

Phenotypic characteristics of Sakub sheep as local livestock genetic resources

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Abstract. *Nurasih AD, Sumaryadi MY, Hidayah CN, Nugroho AP, Setyaningrum A, Haryoko I, Yuwono P, Sodiq A. 2023. Phenotypic characteristics of Sakub sheep as local livestock genetic resources. Biodiversitas 24: 5671-5675.* Sakub sheep is an indigenous sheep with a giant body in the Brebes Regency. Phenotypic characterization is important to increase the population and productivity of Sakub sheep. By combining quantitative and qualitative data, this study will provide a comprehensive insight into the phenotypic profile of Sakub sheep. This study determined the quantitative and qualitative phenotypic characteristics of Sakub sheep. The Sakub sheep used were owned by smallholder farmers using the survey method with interview techniques, observation, and direct measurement of livestock. Samples were taken using purposive sampling in Pandansari and Wanareja villages, which have the largest sheep populations and are easily accessible. The sheep used were rams and ewes sheep in the age group of 1-1.5 years (P0), 1.5-2 years (P1), 2-2.5 years (P2), 2.5-3 years (P3). Phenotypic characteristics observed included quantitative characteristics of body size and qualitative characteristics of body morphology. Body size was measured using measuring tape and hanging scales, including Body Weight (BW), Body Length (BL), Whither Height (WH), Chest Girth (CG), Ear Length (EL), And Tail Length (TL). Body morphology includes head color, body color, face profile, and tail shape. Quantitative characters were analyzed using descriptive statistics, and qualitative characters were analyzed descriptively using relative frequency. The results showed quantitative phenotypic characteristics of Sakub sheep at the age of 1-1.5 years; 1.5-2 years; 2-2.5 years, and 2.5-3 years, such as body weight, body length, chest circumference, whither height, ear length, and tail length increased with age. The qualitative phenotypic characteristics of Sakub sheep are having a head and body with a combination of colors but dominant white, a convex head profile, no horns, and a thin and fat tail.

Keywords: Indigenous sheep, Sakub sheep, qualitative characteristics, quantitative characteristics

INTRODUCTION

Local sheep are indigenous to Indonesia and are one of the small ruminants widely kept by the community. The number of sheep in Indonesia is increasing; in 2021, it amounted to 15.6 million heads (Ministry of Agriculture 2022). This is because sheep fulfill people's animal protein needs (Depison et al. 2021) and are an important part of national livestock production (Tefiel et al. 2023). In addition, the majority of local sheep have advantages such as being able to adapt well to climate change, being resistant to disease, being able to survive on low-quality feed, being able to reproduce throughout the year, and having distinctive genes that can be characterized (Pandie et al. 2021). Local sheep as germplasm must be preserved and developed according to their potential. Their production and population may rise as a result.

Sakub sheep is a local sheep that develops on the western slopes of Mount Slamet, precisely in Brebes Regency which farmers raise to produce meat. Sakub sheep has been designated as an Indonesian local breed by Decree of the Minister of Agriculture No 882/KPTS/PK.010/M/12/2022. The population of Sakub sheep in 2022 reached 16,484 heads. According to (Livestock and Animal Health Service Office 2023), Sakub

sheep is the result of crossbreeding of texel, sulfok, merino and local sheep to have a large body. The selling value of this sheep is also promising because its meat is commonly used for satay and curry, its dung is used as organic fertilizer, and its fur can be used for handicrafts (Livestock and Animal Health Service Office 2023). This sheep could be used as a local livestock genetic resource. Sheep productivity is low due to several factors, such as genetic and environmental factors. It must know its phenotypic characteristics to increase its population and productivity (Hailemariam et al. 2018). Therefore, it is necessary to conduct characterization to identify the phenotypic characteristics of Sakub sheep.

There are many local livestock genetic resources in Indonesia. According to (Alarslan et al. 2021), conservation and development measures are needed to maintain its existence. To be utilized according to its potential, characterization must be done first. Characterization is an important step when managing genetic resources. When conducting characterization, it can also obtain national characteristics that can be used as a characteristic of livestock and know the potential of these livestock. Characterization aims to obtain data on morphological traits or characters of sheep that aim to distinguish phenotypes and genetics in the region.

