

Importance of Body Condition Score for Milk Production Traits in *Peranakan Etawah* Goats

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Abstract

Body condition score (BCS) is critical measure of dairy animal. Adequate body fat promotes milk production, reproductive and herd longevity. This study was conducted to investigate body condition score (BCS, scale 1 to 5) and its association with milk production traits in *Peranakan Etawah (PE)* goats. A total of 108 multiparous does were divided into five groups based on the BCS (BCS 2, n=21; BCS 2.5 n=44; BCS 3 n=35, BCS 3.5 n=6; BCS 4 n=2). BCS was measured during early lactation, while milk production was during the first 90 days of lactation and adjusted the energy corrected milk (ECM). Milk protein and fat contents were measured biweekly within the first 90 days. The result indicated a significant association between BCS and milk production ($p<0.01$), and milk protein ($p<0.05$), nevertheless it was not associated with milk fat. Average milk production for respective BCS groups was 1088.67±260.16; 1168.69±328.98; 1455.15±465.28, 1568.30±340.15 and 1614.56±396.60 mlECM/day. Increased BCS at early lactation was associated with a higher milk production. In contrast, BCS was negatively associated with protein content (%) in milk (3.41±0.40; 3.21±0.30; 3.22±0.16; 3.13±0.09 and 2.85±0.02) for respective BCS groups. The conclusion, the BCS was an important indicator to predict the milk production traits in *Peranakan Etawah* goats and BCS can be used as a marker for milk production and milk quality.

Keywords: BCS; milk protein; milk fat; lactation; Indonesian goat.

1. Introduction

The majority of goat production in Indonesia is managed by small scale farmer under traditional methods and most goats are kept in small pens near the house and fed on by-products and branches of trees from which they eat the leaves and barks, leaving the woody parts to be used as a domestic fuel. According Davendra (2007) goats are valued for variety of important contribution, with the following benefit; **Income:** important means of earning supplementary income; **Food:** provision of animal protein (meat and milk); **Security:** source of investment, assets; **Employment:** effective utilization of unpaid family labour; **Fertilizer:** contribution to crop production and farm fertility through the return of dung and urine; **By-product utilization:** they enable economic utilisation of non-marketable crop residues to generate value-added product; **Social values:** ownership has been shown to increase cohesiveness in village activities and religious ceremonies; **Recreation:** socio-economic impact of animal ownership also includes a recreational contribution to small farmer e.g. buck fighting, buck races. In Indonesia goat is essentially a banking system, (Ørskov, (2011)

Peranakan Etawah (PE) goat is one of dairy goat type in Indonesia and is distributed in almost all regions. This breed is farmed for as a dual purpose goat, both for meat and milk production. This goat is believed to result from undirected natural crosses between Etawah goat originated from India and local goat known as *Kambing Kacang*, of unpredicted genetic composition. The characteristics of *PE* goats are combinations of Etawah and Kacang goats. At the present, this goat breed contributes the most to population in Indonesia. For many years, the objective of raising *PE* goats for milk production, contest of goats and replacement stock or for savings. The goat in research station conditions, mature *PE* doe produces between 0.5 – 2.0 liter/milk/day (Sutama, 2011) indicating that this breed has high potency to be selected and developed as milk goat type. According FAO (2011) *PE* goat in temperate region produced daily milk of 1.725 ± 0,031 kg on average

It is well known that any factors such as nutrition, live weight and body condition score are important factors affecting the phenotypic and milk production performance of farm animal (Meyers-Raybon, 2010). Body condition score (BCS) has been shown to be an important practical tool in assessing the body condition of cattle, sheep, and goats because BCS is the best simple indicator of available fat reserves which can be used by the animal in periods of high energy demand, stress, or suboptimal nutrition (Villaquiran et.al., 2004; Roche et al., 2009).. Body fat reserve in dairy goats bears importance in terms of milk production, fertility, feed consumption and general health of the animal (Koyuncu and Alünçekiç, 2013) Goats that are very fat at kidding will result in

more health problems and goats that are very thin in early lactation will not have the energy reserves required to attain high milk production.

