

(RESEARCH ARTICLE)



Body performance of the mother and the kid of sapera goats based on birth type at Kuncen Farm

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International Journal of Scholarly Research in Science and Technology, 2023, 02(02), 030–039

Publication history: Received on 29 March 2023; revised on 07 May 2023; accepted on 10 May 2023

Article DOI: <https://doi.org/10.56781/ijrst.2023.2.2.0024>

Abstract

Sapera goats have many excellencies but their population is still low. Efforts that can be made are to provide female goats that have the potential to give twin birth type and have high productivity. This is obtained through an assessment of body performance. The mother and her offspring of Sapera goats with twin and single birth types have different body performance. These differences can be a reference to describe the productivity of Sapera Goats on these farms. This research was conducted in January 2023 at Kuncen Farm, Mijen District, Semarang City with the criteria for a mother Sapera goat aged between 1.5 - 2 years and her offspring aged between 3 - 5 months. Based on the results of the study, the body performance of Body Length (BL), Body Height (BH), and Chest Circumferences (ChC) were superior to the mothers and offspring of the twin birth type, while Canon Circumferences (CC) and Head Length (HL) performance of the mother and her offspring in each type of birth do not have much difference. Therefore, it can be concluded that Body Length (BL) Body Height (BH), and Chest Circumferences (ChC) are related to the type of birth while Canon Circumferences (CC) and Head Length (HL) performance are not related. Goat's body performance is influenced by environmental conditions and animal feed.

Keywords: Sapera Goat; Birth Types; Body Performance; Productivity

1 Introduction

Goats are herbivorous animals that are widely raised by rural communities because they are easy to breed. Raising goats can be done intensively (only in kennels) or semi-incentives (can be grazed at any time). Based on its benefits, goats are divided into two types, namely meat and dairy. The meat type is goats used for meat while the dairy type is goats used for milk. The Sapera Goat is a dairy goat that comes from crossing the Sanen Goat and the Ettawa Goat. Sapera goats have the advantage of being able to produce milk with high liters compared to other types of dairy goats as it is reaching 2-3 liters [1] and will increase in subsequent lactations [2]. It was concluded from the research of Christi *et al.* [3], sapera milk has a temperature of 23 °C with a lactose content of 4%, Solid Non-Fat (SNF) of 8.5%, and dry matter including carbohydrates, protein, fat, vitamins and minerals of 12.7%. Differences in nutrition results could be affected by milking time, but it did not show significant differences. Alfian *et al.* [4] states that the exact number of dairy goats in Semarang Regency is not known. Based on the results of interviews with breeders, the population of Sapera goats on 10 farms in Mijen Village reached 80%, which of the 10 farms had a high population of Sapera goats, ranging from 50-100 heads, only on 2 farms. The population of Sapera Goats on other farms is only around 2 - 5 heads. If all breeders in Mijen District are combined, the Sapera Goat population does not reach 50%. The small population of the Sapera Goat has an impact on its milk production which will decrease while the demand for goat's milk will increase every year. Due to its low

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population, it is necessary to increase the population of the Sapera dairy goat. One of the efforts to increase the Sapera Goat population is by providing goats that have the potential to give twin birth type and have high productivity. Goats that have high productivity, if marketed, will have a much higher price than goats that have low productivity. One of the indicators to determine farm animals productivity is by looking at the physical performance of farm animals because the its body performance is directly proportional to its productivity [5]. The appearance of the body performance of the mother and the kid can be used as a selection to get superior offspring so that they have the potential to give birth to twins [6].

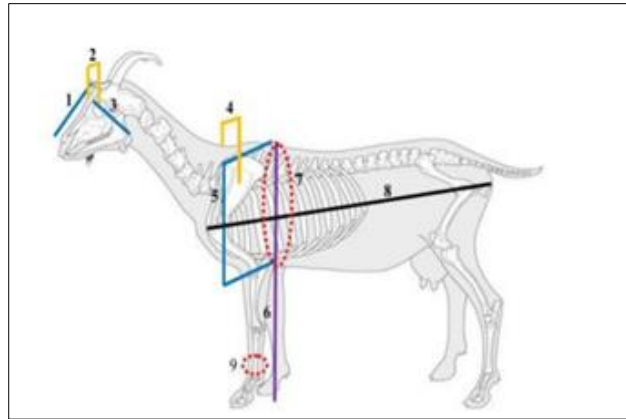


Figure 1 Body Performance (1)Head Length (2)Head Width (3)Head Height (4)Chest Width (5)Inside Chest Width (6)Body Height (7)Chest Circumferences (8)Body Length (9)Canon Circumferences [7]

Sutiyono *et al.* [8] emphasised that goats with single and twin birth types have different body performance because the use of body functions to conceive twins and single kids are different. Goats that give birth to twins generally have superior body performance in parts related to reproductive function. Evidenced in previous research by Sutiyono *et al.* [9] lambs born with the twin birth type had superior body performance compared to single birth type lambs in the parameters of body length, body height, and chest circumferences.

