



Welfare and Health of Prague Goats in Madiun Zoo of Indonesia

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Abstract | Prague goats are originating from Prague, Czech Republic. They were brought to the Madiun Zoo of Indonesia for improving tourism. There are four heads of the Prague goats in Madiun Zoo and they were not studied yet. We aimed to identify the qualitative and quantitative characteristics, helminths infestation status, and body condition score (BCS) of Prague goats in Madiun Zoo. It was estimated that Prague goat I was dominantly a female brown shorthaired (BSH) breed with a little white shorthaired (WSH) blood, goat II was a full female WSH, goat III was a full male BSH, and goat IV was a male WSH and BSH crossbred. The average body weight, body length, heart girth, chest width, wither height, and shoulder width were 19,72±3,77 kg, 42,5±6,36 cm, 59±5,65 cm, 15,25±0,75 cm, 43,5±2,5 cm, and 14,5±0,5 cm for does, and 30,05±1,20 kg, 47,5±0,5 cm, 73±2 cm, 20,5±1 cm, 52,5±6 cm, and 20,5±0,5 cm for bucks respectively. All goats were infested with helminth eggs at mild in goats I and III, moderate in goat IV, and severe degree in goat II. The BCS scores of goat number I, III, and IV was 3.0 out of 5.0 while goat II was 2.0. In conclusion, it is important to improve health and welfare managements to maintain the performans of the goats.

Keywords | Body Condition Score, Health Status, Helminths Eggs, Prague goat, Qualitative Characteristics, Quantitative Characteristics

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INTRODUCTION

Prague goats are dwarf goats originating from Prague, Czech Republic. They have smaller body sizes than the other types of European goats. There are two types of Prague goats: White Shorthaired (WSH) and Brown Shorthaired (BSH). The WSH goat is a dairy breed developed in 1900 - 1960 by crossing local goats with Saanen bucks imported from Switzerland and Germany. The BSH goat is a dairy breed, developed in 1900 - 1930 in North Bohemia (Czech Republic) by crossing a local breed with a crossbreed between Harz goat (Germany) and Brown Alpine (Switzerland) goats. Both breeds are generally used as dairy goats (Sztankoova and Rychtarova, 2018). In Indonesia, these goats can be found in Madiun Zoo, Madiun

is a new type of goat in this commercial zoo. The goats in Madiun Zoo are fed with forages and tofu waste. The forages are mostly collected from the leftover by-products of other animal feeds. For example, the *Hylobates moloch* is fed with bananas and corn, and the herbivores including goats were fed with banana peels and corn husks. In the Czech Republic, Prague Goats are reared extensively based on pasture grazing and they consume grass, forbs, and shrubs (Pokorná et al., 2013).

There is currently no identification of goats originating from the Czech Republic although this identification is necessary to study the physical characteristics of the Prague Goat in Indonesia. It is currently unknown that the original breeds of goats are imported directly or they are a result of

cross-breeding with others. Characteristics identification can be individually seen from several aspects that indicate the type of each animal. Identification of animal characteristics indicates whether the animal is part of a species or a certain breed. The importance of animal identification is to determine a type of animal in terms of physical appearance, place origin, environment, and other characteristics which are different among animals. Goat performances can be measured and determined by identifying qualitative and quantitative characteristics (Khasanah et al., 2022). Quantitative characteristics can be measured and counted such as the animal's body weight, while qualitative properties can be distinguished without measurement such as the animal's hair color. Research on the identification of qualitative and quantitative phenotypic characteristics in goats is aimed to obtain basic data for future goat breeding strategies (Nuraini et al., 2017). Qualitative identifications can be in the form of hair color and the nature of the horns while quantitative measurements can be in the form of body weight, body length, chest circumference, and age (Komariah et al., 2015).