Change in BCS can and should be used to assess the level and change of body fat stores and as an indicator of energy balance. The ideal BCS will support peak milk production during the negative energy balance of lactation. Scores of 3 to 3.5 are ideal; this condition has a positive relationship with health, longevity, efficient reproductive performance and milk production (MzKenzie-Jakes, 2008). Many studies showed that BCS has high correlation with milk production and composition (Zahraddeen et al., 2009; Ahmed et al., 2010; and Pambu et al., 2011) and affects the reproduction performance of dairy (Suharto et al., 2008; and Serin et al., 2010). BCS highly effect on milk yield in dairy cow (Dikmen et al., 2010), BCS at calving and drying off were significant effects on total milk yield (Koyuncu and Alünçekiç, 2013). And according Detweiler et al., (2008) that BCS cannot be assigned by simply looking at an animal. Instead, the animal must be touched and felt, in the lumbar area, lumbar vertebrae which have a vertical protrusion (spinous process) and two horizontal protrusions (transverse process). The objective of present study was to investigate the association of Body Condition Score (BCS), scale 1 to 5 and milk production traits include milk protein and fat content in *PE* goats.

2. Materials and Methods

The study was carried out in farmer condition in Blitar- and Malang Regencies, Eas Java Indonesia. One hundred and eight multiporous *PE* does were used in this experiment. BCS was determined by one person during lactation by observing the body conformation from the hind of animal and body palpation, (Detweiler et al., 2008). Scores were assigned using a five-point scale from 1 thin to 5 grossly fat based on palpation of the fat, half scores were included.

BCS 1: Emaciated and weak animal, there is no fat cover and fingers easily penetrate into intercostals spaces (between ribs); **BCS 2:** Slightly raw-boned, some ribs can be seen and there is a small amount of fat cover; **BCS 3:** Ribs are barely discernible, an even layer of fat covers them; **BCS 4:** The backbone cannot be seen, ribs are not seen; **BCS 5:** The backbone is buried in fat, ribs are not visible, and the ribs cage covered with excessive fat.

Milk production was daily recorded within the first 90 days of lactation. Milk samples for protein and fat content analyzed were collected biweekly from the morning milking and added $K_2Cr_2O_4$ and transported to the Laboratory of Dairy Science Faculty of Animal Husbandry Brawijaya University within two hours after milking. The milk composition was analyzed by Lactoscan Milk Analyzer (MCC-serial 7035-Bulgaria). Milk production was adjusted to Energy Corrected Milk (ECM) of 4% fat and 3,3 % protein (Hemme, 2010). The data were statistically analyzed by ANOVA one way classification unbalanced number per group and continued by LSD (Least Square Difference) with support of Genstat 12.2 software (University's License) .

3. Result and Discussion

3.1 Milk Production

The milk production of *PE* goats in this present study was measurement daily for three months. The milk production declined slightly during first three months. Fat and protein contents measurement biweekly were observed constant during first three months although fat content increased non significantly (Fig. 1). Darwesh et al., (2013) reported; each component, protein, lactose and solid non fat showed the lowest values during early lactation, and then significantly ($p < 0.05$) increased towards the end of lactation. Average of milk production, milk protein and milk fat for 90 days lactation of *PE* goats at the study respectively $1321.92 \pm 3.77.92$ ml/head/day; 3.22 ± 0.22 % and 6.75 ± 1.19 %. The average of milk production in the present study was higher compared to the result of (Suranindiyah et al., 2009) was 774 ± 291 ml/day for the same breed, however, was lower than those for Etawah pure breed goats 2.15 ± 0.30 kg/day.

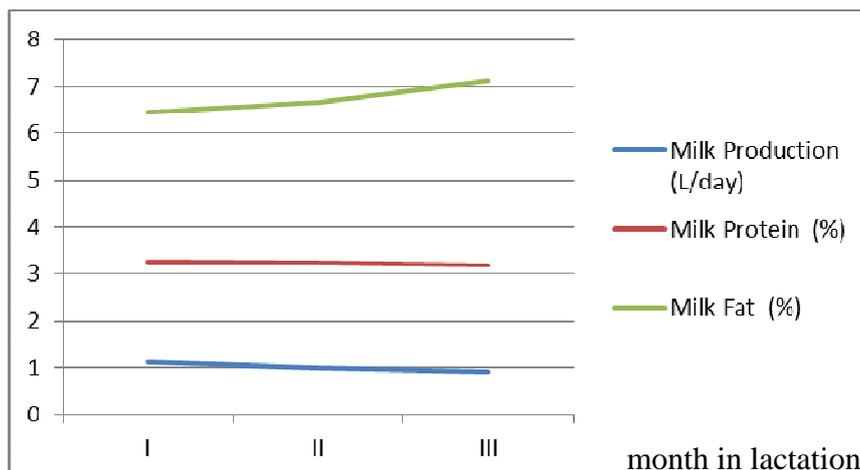


Figure. 1 Milk production (L/day), Milk protein (%) and Milk fat (%) PE goats for 90 days of lactation.

