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Evaluation of Body Weight, Morphometry, and Physiology Status of Etawah Crossbred Doeling on Two Different Farms Management

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ABSTRACT

This study aimed to evaluate the body weight (BW), morphometry, and physiological status of Etawah Crossbred Doeling (ECD) under different farms management. This study was performed in two farms, Garage (Tlogoadi village, Mlati subdistrict) and Bumiku Hijau (Margomulyo village, Seyegan subdistrict), both located in Yogyakarta and each farm used 6 ECD as the replications (12 animals in total). Parameters of the study consist of body weight (BW), morphometry (chest girth, hip height, body length, chest depth, ear length, ear width, and withers height), physiological status (respiration, pulse, and rectal temperature). The parameter was measured weekly for four consecutive weeks of observation. The results showed that the difference in farm management between Garage and Bumiku Hijau influenced on the BW, morphometry, and physiological status of ECD. The study showed that the BW and all morphometry from the Garage farm was higher than Bumiku Hijau farm ($P<0.05$). However, the physiological status (except for rectal temperature) from Garage farm was lower than Bumiku Hijau farm ($P<0.05$). It can be concluded that Garage farm implemented better good farming practices compared to Bumiku Hijau farm.

Keywords: Dairy goat, Etawah crossbreed doeling, Morphometry, Physiology status

Introduction

High consumer demand for milk and dairy products originating from non-cow dairy animals (Liang and Paengkoum, 2019) provides opportunities for the development of the dairy goat industry in Indonesia. The production of goat's milk comes from dairy goat farmers which are smallholders that generally carry out intensively (Escareño *et al*., 2012; Lohani and Bhandari, 2021). In dairy goat farming, rearing management of goat kids is vital and must be considered carefully. Goat kids performance is the basic that will determine milk production in the future (Bélanger-Naud, 2020).

The performance of the kids can be used to measure the productivity and growth of dairy goat from beginning, due to an important step to achieve the excellent quality of dairy goat (Chigwa, 2011). In this case, the growth and health of the kids are a key factors for further production of livestock (Sutama, 2011). The pre-weaning period and the time of weaning is a crucial period for goat kids (TTGSS, 2016). The performance of the goat kids itself is representative of the maintenance management, in which consist of colostrum feeding, milk and solid feed, health management, and record keeping. Improper care of maintenance management can lead to the death of the goat kids.

The study of ECD and BW has been reported by Widi *et al*. (2016) which measured the post-weaning of Etawah crossbred using observation of the hair color. Moreover, another research was done by Sulaksana (2008) on the growth of ECD until six months old in the village. However, the study of ECD has not yet been studied on different farm management in Indonesia. This is a challenge for dairy goat farmers to reach potential of maximum production in Yogyakarta, Indonesia particularly. Therefore, it is necessary to conduct studies and research related to the performance of the goat kids. This study aimed to evaluate the body weight, morphometry, and physiological status of ECD on different farm management. The finding of the study is expected to provide information for dairy goat farmers regarding rearing management for goat kids to obtain a good optimum performance.

Materials and Methods

Research materials

This study was performed in two farms: Garage farm located in Tlogoadi village (Mlati subdistrict) and Bumiku Hijau farm in Margomulyo village (Seyegan subdistrict). A total of 12 ECD aged 3 to 6 months (6 ECD per farm) were used in our study. Feed of Garage farms consist of corn

forage and cassava leaves silages and commercial concentrate, while Bumiku Hijau farm were concentrate and mung beans powder. In addition, our study did not intervene the ECD such as feed treatments or others.

Research parameters

Parameters of BW was evaluated by using a digital scale (Matrix), whilst morphometry of ECD such as body length, hip height, chest depth, and withers height was measured using a measuring stick and tape (SNI, 2015; 2008; Ibrahim *et al*., 2020).

The physiological status was observed using a digital thermometer (Omron model MC-245). Respiration was measured by placing the back of the researcher's palm to the nose of ECD then counted using a hand counter check for one minute (Rosita *et al*., 2015). Pulse was measured using a femoral artery on the inside of the goat's rear leg roughly one-third of the way down the thigh (Gipson *et al*., 2007). Body weight, morphometry, and physiology status were measured weekly throughout four weeks of observation. The temperature and humidity of the environment were measured by using a thermohygrometer (Jungson HTC-2). For the temperature humidity index (THI) was calculated by using the following equation: THI = (1.8 × aT + 32) – [(0.55 – 0.0055 × RH) x (1.8 × aT – 26)] (Thompson and Dahl, 2012).

Data analysis

Data of BW, morphometry, and physiology status were analyzed by independent-samples T-test using SPSS for windows® 23, while data of the feed nutrients, temperature, humidity, and THI were analyzed using descriptive analysis (Steel *et al*., 1997).