Health status is the health condition of an individual seen from the duration and frequency of illnesses, type of disease, and treatment (Nurhalimah 2016). According to Depoorter et al. (2015), animal health status is defined as the health condition of an individual animal to include transferable and zoonotic diseases but it does not include metabolic diseases. Based on the Decree of the Indonesian Minister of Agriculture (61/Permentan/PK.320/12/2015), animal health is all matters relating to the protection of animal resources, public health, the environment, and guaranteeing the safety of animal products, animal welfare, as well as increasing market access to support sovereignty, independence and food security of animal origin. According to Ducrot et al. (2011), animal health status can be defined as the presence or absence of a disease in the individual animal. One of the important health status checks is parasite infestation such as helminths that can be identified by measuring the presence of their eggs in the goat feces. The manifestation of nematode parasites can cause weight loss and it will result in the death of the goats in severe infestation due to depleted nutrition (Mukti et al., 2016). Another simple health status check is to examine the body condition score (BCS) of the goats. According to Rifai'i and Agriawan (2020), BCS can be used to determine the production potential of the goats and it is one of the factors that influence the level of production and reproduction in goats. Therefore, this study aimed to identify qualitative and quantitative characteristics, helminths infestation status, and BCS of Prague goats in Madiun Zoo, Madiun, East Java, Indonesia.

QUALITATIVE CHARACTERISTICS IDENTIFICATION

Examination of qualitative characteristics was obtained by observing hair color by looking at the dominant color of the goat's hair, horn whether they had horns or not (Nuraini et al., 2017), face shape whether it was convex or concave, ear shape as straight ears or curved ears (Komariah et al., 2015), and BCS by direct measurement based on the BCS standard criteria from 1 to 5 (Villaquiran et al., 2008).

QUANTITATIVE CHARACTERISTICS IDENTIFICATION

Examination of quantitative characteristics was performed by measuring body length, wither height, shoulder width, chest width using a caliper, and chest heart girth using a tape measurement following the procedures of Salako and Ngere (2002) as follows:

Body length (BL): The distance from the head of the humerus to the distal end of the pubic bone.

Wither height (WH): The distance between the most cranial palpable spinosus and the ground.

Shoulder width (SW): Width at shoulders, the distance between the lateral tuberosities of the humerus.

Chest Width (CW): measured as the width of the chest inside the foreleg.

Heart girth (HG): Measured as the body circumference just behind the foreleg.

FECES COLLECTION

The feces collection technique was done by taking samples from the rectum of each goat. There were eight feces containers with (4) or without (4) formalin addition. The feces container were labelled according to the identity of each goat and stored in an ice gel cooler. Samples without formalin were analyzed at Healthy Pet Clinic Madiun while samples with formalin were analyzed at Subang Veterinary Bureau.

IDENTIFICATION OF HELMINTH EGGS IN FECES

Examination of helminth eggs in the feces was done by using a native method at Healthy Pet Clinic Madiun as well as using Whitlock and sedimentation methods at Subang Veterinary Bureau.

DATA ANALYSIS

All data obtained will be processed and presented descriptively with the help of Microsoft Excel 2021. The total prevalence of feces samples identified as helminths will be calculated using the following formula:

$$\text{Prevalence} = \frac{F}{N} \times 100\%$$

Description,

Prevalence: Percentage of total feces samples identified as helminths eggs

F: The number of positive feces samples identified as helminths eggs

N: Total number of all samples examined

ETHICS RESEARCH

Research ethics have been submitted before the research begins to the ethics commission at the Faculty of Medicine, Padjadjaran University with an ethics number 930/UN6.KEP/EC/2022.

RESULTS AND DISCUSSION

The result of the study showed that there were four Prague Goats at Madiun Zoo consisting of two males and two females. The goats were given the numbering identities: I, II, III, and IV (Figure 1).