3.2 Body Condition Score (BCS)

The results of this study found that the daily milk production increased significantly ($p < 0.01$) with increasing the BCS level (Table 1) and the relationship milk production and BCS showed on Fig. 2. The animal having BCS 2 produced lower milk (1088.67 ± 260.16 ml ECM/day) than those groups with BCS of 2.5, 3.0, 3.5 and 4.0 (1168.69 ± 328.98 , 1455.15 ± 465.28 , 1568.30 ± 340.15 and 1614.56 ± 396.60 ml ECM/day, respectively). The animals are able to produce an adequate amount of milk if they are fed adequately and they kept in a body condition in consistence with their lactation period. Does' BCS significant influenced milk yield, this parameter increased with increase in the does BCS (Koyuncu and Alünçekiç, 2013)

Table 1. Mean (\pm SE) Daily Milk Production, Protein and Fat of *Peranakan Etawah* goats

Parameter	Body Condition Score (BCS)				
	2 (N=21)	2.5(N=44)	3(N=35)	3.5(N=6)	4(N=2)
Milk Production (ml ECM)	1088.6 ± 260.2^a	1168.7 ± 328.9^a	1455.2 ± 465.3^b	1568.3 ± 340.3^b	1614.6 ± 396.6^b
Milk Protein (%)	3.41 ± 0.04^y	3.21 ± 0.30^x	3.22 ± 0.16^x	3.13 ± 0.09^x	2.85 ± 0.02^x
Milk Fat (%) ^{ns}	6.80 ± 0.90	6.58 ± 1.45	6.72 ± 1.00	6.85 ± 1.06	6.09 ± 1.12

^{a,b} means within column with different superscripts were significantly different at $P < 0.01$

^{x,y} means within column with different superscripts were significantly different at $P < 0.05$

^{ns} non significant

According Sahlu and Goetsch (2012), generally milk production peaks six to nine weeks after kidding, and feed intake does not peak until later. Thus does are usually in a state of negative energy balance in early to mid-lactation. Therefore, body reverse fat and protein have to be used to make up for this energy deficit. In this condition, the level of BCS was decreased as well as the milk production to 60 – 80% of the peak and Darwesh et al., (2013) had concluded that lactation stage influences BCS, serum glucose and milk constituents. So body condition score (BCS) in dry period is important. According Park and Haenlein (2010) A positive correlation exists between milk production and body weight. Storage of body fat during the dry period influences milk production positively at the onset of lactation.

BCS is a simple and accurate indicator to predict the ability of animal to produce milk during lactation period. The high positive correlation between BCS and milk yield during lactation period in dairy sheep, but negative correlation to lactose content (Carcangiu, 2011). The association between BCS and milk production is probably through signaling the hypothalamus via leptin hormone which regulates body metabolism. Leptin serves as an intake satiety signal by acting predominantly on regions of the brain involved in regulation of energy metabolism (Roche, et.al., 2009)).

The diet post calving might impact the association between BCS and milk production (Berry et al., 2007). The results of this study BCS was associated with milk production ($P < 0.01$) and negatively associated with milk

protein ($P < 0.05$) (Fig. 3) but it was not associated with milk fat. Mushtaq et al., (2012) reported that BCS correlated positively with fat and protein and negatively with lactose content and milk production decreased while BCS increased with advancing lactation. Milk production and BCS correlated inversely with negative relationship may be due to mobilization of body reserves, indicating their better genetic potential as dairy breeds.

Fat content in the PE does milk was not associated with BCS (Fig. 4) of the animals although the does with BCS of 3.5 showed to tend higher fat content in the milk than the other groups. BCS reflects the nutrient status, internal physiological condition and energy reserves in the body of animal. Different results were reported by Mushtaq and Qureshi (2009), who showed that BCS slightly positive correlated with milk yield and milk protein. But Pryce et al., (2002) reported high-yielding dairy cows generally have a lower BCS. Gráff (2011) found that the highest amount of milk was produced Saanen goats where the BCS was 2.5 at the beginning of the lactation (0-60 day), 2.7 in the middle of the lactation (60-120 day) and the last third of the lactation 3 or slightly more. If the average lactation BCS was lower than 2 BCS, the animal were not able to perform the milk production.