Results and Discussion

Results

The results showed that the different farm management influenced the BW of ECD, where BW of the doeling in the Garage farm was higher than Bumiku Hijau farm (P<0.05). The BW of ECD from Garage farm ranged 20.77 to 23.72 kg, while the BW of ECD from Bumiku Hijau farm was 8.97 to 16.47 g in first to fourth weeks (Figure 1).

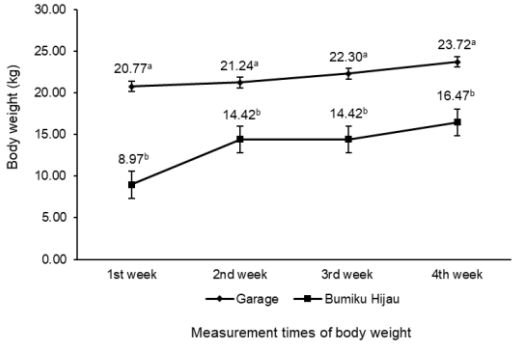

Figure 1. Body weight of ECD from Garage and Bumiku Hijau farms at difference measurement time.

Different farm management has implication to the morphometry parameters of ECD. The morphometry parameters of Garage farm were higher than Bumiku Hijau farm (P<0.05) as shown in Table 1. The chest girth and depth of ECD in Garage farm has ranges from 60.83 to 64.00 cm and 25.50 to 27.17 cm, respectively, while Bumiku Hijau farm was 48.00 to 55.00 cm and 19.67 to 22.00 cm, respectively. Hip height and body length of ECD in Garage farm ranged from 65.00 to 67.50 cm and 56.17 to 62.00 cm, respectively, while Bumiku Hijau farm was 47.17 to 59.00 cm and 37.33 to 48.33 cm, respectively. The ear width and length of ECD in Garage farm range from 8.25 to 10.42 cm and 27.50 to 29.83 cm, respectively, while Bumiku Hijau farm ranges from 5.83 to 8.00 cm and 15.33 to 19.58 cm, respectively. Furthermore, the withers height of ECD in Garage farm ranges from 60.17 to 64.67 cm, while in Bumiku Hijau farm ranges from 43.33 to 55.50 cm (Table 1).

Furthermore, the different farm management also affected the physiology status. The results of ECD respiration and pulse in Bumiku Hijau farm were higher than in Garage farm (P<0.05), including rectal temperature (P<0.05) for the first week, while the third and fourth weeks did not different (Table 2). The temperature, humidity,

Table 1. Morphometry of ECD from Garage and Bumiku Hijau farms under different farms management

Parameters (cm)	Farms	Measurement time of morphometry			
		1st week	2nd week	3rd week	4th week
Chest girth	Garage	60.83±2.99[a]	62.17±3.19[a]	62.50±2.66[a]	64.00±3.90[a]
	Bumiku Hijau	48.00±6.29[b]	55.00±4.69[b]	54.50±6.06[b]	54.67±7.17[b]
Hip height	Garage	65.00±4.47[a]	65.33±4.46[a]	65.83±2.23[a]	67.50±2.26[a]
	Bumiku Hijau	47.17±3.13[b]	57.83±5.23[b]	59.00±5.76[b]	58.67±6.12[b]
Body length	Garage	56.17±3.97[a]	58.83±3.19[a]	60.33±2.42[a]	62.00±3.22[a]
	Bumiku Hijau	37.33±4.41[b]	46.83±7.25[b]	46.83±5.34[b]	48.33±5.75[b]
Chest depth	Garage	25.50±1.05[a]	26.17±0.75[a]	26.67±1.37[a]	27.17±2.04[a]
	Bumiku Hijau	19.67±1.51[b]	22.00±2.53[b]	20.00±2.00[b]	20.17±3.19[b]
Ear width	Garage	8.25±0.42[a]	9.17±0.75[a]	9.92±1.28[a]	10.42±1.39[a]
	Bumiku Hijau	5.83±1.47[b]	7.67±1.51[b]	8.00±1.55[b]	7.83±1.47[b]
Ear length (cm)	Garage	27.50±1.38[a]	28.83±1.72[a]	29.83±0.75[a]	28.33±2.25[a]
	Bumiku Hijau	15.33±1.03[b]	18.92±2.97[b]	19.58±3.41[b]	19.17±3.25[b]
Withers height (cm)	Garage	60.17±3.25[a]	63.00±2.10[a]	64.17±1.94[a]	64.67±2.16[a]
	Bumiku Hijau	43.33±5.32[b]	55.33±5.72[b]	55.50±6.35[b]	55.17±6.55[b]

[a,b] Different superscripts on the same column for each of the parameter indicates significance (P<0.05) among treatments.