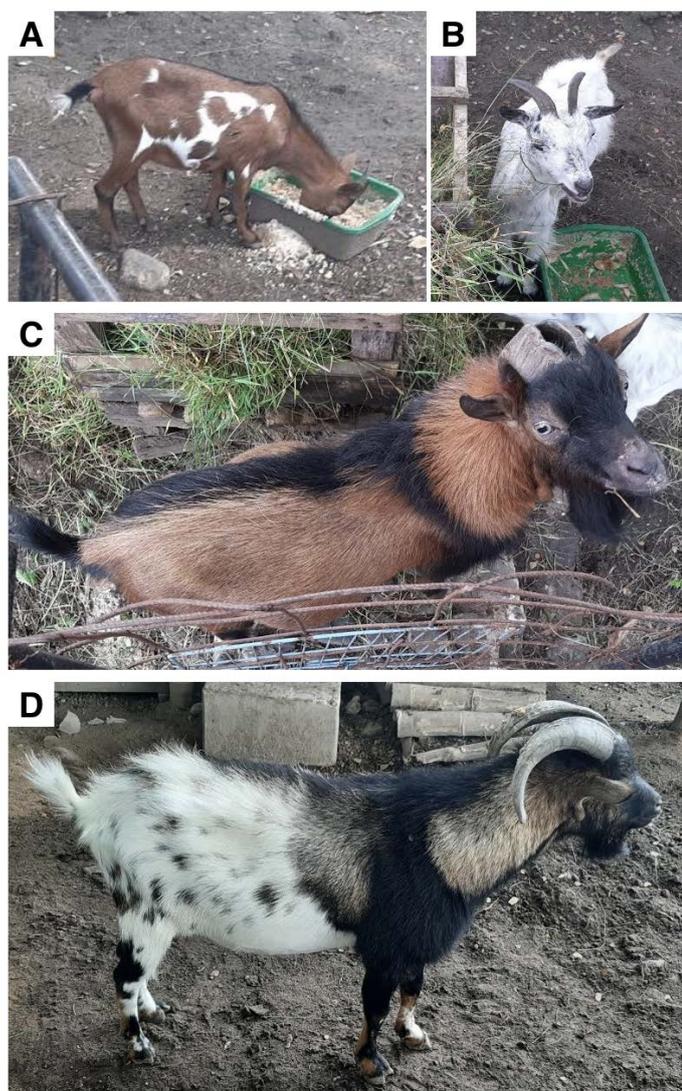


Figure 1: Prague Goats at Madiun Zoo

QUALITATIVE CHARACTERISTICS IDENTIFICATION RESULT

Prague Goats I and III (Figure 1) have characteristics similar to BSH goats from the Czech Republic as can be seen from the dominant brown color of their body. However, goat I had some white spots (Table 1) that indicate the goat is a cross breeds between BSH and WSH goats. According to Sztankoova and Rychtarova (2018), the characteristic of the Brown Shorthaired breed is similar to the German Brown (Erzgebirgziege) in appearance with glossy short hair and dark brown coat and face. The coat is significantly ($P < 0.05$) short and smooth. Black stripes are running from withers to tails. The typical characteristics of the breed are a black triangle behind the ears, a black muzzle, hair inside the ears, abdomen, shank, and hooves are black. They are mostly hornless about 75–80% with upright ears.

Prague Goat II (Figure 1) has characteristics similar to WSH Goats from the Czech Republic as can be seen from the dominant white color of its body with black dots (Table 1). According to Sztankoova and Rychtarova (2018), the characteristic of the WSH breed is like the Saanen in appearance, pure white, and shorthaired without any colored hair. Some strains maintain the characteristic of Saanen's black spots on the skin of the nose, eyelids, and udder with upright ears. They are mostly hornless (75–80%). Animals are medium-sized; the head is quite long and wide at the front and the neck is relatively long and thin. Strong, short, smooth coat without pigment in some animals with the occurrence of skin appendages and corners.

Prague Goat IV (Figure 1) has characteristics similar to BSH Prague goats with black/brown head, black forelegs with black strips on the back, and similar to WSH in white body with black spots (Table 1). It is most likely that goat IV is a crossbreed between BSH and WSH goats.