At Kuncen Farm, one of the farms in Kuncen Village, Mijen District, Semarang City, there is a population of >100 heads of sapera goats, both from single and twin births. On this farm, Sapera goats have more kids with twin birth type than other types of goats. Compared to other farms in the vicinity, this farm has a focus on producing milk from Sapera Goats for sale. This can happen as it is influenced by factors both from the surrounding environment and from farm animals rearing procedures. The environmental conditions the vegetation, geography, or climate can be the support factors to produce goats with high productivity until it is declared fit for breeding [10]. Livestock procedures such as the cage and feeding can also be support factors to produce goats with high productivity [1]. Regarding the excellence of the Sapera Goat, its high population, and births of various types in Kuncen Farm, it is necessary to conduct research to obtain the knowledge about body performance of mothers and goat kids of Sapera Goats from twin and single births in Kuncen Farm as the description to discover the productivity of mothers and kid of goats in the mentioned farm.

2 Material and methods

This research was conducted in Kuncen Farm, Mijen, Semarang in January 2023. The purposive sampling method was used to collect the samples with desired criteria, which are Sapera Goat mothers with the age range of 1.5 - 2 years in total of 4 goat mothers: 2 twin births, 2 single births, as well as the 6 goat kids of each birth types. Hence, the total of the Sapera Goats sampled was 10. The measurement parameters were Body Height (BH), Body Length (BL), Chest Circumferences (ChC), Canon Circumferences (CC), and Head Length (HL) which were measured directly on the spot using a measuring stick (cm) and measuring tape (cm). Remeasurements were done 3 times per parameter. The supporting data were temperature and humidity measurements using a hygrometer which was measured every morning for one month. The collected data are presented in the form of tables, graphic and pictures. The data are descriptively analyzed that is adapted to the library.

The measurement, according to Tagoi *et al.* [7] includes:

Body Height (BH), measured by gauging perpendicularly from the highest part of the shoulder (scapula) to the ground using the measuring stick.

- *Body Length (BL)*, measured by gauging perpendicularly from the lower chest to the lump of the sieve bone using the measuring stick.
- *Chest Circumferences (ChC)*, measured by circling the measuring tape around the leg from the front, the back, to the front of the scapula.
- *Canon circumferences (CC)*, measured by circling the measuring tape around the left front leg.
- *Head Length (HL)*, measured by gauging the distance from the midpoint of the head to the posterior point of the skull using the measuring tape.

3 Results and discussion

Sapera Goat's characteristics are white fur, triangular face shape, hanging ears, and horns. This goat species tends to have the characteristics of fur color, ear shape, and earlobe that follow the Sanen Goat [11], while for the body size and head, this goat species is similar to the Etawah Goat [5].



Figure 2 Twin Goat

The following table is the average measurement results of the Sapera goat mothers and the goat kids from several parameters with three repetitions (R).

Table 1 Average Measurement Results of The Sapera Goat Mothers and The Goat Kids

Mother/Kid	Parameters														
	BH (cm)			BL (cm)			ChC (cm)			CC (cm)			HL (cm)		
	R1	R2	R3	R1	R2	R3	R1	R2	R3	R1	R2	R3	R1	R2	R3
Mother of Single Kid (IT ₁)	63.0	63.0	63.0	60.0	61.0	60.0	73.0	72.0	72.0	12.0	12.0	12.0	25.0	24.0	24.0
Single Kid (AT ₁)	40.0	41.0	40.0	35.0	34.0	35.0	44.0	41.0	43.0	9.0	10.0	10.0	14.0	13.0	14.0
Mother of Single Kid (IT ₂)	61.0	60.0	60.0	58.0	57.0	57.0	67.0	66.0	67.0	11.0	10.0	10.0	21.0	21.0	22.0
Single Kid (AT ₂)	46.0	45.0	45.0	41.0	39.0	40.0	51.0	50.0	50.0	10.0	11.0	10.0	15.0	16.0	17.0
Mother of Twin Kids (IK ₁)	70.0	69.0	68.0	65.0	65.0	66.0	79.0	79.0	80.0	11.0	11.0	12.0	23.0	23.0	23.0
Twin Kid (AK _{1.1})	43.0	43.0	42.0	43.0	44.0	43.0	55.0	54.0	56.0	11.0	11.0	11.0	15.0	16.0	16.0
Twin Kid (AK _{1.2})	49.0	48.0	49.0	42.0	41.0	42.0	54.0	53.0	53.0	10.0	10.0	10.0	15.0	16.0	16.0
Mother of Twin Kids (IK ₂)	70.0	69.0	70.0	51.0	52.0	51.0	80.0	80.0	79.0	13.0	12.0	11.0	23.0	23.0	24.0
Twin Kid (AK _{2.1})	54.0	55.0	55.0	43.0	44.0	44.0	58.0	59.0	59.0	11.0	10.0	10.0	19.0	18.0	19.0
Twin Kid (AK _{2.2})	53.0	54.0	53.0	55.0	54.0	55.0	63.0	63.0	63.0	12.0	11.0	11.0	21.0	21.0	21.0