Phenotypic evaluation of local livestock can lead to official designation and recognition of herds, thereby increasing business opportunities for smallholder farmers (Aranda et al. 2021), improvement and sustainable utilization (Mavule et al. 2013). Phenotypic is the expression of genetic characteristics modified by environment. Phenotypic characterization is important for managing animal genetic resources as it is the earliest step in efforts to improve productivity before genetic characterization (Harkat et al. 2015). In addition, phenotypic characterization can also obtain the livestock nation's characteristics to determine the livestock's potential. Phenotypic characterization is done qualitatively and quantitatively. Qualitative traits are observable and visible traits that can be described directly, such as fur color, horn shape, and ear shape. At the same time, quantitative characteristics or morphometric characters are measurements made on the body of livestock, such as body length, chest circumference, chest depth, tail length, and pelvic width (Depison et al. 2021).

Currently, Sakub sheep have not been extensively utilized for research or as a subject for writing articles. Based on bibliometric data with the keyword Indonesian local sheep, Scopus articles only contain 39 studies. None of these articles discusses the qualitative and quantitative phenotypic characteristics of Sakub sheep, only sheep such as Palu sheep, Batur sheep, Kupang sheep, Wonosobo sheep, Garut sheep, Thin-tailed sheep, and Fat-tailed sheep. This study aimed to determine the qualitative phenotypic characteristics and quantitative phenotypic characteristics of Sakub sheep as local sheep.

MATERIALS AND METHODS

Study area

This research lasted for 4 months and was conducted in Pandansari Village, Paguyangan Subdistrict, and Wanareja

Village, Sirampog Subdistrict, Brebes District, Central Java, Indonesia. Pandansari village is located at coordinates $7^{\circ}17'23''$ S $109^{\circ}08'29''$ E with an altitude of 1,975 m above sea level (Figure 1). Wanareja village is located at coordinates $7^{\circ}14'53''$ S $109^{\circ}05'46''$ E, and its altitude is 1,500 m above sea level. These villages were chosen because the largest population of Sakub sheep is located in these two villages.

Procedures

The Sakub sheep used were owned by smallholder farmers using the survey method with interview techniques, observation, and direct measurement of livestock in Pandansari and Wanareja villages, which have the largest sheep population and are easily accessible. The numbers used were 4 rams and 10 ewes aged 1-1.5 years (characterized by not having a pair of permanent incisor teeth) (P0); 3 rams and 10 ewes aged 1-5-2 years (characterized by having one pair of permanent incisor teeth) (P1); 3 rams and 12 ewes aged 2-2.5 years (characterized by having two pairs of permanent incisors) (P2); 4 rams and 12 ewes aged 2.5-3 years (having three pairs of permanent incisors) (P3). Phenotypic characteristics observed included quantitative characteristics of body size and qualitative characteristics of body morphology. Body size was measured using a measuring tape and hanging scales including Body Weight (BW), Body Length (BL), Whither Height (WH), Chest Girth (CG), Ear Length (EL), and Tail Length (TL) (Figure 2). Body morphology includes head color, body color, face profile, and tail shape.

Quantitative character data in the form of body weight and body measurements were grouped by age and sex. Descriptions of quantitative characters were analyzed using descriptive statistics, which included mean values and standard deviations using Microsoft Excel 2021. Qualitative character data were analyzed descriptively using relative frequency.