QUANTITATIVE CHARACTERISTICS IDENTIFICATION RESULT

All the goat body weights are below 50 kg (Table 1). The average body weight of does were $19,72 \pm 3,77$ kg, while bucks were $30,05 \pm 1,20$ kg (Figure 2). According to Sztankoova and Rychtarova (2018), the average body weight of WSH is 54–68 kg in does and 68–86 kg in bucks. The average body weight of BSH is 50–55 kg in does and 70–85 kg bucks. This huge difference in weight may be due to differences in the environment, climates, and frequency of feed given. Sztankoova and Rychtarova (2018) studied the Prague goats that were raised as dairy goats while in Madiun Zoo, goats are raised as exotic or fancy animals.

The average body lengths, heart girth, chest width, wither height, and shoulder width were $42,5 \pm 6,36$ cm, $59 \pm 5,65$ cm, $15,25 \pm 0,75$ cm, $43,5 \pm 2,5$ cm, and $14,5 \pm 0,5$ cm for does

Table 1: Qualitative Characteristics of Prague Goat at Madiun Zoo of Indonesia

Characteristics	Prague Goat			
	I	II	III	IV
Age (Years old)	2	4,5	4,5	2
Sex	Female	Female	Male	Male
Weight (Kg)	15,95	23,50	29,20	30,90
Hair Color	Dominant brown with black strips on the back, and some white spots.	Dominant white with some black dots.	Dominant brown with black strips on the back	Brown head, white body with black spot, black forelegs, black strip on back.
Horn	Yes	Yes	Yes	Yes
Face Shape	Concave	Concave	Convex	Convex
Ear Shape	Straight	Straight	Straight	Straight
Body Condition Score (BCS)	3,0	2,0	3,0	3,0

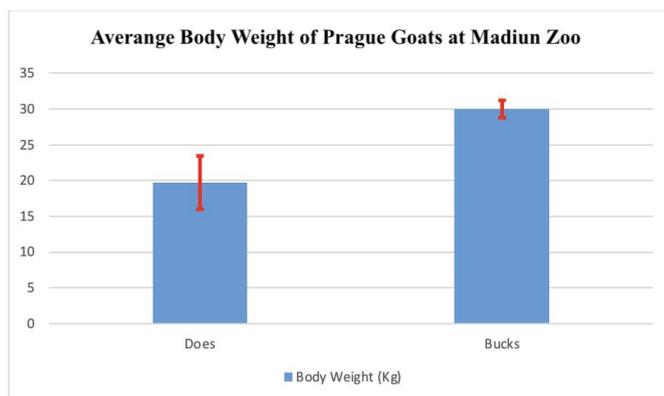


Figure 2: Average Body Weight of Prague Goats at Madiun Zoo

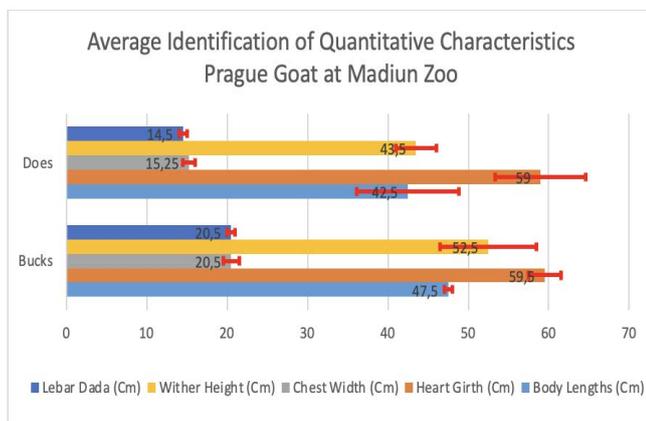


Figure 3: Average Identification of Quantitative Characteristics Prague Goat at Madiun Zoo

and 47,5±0,5 cm, 73±2 cm, 20,5±1 cm, 52,5±6 cm, and 20,5±0,5 cm for bucks respectively (Figure 3). The goats' body length was below the average of those studied by Sz-tankoova and Rychtarova (2018) where an average WSH height in withers is 72 - 80 cm and heart girth 85 - 105 cm in does, 75 - 85 cm in withers and 95 - 115 cm in heart girth in bucks. The average BSH height of the withers is 65 - 75 cm in does and 70 - 80 cm in bucks. The significant

differences in quantitative measurements between Prague goats in Madiun Zoo and Prague goats in the Czech Republic are likely due to different purposes for raising the goats. The goats in Madiun Zoo are raised as exotic animals to educate visitors about other species of goats from the Czech Republic while in the Czech Republic, most Prague goats are raised for milk production.