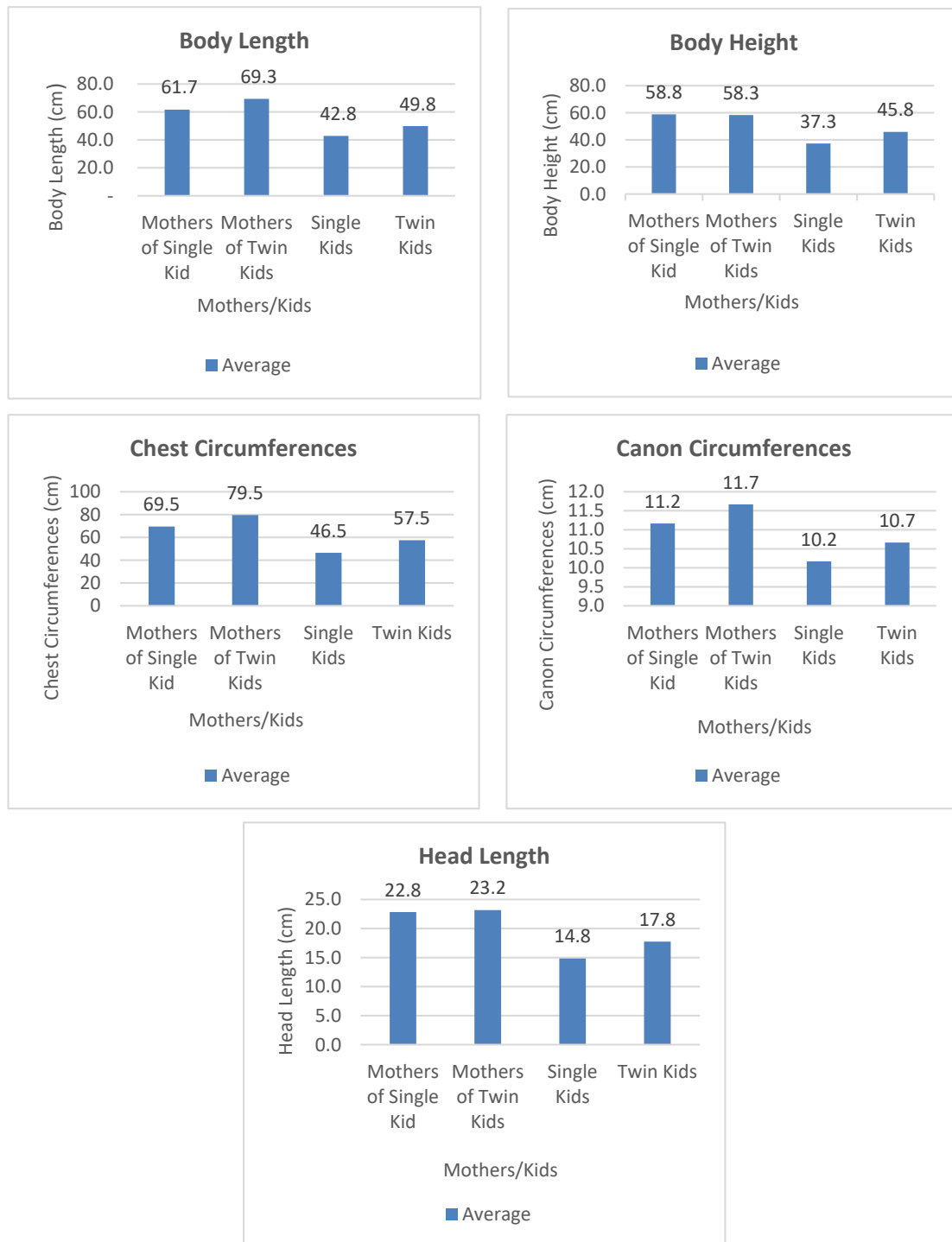


Figure 3 Average Measurement Results of Body Performance by Type of Birth

Based on **Table 1**, it is known that both mother goats of single-birth type (IT_1 and IT_2) have the size of BL, BH, CC, and HL which are similar. The significant size difference is only at the ChC parameter. Moreover, both mother goats of twin-birth type (IK_1 and IK_2) also have similar sizes of BL, CC, and HL. The most significant size difference is found in the BL and ChC parameters. If the mother goat's body performance corresponds to the birth type, the mother goats with twin-birth types have higher body performance on the BL, BH, and ChC parameters. Whereas the CC and HL parameters generally have no significant difference.

On the BL parameter, all four mother goats have sizes that are in accordance with research from Anggraini [11] that the average body length and body height of adult female goats being >60 cm. However, on the BH parameter, IT_2 and IK_2 mother goats are not in accordance with the previous study due to the average size of <60 cm. Whereas on the ChC

parameter, adult female goats measure generally >70 cm. Compared to the table above, the ChC size of IT₂, IK₁, and IK₂ mother goats are in accordance with the previous study, while the IT₁ mother goat is not in accordance because its average size of <70 cm.



Figure 4 The Measurement of Body Length (BL)

Making a comparison based on the birth type, the kids of Sapera Goats that have better body performance were born from the twin type. This is different from the research done by Sutyono *et al.* [9], that a single-birth lamb tends to have higher body performance on the BH and ChC, while the twin-birth types have higher BL values. This was caused by the difference of species and the rearing practices applied. The parameter for BL is affected by the growth of backbones so it can be known that the kids of the Sapera Goat who was twin-birth types have better developments on the spinal bones such as backbones, waist, and groin. The growth of these bones is influenced by feed and environment [12].

The performance of BH is influenced by the growth of the leg bones where the IT₁ and IK₁ mothers have the tendency to possess sturdier leg bones than those of IT₂ and IK₂ mothers [13]. The growth of these leg bones functions to prop up the body of the goat. The performance of BH, BL, and ChC is heavily related to the body mass of the livestock so that it can be used to estimate the weight of the livestock itself [14]. In common terms, the performances of the three show a positive correlation with the body mass of the livestock, hence