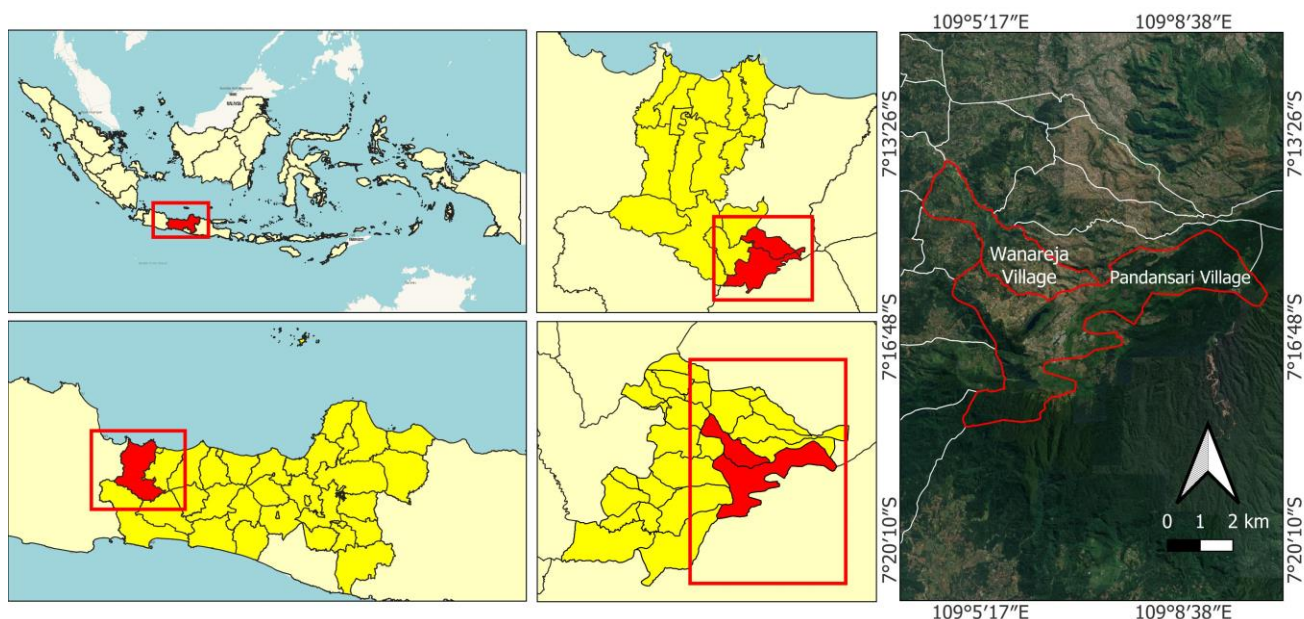


Figure 1. Location of Pandansari Village, Paguyangan Subdistrict and Wanareja Village, Sirampog Subdistrict, Brebes District, Central Java, Indonesia

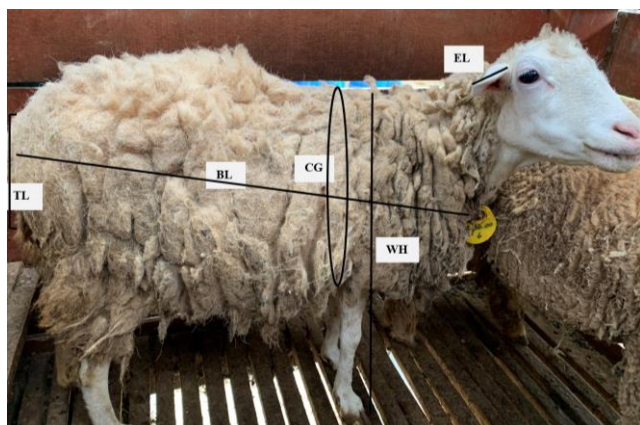


Figure 2. The body easurements scheme Body Length (BL), Chest Girth (CG), Whither Height (WH), Ear Length (EL), and Tail Length (TL) in Sakub sheep

RESULTS AND DISCUSSION

The results of quantitative character are presented in Table 1. The Table shows that the age groups P0 (1-1.5 years), P1 (1.5-2 years), P2 (2-2.5 years), and P3 (2.5-3 years) of Sakub sheep increased with age. The increase in quantitative characters with increasing age also occurs in local sheep in Ethiopia (Asefa et al. 2017). The average body weight of rams Sakub in the P0 age group was 36.87 kg which was smaller than that of rams batur which was 68.49 kg at the same age (Ibrahim et al. 2020), smaller than rams dombos at 1-1.5 years which was 50.88 kg (Haryanti et al. 2015). However, the body weight of the Sakub ram is greater than the body weight of ram fat-tailed sheep at the age of 1 year, which is 27.834 kg (Ashari et al. 2015). The average body weight of rams at P1 (1.5-2 years) was 46.45 kg greater than that of fat-tailed sheep at the age of 2 years, which was 34.760kg (Ashari et al. 2015). The average body weight of rams in the P2 group (2-2.5 years) was 59.18 kg and P3 (2.5-3 years) was 85.50 kg.

The average body weight of ewe Sakub in the age group P0 is 30.13 kg. The average body weight of P0 ewe Sakub is heavier than local sheep in Rote Ndao Regency aged 1-1.5 years in research (Pandie et al. 2021) which is 7.84-14.07 kg. However, it is lower than Batur sheep aged 1-1.5 years, which is 57.37 kg (Ibrahim et al. 2021). The body weight of female Sakub sheep at P1 had an average of 42.17 kg. This average is higher than that of fat-tailed sheep at the age of 2 years, which is 32.90 kg (Ashari et al. 2015). The average body weight of female Sakub sheep in P2 group was 47.44 kg and in P3 group was 53.90 kg.