Prague goats in the Madiun Zoo were kept in lowlands with high environmental temperature. According to Diana (2015), high environmental temperatures in lowlands decreased feed intake in goats due to a decreased heart rate of the goat's body to produce heat. It is possible the goats don't consume a lot of feed because of the environment. The frequency of feed given also would be different for Prague goats at Madiun Zoo and in their origin country. In their origin country, goats are fed regularly and considered as livestock, while the Prague goats at Madiun Zoo are given sufficient food as tourist animals. According to Foeh et al. (2021), feeding goats with attention to concentrate and a good and regular feeding pattern will increase goat production and performance. It is possible there was a differences of Prague goats at Madiun Zoo and in Czech Republic because feeding at Madiun Zoo is limited and no additional concentrates and vitamins are given.

HELMINTHS EGGS IN FECES RESULT

The total prevalence of feces samples identified as helminths is 100% (Figure 4). All goats were infested with helminth eggs. The helminth eggs (Table 2) found were *Oesophagostomum* spp. (6,25%), *Trichuris* sp. (26,25%), *Haemonchus* sp. (10%), *Cooperia* sp. (1,25%), *Strongyloides* sp. (52,5%), *Toxocara* sp. (3,75%). Goats I, II, and III were infested by *Haemonchus* sp. (Figure 5). During data collection, goat II had diarrhea. When examining its health status from the helminths infestation, goat II was exposed to a severe level of infestation.

Worm parasites in the digestive tract are the main prob

Table 2: Identification of Helminths Eggs in Feces of Prague Goat at Madiun Zoo

Prague Goat	Helminths Eggs	
	Result	Species
I	+	<i>Haemonchus sp.</i>
II	+	<i>Cooperia sp.</i> , <i>Haemonchus sp.</i> , <i>Oesophagostomum sp.</i> , <i>Strongyloides sp.</i> , <i>Trichuris sp.</i> , <i>Toxocara sp.</i>
III	+	<i>Haemonchus sp.</i> , <i>Oesophagostomum sp.</i> , <i>Toxocara sp.</i>
IV	+	<i>Oesophagostomum sp.</i> , <i>Strongyloides sp.</i> , <i>Trichuris sp.</i>

Table 3: Eggs Per Gram (EPG) Whitlock Method Test Results with McMasters

Prague Goat	Worm Egg Identification Test Results					
	<i>Cooperia sp.</i>	<i>Haemonchus sp.</i>	<i>Oesophagostomum sp.</i>	<i>Strongyloides sp.</i>	<i>Trichuris sp.</i>	<i>Toxocara sp.</i>
I		90				
II	30	60	60	1240	30	30
III		90	30			90
IV			60	30	600	

Table 4: Interpretation of Severity Level in Calculation of Worm Eggs in Goats/Sheep (Subang Veterinary Bureau, 2021)

Types of Worm Eggs	Degree of Worm Egg Severity Infestation		
	Mild	Moderate	Severe
Mixed infestation	<250	250-2000	>2.000
Mixed infestation (<i>without Haemonchus sp.</i>)	<150	150-1000	>1.000
<i>Haemonchus sp.</i>	<2.500	2.500-8.000	>8.000
<i>Ostertagia sp.</i>	<200	200-2.000	>2.000
<i>Trichostrongylus sp.</i>	<500	500-2.000	>2.000
<i>Nematodirus sp.</i>	<100	100-600	>600
<i>Strongyloides sp.</i>			>10.000