when they have high values then the estimated goat will most likely have a relatively weighty body mass. This is reflected in the IK₁ mother. The IK₁ mother has more BH, BL, and ChC compared to the other mothers, thus, without taking proper body mass measurements, it can be presumed that the IK₁ mother weighs heavier in body mass than the rest. Mothers who were twin-birth types like IK₁ and IK₂ bear bigger BL performance because they were pregnant with more than one kid, hence the wombs needed are considerably wider and spacious.



Figure 5 The Measurement of Body Height (BH)

The performance of the ChC is related to the growth of flesh on bones hence ChC is mostly relevant to body mass instead of BH and BL [12]. Galib *et al.* [15] stated that ChC holds a determination value of as much as 99,6% on female livestock, proving that the size of linear regression on ChC can be used to estimate the body mass of the livestock. Subsequently, ChC is connected to the ribs, whereas the wider ribs allow growing more than one kid Atmaja *et al.* [16] hence IK₁ and IK₂ mothers hold bigger ChC than IT₁ dan IT₂. Other than that, ChC is also related to the increasing muscles on the sternum. The difference in ChC measurement is influenced by the variation of sex, feed, and growth speed of the respective livestock [17].



Figure 6 The Measurement of Chest Circumferences (ChC)

The performance of CC on the livestock is related to their forelimbs [8]. Based on previous research by Mathapo & Tyasi [18], as years passed by, the size of the CC influences the body mass of the female goats while it does not affect the male ones. On the measurement table, it can be summarized that the CC of each mother as well as their kids with their respective types does not show any differences hence CC is not related to the birth type of the livestock.



Figure 7 The Measurement of Canon Circumferences (CC)



Figure 8 The Measurement of Head Length (HL)

The performance of livestock's HL will increase with age, with the accordance to Tagoi *et al.* [7] that states the HL performance of local pre-weaning goats tends to increase with their ages so that all goat kids, be it from twins or single birth, can still grow rapidly as their age increase until they matured. This is reflected in the observation table that states goat kids from both birth types have more varied HL sizes than their mothers. The performance of HL is also affected by the shape of their heads, as different species have different characteristics. Based on Ariyanto *et al.* [5], the head shape of the Sapera goat resembles the PE goat so their HL sizes are relatively the same.