Milk production (ml ECM/d)

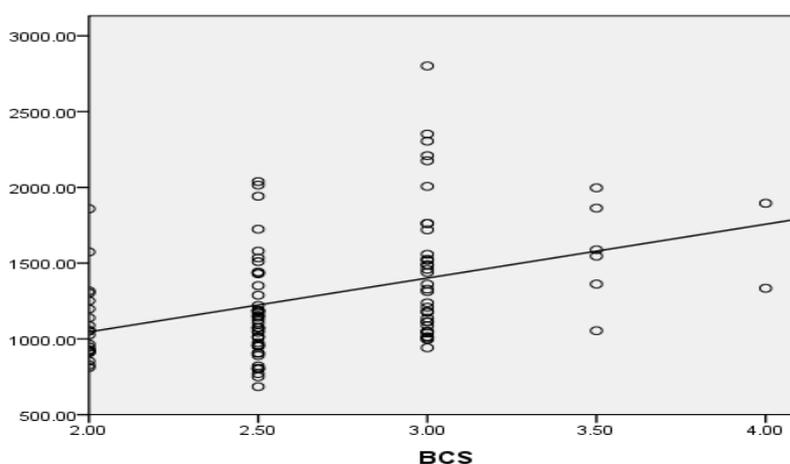


Figure 2. Relationship of milk production and body condition score (BCS) in PE goats ($R^2 = 0.162$; $p < 0.01$)

Milk protein (%)

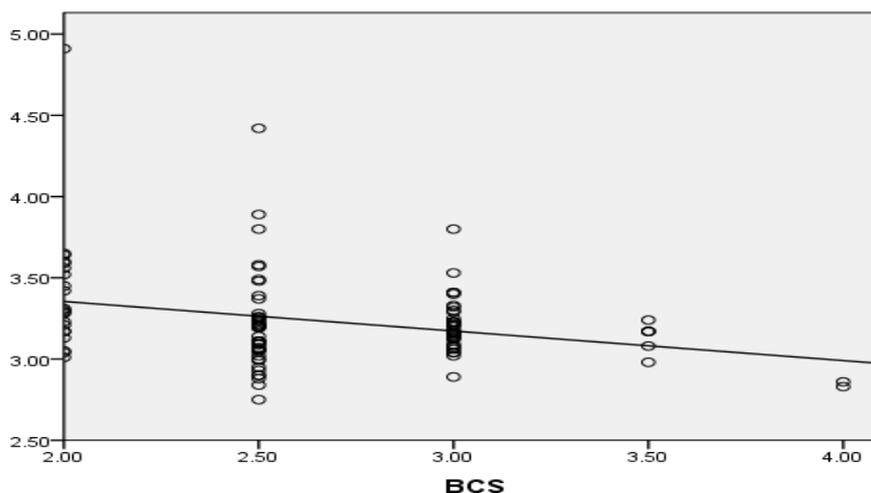


Figure 3. Relationship of milk protein and body condition score (BCS) in PE goats ($R^2 = 0.081$; $p < 0.01$)

Milk Fat (%)

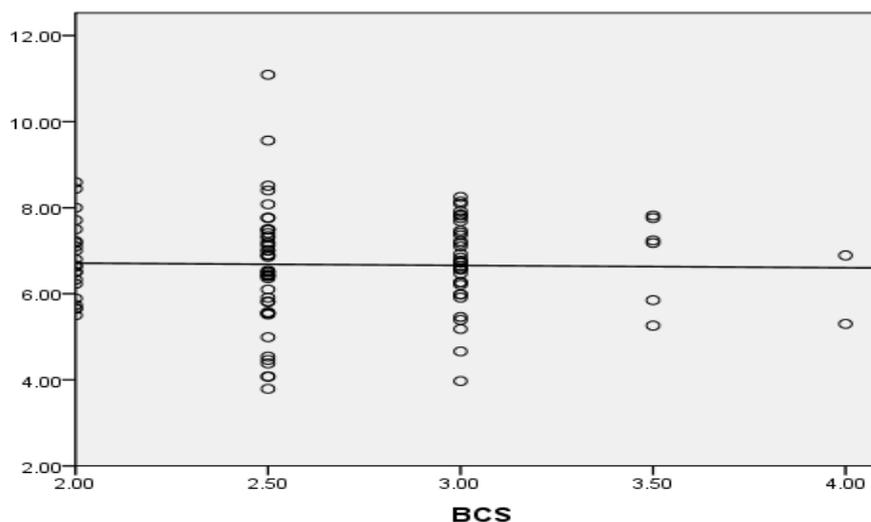


Figure. 4. Relationship of milk fat and body condition score (BCS) in PE goats

4. Conclusions

Body Condition Score (BCS) is one of an important indicator to predict the potency of milk production in the *Peranakan Etawah* goats. Increasing BCS ranged between 2 to 4 increased significantly the milk production, however, BCS had a negative association with milk protein concentration. BCS was not associated with fat concentration in milk.

BCS is a simple but useful procedure, which can help producers make management decisions regarding the quality and quantity of feed needed to optimize performance, and routine scoring of the body condition of dairy goats can help detect potential problems that might cause a decrease in milk production.

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