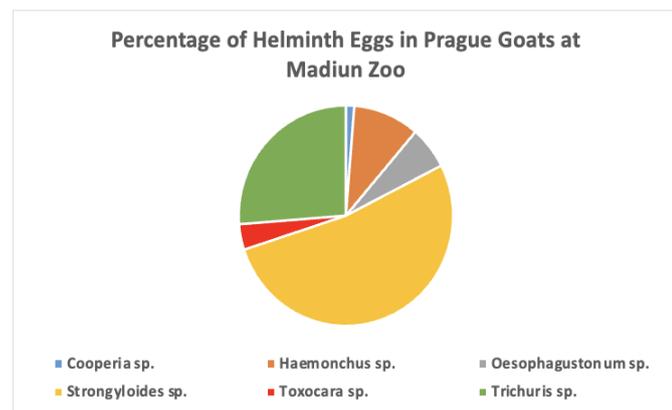


Figure 4: Percentage of Helminth Eggs in Prague Goats at Madiun Zoo

lem that infests small ruminants causing health problems. These endoparasites can lead to a lack of nutrient absorption which can inhibit growth (Purwaningsih et al., 2017) and weaken the body's immune, thus other pathogens are easier to infect the goat body (Garedaghi et al., 2011). The potential clinical signs of helminth infestation are loss of body weight, severe anemia, and diarrhea (Julaeha et al., 2021). Species of helminths commonly infesting goats

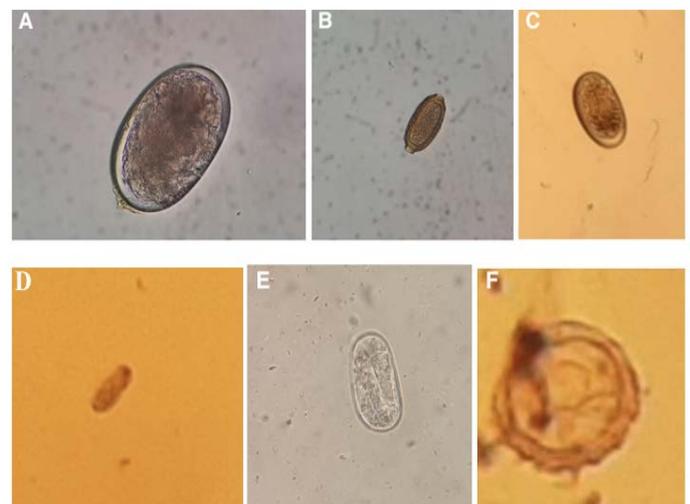


Figure 5: Helminth eggs (A) *Oesophagostomum spp.* (40x), (B) *Trichuris sp.* (40x), (C) *Haemonchus sp.* (40x), (D) *Cooperia sp.* (40x), (E) *Strongyloides sp.* (40x), (F) *Toxocara sp.* (40x)

in Indonesia are *Haemonchus contortus*, *Trichostrongylus spp.*, *Oesophagostomum spp.*, *Strongyloides sp.*, *Trichuris sp.* (Purwati et al., 2021), Taeniidae family (Yufa et al., 2018),

Bunostomum spp., and *Chabertia* spp. (Puspitasari et al., 2019).

A study conducted by Khirqah et al. (2021) showed that the prevalence of goats with helminth infestation in intensive rearing was 90% and 100% in semi-intensive rearing. Another study by Tikyaa et al. (2019) showed that goats with intensive care had a smaller prevalence of helminth infestation of up to 18,1%, compared to those raised by grazing (38,8%). Tolistiawaty et al. (2016) mentioned that ruminants in semi-intensive care have a higher chance infected with helminth worms during grazing.

Another factor affecting the high prevalence of helminth infestation is farm housing contractions (Purwaningsih et al., 2017). Generally, goats are kept in individual pens and given their feed and drink based on the cut and carry system. While in Madiun Zoo, goats are released in a large open paddock and given feed and drink in one place inside. It increases the potential of helminth infestations in the goats.