Based on the results of the study, the body weight of male Sakub sheep is heavier than female Sakub sheep in the same age group (Table 1). Quantitative characteristics in male sheep are higher than those in female sheep because the growth of male sheep is faster than that of female sheep. In addition, female sheep have estrogen hormones that limit bone growth. According to (Ibrahim et al. 2020), male animals have the hormone testosterone, one of whose functions is to accelerate metabolism so that the growth rate of male animals is greater than that of female

animals. Ashari et al. (2015) reported that sex significantly affects body weight in fat-tailed sheep, and the body weight of male sheep is higher than that of female sheep. Research (Hailu et al. 2020) on sheep in the Tahtay Maichew area, Ethiopia, shows that the body weight of male sheep is higher than that of female sheep. In contrast to research (Abera et al. 2014), the linear body size of female sheep is higher than that of local rams in Central Ethiopia.

Based on Table 1, in the P0 age group, the body length of the Sakub ram was 67.25 cm. Shorter than local sheep (Hailemariam et al. 2018) at the same age of 72.64 cm. Ram Sakub, in the P1 age group, had an average body length of 74.67 cm, in the P2 age group was 81.33 cm, and in the P3 age group was 83.50 cm. The average body length of a ewe in the P0 age group was 59.50 cm, shorter than local sheep of the same age in the study (Hailemariam et al. 2018), which was 59.89 cm. The body length of female Sakub sheep in the P1 age group is an average of 64.70 cm. Longer than female Wonosobo sheep, 61.89 cm in the same age group. In the age group P2, ewe Sakub have an average body length of 65.42 cm, while in the age group P3, it is 66.42 cm. Based on these data, it can be seen that in the same age group, ram Sakub have a higher body length than ewe Sakub sheep. This is similar to the study (Kenfo et al. 2017) on local sheep in Southern Ethiopia, which showed that in the youngest, middle, and oldest age groups, the body length of the ram was higher than that of the ewe. Research (Mavule et al. 2013) on Zulu sheep showed that adult males were larger than females of the same age group in all measurements. This is due to differences in hormone secretion and activity in both sexes.

Table 1. Mean values and standard deviation of Sakub sheep by age and sex

Variable	Age	Ram	Ewe
Body weight (kg)	1-1.5 years	36.88±4.95	30.13±3.75
	1.5-2 years	46.45±4.08	42.17±4.45
	2-2.5 years	59.18±2.90	47.44±4.13
	2.5-3 years	85.5±6.86	53.90±4.18
Body length (cm)	1-1.5 years	67.25±3.87	59.5±5.84
	1.5-2 years	74.67±7.02	64.7±6.24
	2-2.5 years	81.33±5.03	65.42±5.88
	2.5-3 years	83.50±9.32	66.42±7.20
Chest girth	1-1.5 years	82.25±2.87	78.5±5.02
	1.5-2 years	88.00±6.24	87.70±6.20
	2-2.5 years	96.00±3	87.75±6.82
	2.5-3 years	105.00±4.39	91.75±3.39
Whither height (cm)	1-1.5 years	60.00±6.78	64.10±4.07
	1.5-2 years	75.00±3	66.60±4.45
	2-2.5 years	77.00±3.60	66.58±4.94
	2.5-3 years	80.00±1.41	65.83±3.01
Tail length (cm)	1-1.5 years	26.25±4.57	28.6±4.58
	1.5-2 years	30.00±3.61	27.90±3.81
	2-2.5 years	31.67±1.15	30.67±1.15
	2.5-3 years	31.75±2.63	28.50±3.37
Ear length (cm)	1-1.5 years	14.00±1.41	13.90±1.37
	1.5-2 years	14.67±1.15	14.30±1.25
	2-2.5 years	14.67±1.53	14.83±1.34
	2.5-3 years	14.75±1.26	14.08±1.68

Tabel 2. Qualitative characteristics of Sakub sheep

Variable	Qualitative characteristics	Proportions (%) n=58
Head color	White	53.45
	Brown	20.69
	White with brown spots	24.14
	White with black spots	1.72
Body color	White	53.45
	Brown	18.97
	White brown dominant white	24.14
	White brown dominant brown	1.72
	White black	1.72
Face profile	Convex	75.86
	Concave	24.14
Horns	None	74.13
	Small	6.90
	Curved outward	6.90
	Curved inward	12.07
Tail	Fat	41.38
	Thin	58.62

In measuring chest girth, the mean chest girth of rams Sakub in P0 was 82.25 cm, greater than that of local sheep (Hailemariam et al. 2018), which was 72.64 cm. The average chest girth of Ram Sakub in the P1 age group was 88.00 cm. The average chest girth in the P2 age group was 96.00 cm, and in the P3 age group, it was 105.00 cm. Meanwhile, the chest girth of ewes Sakub at P0 was 78.50 cm, which was greater than that of local ewes in Rote Ndao Regency at the same age (50.38 cm) (Pandie et al. 2021). The average chest circumference of ewes Sakub in the P1 age group was 87.70 cm, and in the P2 age group was 87.76 cm. The P3 age group was 91.75 cm, smaller than that of ewes batur at the age of >2.5 years, namely 106.64 cm (Ibrahim et al. 2021). Table 1 shows that the average value of chest circumference in Ram Sakub is higher than the ewe as the age increases. Research on fat-tailed sheep conducted by (Ashari et al. 2015) found that male fat-tailed sheep have a higher linear body size than females in various age groups.