Table 2. Physiology status of ECD from Garage and Bumiku Hijau farms on different farms management

Parameters	Farms	Measurement time of physiology status			
		1st week	2nd week	3rd week	4th week
Respiration (min)	Garage	43.50±1.67[b]	45.17±1.99[b]	44.72±3.56[b]	40.83±3.93[b]
	Bumiku Hijau	68.67±4.07[a]	52.00±5.80[a]	57.00±3.28[a]	59.00±4.03[a]
Pulse (min)	Garage	57.11±2.03[b]	48.78±2.05[b]	57.11±3.99[b]	52.06±3.52[b]
	Bumiku Hijau	65.61±4.10[a]	61.17±4.28[a]	63.06±2.28[a]	62.94±2.43[a]
Rectal temperature (°C)	Garage	38.99±0.18[b]	39.17±0.18[a]	39.07±0.15	39.00±0.33
	Bumiku Hijau	39.32±0.11[a]	38.17±0.17[b]	38.94±0.21	38.80±0.48

[a,b] Different superscripts on the same column for each of the parameter indicates significance (P<0.05) among treatments.

and THI of the environment in Garage farm were 28.38°C, 64.50%, and 78.07, respectively, while Bumiku Hijau farm were 29.25°C, 52.25%, and 77.72, respectively (Table 3).

Discussion

The critical indicators growth of dairy goat kids were performance, health, and welfare. The rearing of goat kids is the basis for productivity of goat farming. Therefore, it is necessary to optimize the growth and health of the kids in the early stage of their life to obtain better future growth and production. Moreover, weaning is also a crucial period of the goat kid's life. Dairy goat farm's productivity depends on several factors related to genetics and the management of the herd (Bélanger-Naud, 2020). The result of farm management were shown in the performance of the kids, particularly BW (Figure 1) and morphometry (Table 1).

Based on the results, BW of the ECD from Garage farm was higher than Bumiku Hijau, due to the difference in feed either their concentrate or forage. Furthermore, the nutrient content of feed ingredient in Garage farm showed that crude protein (CP) and crude fiber (CF) of corn silage, cassava leaves silage, and commercial concentrate were 7.95% and 29.38%, 9.20% and 35.28%, and 13.45% and 16.19%, respectively. At the same time, CP and CF of concentrate and mung bean powder in Bumiku Hijau farm were 15.56% and 17.37%, 14.16% and 20.52%, respectively. Furthermore, feed quality is one of the most important factors that greatly affect goats' BW (Atti *et al*., 2004; Salah *et al*., 2014; Jiwuba *et al*., 2017).

The result for BW of the ECD in this study (Figure 1) is in accordance with the National Standard of Indonesia (SNI 7325) which ranges from 17 to 27 kg at the age of 6 to 12 months (SNI, 2008). However, based on SNI 7352.1 has been regulated that BW of ECD at the age of 8 to 12 months is a minimum of 19 kg (SNI, 2015) and the BW of ECD in Garage farm is in accordance, while in Bumiku Hijau farm is not. Furthermore, the BW of ECD in our study differed from that reported by Widi *et al*. (2016) showed that the ECD at the age of three months old ranged from 15.10 to 18.64 kg and 13.01 to 13.96 kg for Etawah crossbreed at the age of six months (Sulaksana, 2008). In addition, the BW of Etawah crossbreed doe from Polewali Mandar (West Sulawesi) is 33.04 kg (Rahim *et al*., 2020), and 12.73 kg for Etawah crossbreed at the age ranges from 8 to 12 months (Nugraha *et al*., 2019). Murti *et al*. (2022) explained that the BW of Etawah crossbreed weaning is 20.64 kg and 13.07 kg for 2 months of age. Additionally, the higher BW of ECD in Garage farm compared to Bumiku Hijau farm was also supported by the higher morphometry parameters such as chest girth, hip height, body length, chest depth, ear length, ear width, and withers height (Table 1). The different BW of Etawah crossbreed is affected by the different feed quality and animal conditions (health, physiological status, and age).

Body growth is closely related to the size of the body limb and BW. Several body measurements such as body length, chest depth, and withers height are known to correlate and are indicators for animal BW. Thus, the morphometry measurements can describe the appearance of goat production (Budisatria *et al*., 2018). The morphometry of ECD from the Garage farm from our study is in line with quantitative requirements from SNI (SNI 7325) for ECD, especially body length, chest girth, and ear length. Meanwhile, in Bumiku Hijau farm only body length is in accordance with SNI, but chest girth and ear length are not. The standard for body length ranging from 45 to 55 cm (50±5 cm), chest girth from 57 to 69 cm (63±6 cm), and ear length from 21 to 27 (24±3 cm) cm for does with age ranges from 6 to 12 months (SNI, 2008). However, SNI (7352.1) has been regulated for withers height, body length, chest girth, and ear length which were minimum 56 cm, 51 cm, 52 cm, and 22 cm, respectively (SNI, 2015).