The performance of the body is influenced by several factors, including the environment and feed [13]. Other than that, it will increase with the age of the livestock [7]. Kuncen Farm is located in lowland areas that have agricultural lands with stable temperatures around 24 – 26 °C inside the enclosure. The relatively low temperature is suitable for Sapera Goats, as stated by Smith & Mangkuwidjojo on Ariyanto *et al.* [5], they are raised best in 18 – 30 °C temperatures. Based on observations, the air humidity in the farm is relatively high. High humidity along with low temperature can affect the livestock's body temperature. Environments with low temperatures and high humidity prevent the goats from heat stress which can cause a decrease in forage and milk production [19].

Table 2 Abiotic Data

No	Abiotic	Result
1.	Temperature (°C)	24 - 26
2.	Humidity (%)	77 - 95

According to Ariyanto *et al.* [5], the height of the place is also influential on the availability of the food stock and physiological conditions of the livestock. Animal feeds are categorized into two, namely concentrate and green fodder. Feed is essential to the productivity of the livestock as high nutrients affect the size and body physiology like hormones [20]. Other than that, the feed can also influence Sapera Goats and the quality of the milk they produce. The feed given is a mixture of tofu dregs and cassava peel in the morning combined with various green fodder in the evening. Tofu dregs and cassava is one of the concentrates that are high in carbohydrates and protein while green fodder is used to produce good quality milk [21].

Table 3 Feeds Composition of Sapera Goats at Kuncen Farm

No.	Feeds Composition
1.	Morning Cassava Peel 45 kg + Tofu Dregs 155 kg
2.	Afternoon <ul style="list-style-type: none"> • Pakchong Grass • <i>Calliandra callothyrsus</i> • <i>Pennisetum Purpureum</i> cv. Mott (Odor Grass) • <i>Pennisetum purpureum</i> (Elephant Grass) • <i>Ipomea sp.</i> • Corn straw
3.	Water 150 L + Salt 20 L + Mineral Premix 2 kg

Relating to the feed given, in compliance with Zucali *et al.* [28], high-quality milk can be produced only if they are fed with high carbohydrates or energy and protein as well. Other than that, they need some dose of mineral sources like table salts, calcium, bone meals, and mixtures of minerals and vitamins such as yellow corn or carrots. When the livestock are provided with enough nutrients, it can help them to increase their productivity. Sapera Goats that were given complete nutrients with good feed management can have their milk quality upgraded [29]. In accordance with **Table 4**, each feed types have different nutrients contained in them. Those nutrients rely on the age of the green fodder used, for example, the crude fiber content that can increase along its aging [24]. The crude fiber content is influential to the body mass hence tofu dregs, *Calliandra callothyrsus*, and *Ipomea sp.* are good to consume for weight addition.

Table 4 Nutrition of Animal Feeds

Feed Type	Crude Protein (%)	Crude Fat (%)	Coarse Fiber (%)
Tofu Dregs [22]	21.66	2.73	20.26
Casavva Peel [23]	8.11	-	15.20
<i>Calliandra callothyrsus</i> [24]	21.20	1.86	18.46
<i>Pennisetum Purpureum cv. Mott</i> [25]	12.72	2.28	32.25
<i>Pennisetum purpureum</i> [22]	15.37	3.18	30.20
Pakchong Grass [26]	16.45	-	15.25
<i>Ipomea sp.</i> [27]	21.36	3.30	12.81
Corn Straw [22]	5.56	1.28	33.28

The condition of the livestock enclosures also affects their productivity. Great ventilation and good consideration of number density, as well as hygiene, can be influential to their physiological conditions, mainly for milk production [28]. The lack of care for the things mentioned can cause stress to them, resulting in a decrease in productivity and quality. That being said, it is essential to take those things into account to prevent the stress on the means to increase their productivity. Based on the observation of the enclosure, the Sapera Goats are raised in an environment with great ventilation and cleanliness. The enclosure itself is made from wood and is formed staged so that the floor does not directly touch the ground. It is surrounded by agriculture and farming areas so that the farmers can easily get their green fodder supplies.

**Figure 9** Outside and Inside Conditions of the Cage

4 Conclusion

Based on the research, the body performance of BL, BH, and ChC, are considerably better in the mothers and kids with twin-birth type; while the body performance of CC and HL on each birth type does not show any significant difference. Hence, it can be concluded that BL, BH, and ChC are related to the birth type while CC and HL are not. The body performance of the goats is mainly influenced by their environment and feed.

Compliance with ethical standards

Acknowledgments

We would thank for the owner of the kuncen farm for allowing the research to be carried out and to all team members who helped during collection until analyze data.

Disclosure of conflict of interest

No conflict of interest among the authors.

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