In the measurement of shoulder height, the average shoulder height of male Sakub sheep in the P0 age group is 60.00 cm, shorter than male Wonosobo sheep in the same age group, which is 64.81 cm (Haryanti et al. 2015), higher than local sheep in the Gamogofa area in (Hailemariam et al. 2018) is 56.9 cm. The whither height at P1 is 75.00 cm higher than the ram sapudi in the same age group, which is 57.04 cm (Tanziila 2018), at P2 is 77.00 cm higher than the ram dombos, which is 67.00 cm. The average whither height of Rams Sakub in the P3 group is 80.00 cm. The average whither height of the ewe lambs in P0 is 64.10 cm, and in P1, it is 66.60 cm. The whither height in the P2 age group was 66.58 cm, higher than the Sapudi sheep of the same age at 56.87 cm (Tanziila 2018). In the P3 group, the average whither height of the ewe Sakub is 65.83 cm, higher than the ewe batur at the age of >2.5 years, which is 62.40 cm (Ibrahim et al. 2021). Based on the study results, there is an increase in shoulder height and livestock age.

In the P0 group, males have an average tail length of 26.52 cm, shorter than the tail of male Batur sheep, which is 30.50 cm at the age of 1 year (Ibrahim et al. 2020). P1 is

30.00 cm, P2 is 31.67 cm, and P3 is 31.75 cm. In P0, female sheep have an average tail length of 28.60 cm, longer than female batur sheep at one year, which is 27.63 cm (Ibrahim et al. 2020). P1 is 27.90 cm, P2 is 30.67 cm, and P3 is 28.50 cm. Based on the study's results, the length of the sheep's tail varies because the livestock's tail does not grow anymore after adulthood (Pandie et al. 2021). The average ear length of Rams Sakub sheep at P0 was 14.00 cm, P1 was 14.67 cm, P2 was 14.67 cm, and P3 was 14.75 cm. In ewes Sakub, P0 is 13.90 cm, P1 is 14.30 cm, P2 is 14.83 cm, and P3 is 14.09 cm. longer than Barind sheep, which is 7.13 cm (Haque et al. 2020). The study showed that age group and sex did not affect ear length. This can occur because ear growth is relatively slow and will reach maximum size at a certain age (Ibrahim et al. 2020). Ear length in both male and female sub-sheep is longer than that of local sheep in the Gamogofa area (Hailemariam et al. 2018).

Qualitative character traits cannot be measured but can distinguish and classify individuals. The results of qualitative character research on head fur color, body fur color, face profile, tail shape, and horn shape can be seen in Table 2. Local sheep fur color patterns are grouped into single and two-color combinations. Based on the results of the study, the head color of Sakub sheep is dominated by white (53.45%), then white, brown spots (24.14%), brown (20.69%), and white, black spots (1.72%). The body hair color of Sakub sheep is dominated by white (53.45%), then white, brown dominant white 24.14%, brown 18.97%, white, brown dominant brown 1.72%, and black white 1.72%. The combination of color on the head and body of Sakub sheep appears to be the dominant color; white spots are found around the eyes, neck, abdomen, thighs, and hind legs.

A convex shape of 75.86% dominates the head profile of the Sakub sheep, while the concave shape is 24.14%, like the Pantaneiro sheep in Brazil, which has a convex face profile (Aranda et al. 2021). Most Sakub sheep do not have horns (74.13%), while those with horns consist of small horns (6.90%), curved shape inward 6.90%, and curved shape outward 12.07%. The tail shape of Sakub sheep is thin-fat (58.62%-41.38%) (Table 2).

In conclusion, based on the research results, it can be concluded that: 1). Quantitative phenotypic characteristics of Sakub sheep at the age of 1-1.5 years; 1.5-2 years; 2-2.5 years, and 2.5-3 years, such as body weight, body length, chest circumference, whither height, ear length, and tail length increased with age. 2). Qualitative phenotypic characteristics of Sakub sheep are having a head and body with a combination of colors but predominantly white, a convex head profile, no horns, and a thin and fat tail. This study implies that Sakub sheep has the potential to be developed because, as a meat producer, this sheep has an increasing body weight gain as the sheep ages.

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