Generally, the morphometry of ECD in Garage farm was higher compared to Bumiku Hijau Farm (Table 1), because feed from Garage farm has better quality than feed from Bumiku Hijau. The body length, hip height, chest girth, withers height, of ECD in our study (Table 1) was differed to the reported by Rahim *et al*. (2020) that the body length of doe from Polewali Mandar (West Sulawesi) is 71.70 cm, 71.34 cm, 72.19 cm, and 67.98 cm, respectively, which was fed by legumes feed (*Leucaena leucochepala*, *Sesbania glandiflora*,

Table 3. Temperature, humidity, and THI of Garage and Bumiku Hijau farms

Farms	Temperature (°C)	Humidity (%)	THI
Garage	28.38	64.50	78.07
Bumiku Hijau	29.25	52.25	77.72

THI = temperature humidity index.

and *Gliricidia maculata*) and sago. Furthermore, Nugraha *et al*. (2019) also reported that the morphometrics of Etawah crossbreed at age ranges from 8 to 12 months such as chest girth is 52.35 cm, 23.68 cm for chest depth, 50.33 cm for body length, 53.49 cm for hip height, and 49.16 cm for withers height.

Murti *et al*. (2022) explained that the body length of Etawah crossbreed is 56.13 cm, 69.87 cm for withers height, and 66.07 cm for chest girth. Rasminati (2013) reported the morphometrics from Etawah crossbreed doe, which kept in the lowland and highlands are chest girth is 59.00 cm and 57.67 cm, 12.50 cm and 13.00 cm for chest depth, 48.00 cm and 49.67 cm for body length, and 57.00 cm and 55.59 cm for withers height, respectively. The ear length and width of the ECD (Table 1) in our study differed from reported by Murti *et al*. (2022) for Etawah crossbreed is 26.97 cm ear length and 8.92 ear width. Furthermore, Rasminati (2013) reported that ear length and width of Etawah crossbreed which is kept in lowland area is 19.50 cm and 22.44 cm for highland area. The ear length in our study is in accordance with SNI 7325 with ranges from 21 to 27 cm (24±3 cm) (SNI, 2008) and SNI 7352.1 is a minimum 22 cm (SNI, 2015) for Garage farm, while ear length in Bumiku Hijau farm is not accordance to SNI. The different morphometrics of Etawah crossbreed are affected by different ages of doe, feed quality, environmental conditions (temperature and humidity), and animal conditions (health, physiological status, and welfare).

The rectal temperature of ECD from both farm Garage and Bumiku Hijau are considered to be normal, while pulses are under the standard. The study result showed that in Bumiku Hijau farm the respiration is higher indicating the ECD might be suffering from heat stress which is characterized by panting. Moreover, the respiration of ECD from the Garage farm is considered normal (Table 2). Our study showed that Garage farm is more comfortable for ECD than Bumiku Hijau farm. The calculation of THI from Garage and Bumiku Hijau farms showed that ECD in both locations underwent mild heat stress due to THI that ranged from 77.72 to 78.07. Koluman and Daskiran (2011) explained that the comfort zone for goats has THI of 70 or less, mild-moderate stress when THI ranges from 75 to 78, and severe stress when THI exceeds 78. Garage farm is located in an open space surrounded by rice fields, which has good air circulation, has a wide area for the exercise of the ECD, and the distance from residential areas is quite far, whilst Bumiku Hijau farm is in the opposite condition.

Normal rectal temperature is ranges from 38.5 to 40^{o}C, respiration from 26 to 54 times/minute, and pulse from 70 to 135 times/minute (Rosita *et al*., 2015). According to Andriani *et al*. (2010), the rise of the ambient temperature resulting a higher respiration rate, which is used to maintain a physiological balance in the animal's body so that the body temperature is at the normal level. Furthermore, Dukes (1993) stated that the frequency of breathing could be influenced by several factors, including body size, age, physical activity, ambient temperature, digestive tract conditions, and animal health.

Conclusions

It can be concluded that Garage farm implemented better good farming practices compared to Bumiku Hijau farm. The BW and all morphometry parameters from the Garage farm were higher compared to Bumiku Hijau. However, the respiration and pulse of the physiology status were lower than Bumiku Hijau.

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