SH-BW = 0,00463
Regression Equation (Y)	Y = -40,304 + 1,038 CG
	Y = -55,556 + 1,438 BL
	Y = -55,423 + 1,470 SH

Note: CG = Chest Girth (cm), BL = Body Length (cm), SH = Shoulder Height (cm), BW = Body Weight (kg).

Rams have a body weight whose increase is assessed based on the growth of external body dimensions (chest girth, body length, and shoulder height). Simultaneously, external body dimensions provide a correlation value of 0.90 and a coefficient of determination value of 80.02 percent of the livestock body weight value. This value indicates that chest girth, body length, and shoulder height have a very strong (significant) relationship with a coefficient of determination of 80.02 percent (19.98 percent comes from other factors) in explaining and predicting livestock body weight. Linear body dimensions have a strong relationship with body weight, so can be used to estimate livestock body weight [20].

Based on the results of simultaneous analysis, chest girth and body length had a significant effect in explaining and predicting body weight of male Sakub sheep at rams, while shoulder height was not significant. Partially, chest girth has a correlation value of 0.88 and a coefficient of determination value of 77.55 percent in explaining and predicting the body weight of male Sakub sheep at rams. This value is higher than the correlation value for body length, which is

0.84 and the coefficient of determination value, which is 69.53 percent, in explaining and predicting the body weight of male Sakub sheep at rams. The size of the chest girth increases along with the increasing growth and development of muscle tissue in the chest [4]. Chest girth is strongly related to the chest and abdominal space, most of the livestock body weight comes from the chest to the hips, so the larger the chest girth, the greater the livestock body weight [1].

Based on the results of partial analysis, the values of chest girth, body length, and shoulder height have a correlation value of 0.88 (very strong), 0.84 (very strong), and 0.76 (strong) to the increase in body weight of male Sakub sheep in rams. Chest girth has the strongest relationship with body weight growth in male Sakub sheep at rams. Chest girth can be used to predict livestock body weight because the development of chest girth is in line with the development of bones, muscles, and fat proportions [8].
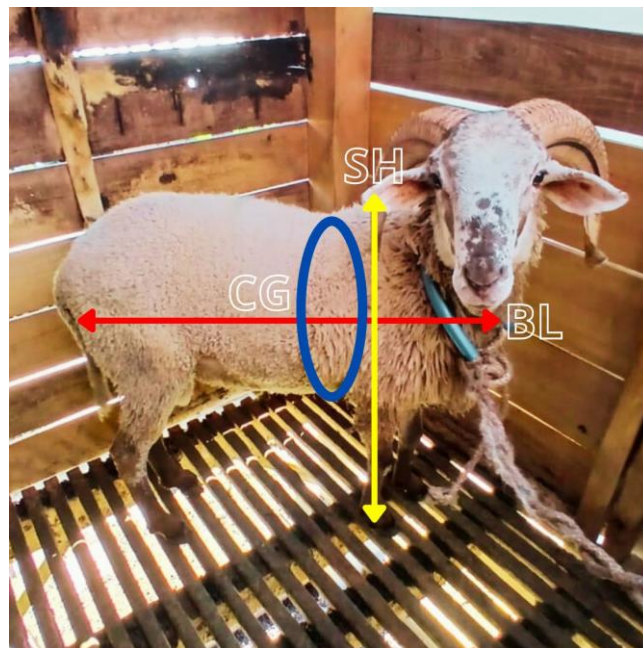

Figure 2. Male Sakub sheep (Ram).

D. Conclusion

Based on the research review that has been presented, it was concluded that external body dimensions (chest girth, body length, shoulder height) have a very strong (significant) relationship and can be used as predictors in estimating the body weight of male Sakub sheep. Chest girth and body length are significant body measurements in explaining and predicting body weight of male Sakub sheep at different physiological ages, while shoulder height is not significant. Body length is the most significant body measurement in explaining and predicting the body weight of male Sakub sheep at lambs. Chest girth is the most significant body measurement in explaining and predicting body weight of male Sakub sheep at rams.

E. Acknowledgement

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