The interpretation of the severity of worm infestation of small ruminants depends on the degree of worm egg infestation in the feces which can be categorized into mild, moderate, and severe. In goats or sheep, the interpretation is shown in Table 4 which explains the severity of the calculated Whitlock test results (Table 3). In the Whitlock calculation, each type of worm egg found will be counted and then multiplied by 30. The multiplication results will be compared with the information in Tables 3 and 4. If more than one type of worm egg was found, it will be totaled and counted in the table for the mixed results section (Subang Veterinary Bureau, 2021).

The Whitlock test results of Prague goat I showed a positive *Haemonchus* sp. (90%). It indicates that the goats have a mild level of severity according to Table 4. The type of worm that infested Prague goat I was only *Haemonchus* sp. Prague goat II had the Whitlock test results from a positive *Cooperia* sp., *Haemonchus* sp., *Oesophagostomum* sp., *Strongyloides* sp., *Trichuris* sp., and *Toxocara* sp. indicating a severe infestation (Table 4). Prague goat III had the Whitlock test result a positive *Haemonchus* sp., *Oesophagostomum* sp., and *Toxocara* sp. indicating a mild infestation (Table 4) because it was below 250 and it was a mixed infestation. Prague goat IV had the Whitlock test result from a positive *Oesophagostomum* sp., *Strongyloides* sp., and *Trichuris* sp. indicating a moderate infestation (Table 4) because it was between 250 and 2000 and it was a mixed infestation. Therefore, the health status of Prague goats in Madiun Zoo based on the helminth infestation was not good, especially in Goat II with a severe infestation.

The high intensity of helminth eggs in goats is caused by a lack of cleanliness in both cages and the goats themselves. A dirty cage could cause helminth eggs in feces accidentally be eaten by ruminants. The helminth eggs could infect ruminants with low hygiene care so it can increase helminth infestation that can be transmitted through the skin (Nery et al., 2019). The low level of cleanliness for these goats in Madiun Zoo caused them to be infested by helminths, especially Goat II who had diarrhea that indicates severe infestation (Table 4).

BODY CONDITION SCORE RESULT

The results of identification of health status as seen from the BCS score for goats I, II, III, and IV were 3.0, 2.0, 3.0, and 3.0 respectively (Table 1). The health status of Prague goats in Madiun Zoo as seen from the BCS score was good except for goat II with a BCS score of 2.0 where the goat was suspected of being malnourished so it had a low BCS score.

The goats need to maintain their body condition to a moderate score to prevent decreased fertility and production as well as increased disease and parasite infestation which might increase operating costs. When overall body condition starts to decrease in the flock, it is a sign that the flock needs supplemental feeding, deworming, pasture rotation, and so on. When overall body condition starts to increase in the flock, it is a sign that the farmer should reduce the supplemental feeding. It is important to maintain and check the body condition of the flock of the goat regularly to help the farmer to prevent malnutrition and overfeeding from flocks (Villaquiran et al., 2008).

CONCLUSION

Several Prague goats in Madiun Zoo are mixed breeds and several others are full BSH breed and WSH breed. Goat I is a female mixed breed with mild helminth egg infestation and a BCS score of 3.0. Goat II is a female WSH breed with severe infestation and a BCS score of 2.0. Goat III is a male BSH breed with mild infestation and a BCS score of 3.0. Goat IV is a male mixed breed with moderate infestation and a BCS score of 3.0.

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The authors would like to thank Madiun Zoo's staff and Subang Veterinary Services' staff for the opportunity to learn and carry out this research work.

CONFLICT OF INTEREST

The authors do not have any conflict of interest.

Prague goats are originally from Czech Republic and imported to Madiun Zoo since late 2019. Since first came to the zoo, these goats have not been studied yet on their performance, welfare, and health status.

AUTHORS CONTRIBUTIONS

CAPA: Data collection, laboratory analyses, data analyses, and original manuscript preparation

IK: Research design, data analysis, manuscript review and editing, and supervision

DR: Research design, data analysis, manuscript review and editing, and supervision.

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