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Body Condition Score and its Relation to Body Weight and Measurements of Local Goats of Andhra Pradesh under Field Conditions

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ABSTRACT

The technique of Body Condition Score (BCS) is a means of subjectively assessing the degree of fatness or condition of the live animal. It is a simple, non-invasive, time saving and effective management tool to rank goats according to their body reserves by touch and sight. To assess the relationships among body condition score (BCS), body weight and measurements of goats under field conditions, a study was conducted during the year 2019 on local goat flocks of farmers in Gundlasamudram and Marripudi villages of Prakasam district of Andhra Pradesh, India. A total of 100 does (2 to 4 years old) were assigned the BCS and the mean BCS of the test flock was 2.88±0.05. A total of 37 does were in the age group of 2 years with a mean BCS of 2.82±0.77, 52 does were in the age group of 3 years with a mean BCS of 2.96±0.75 and 11 does were in the age group of 4 years with a mean BCS of 2.75±0.16. Pin–shoulder length, height at withers, chest girth, abdominal girth, thigh circumference and body weight were significantly (p<0.01) positively correlated with each other. BCS was significantly (p<0.01) and positively correlated with all physical measurements studied. The mean BCS was significantly (p<0.01) higher for the does of age group of 3 years compared to does of age group of 2 and 4 years. The live weight of does increased by 2.66–2.80 kg for each unit increase in BCS. The present study suggested that BCS can be an effective indicator of degree of fitness of does.

KEYWORDS: Body condition score, body weight, measurements, local goats

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1. INTRODUCTION

Body condition is a term used to indicate the body reserves present in an individual animal. An animal's body condition indicates the amount of lipid (fat) and protein (muscle) reserves that are available for maintenance, gestation and production. Different methods exist to monitor changes in body fat reservesbut BCS is the most widespread method across species being considered simple and repeatable. Body condition score is considered a valid, reliable and feasible welfare indicator with high potential to be included in on-farm welfare protocols. Scoring is performed in goats using BCS ranging from 1.0–5.0, with 0.5 increments. It is helpful to detect changes and sudden losses in condition which are difficult to observe from the external appearance of animal. The BCS of animal indirectly reflects the farm management or even more close to feeding management of the animal. Body Condition Scoring is an important tool for livestock managers to optimize the production, feeding program and welfare of the animals they manage (Carlson, 2017). Body condition score (BCS) has been shown to be an important practical tool in assessing the body condition of 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 (Villaquiranet al., 2007). Unlike liveweight (LW), BCS isnot affected by factors such as variations in gut-fill, fleece weight, pregnancy, and frame size thatconfound liveweight as a measure of animal size to predict the body condition (Kenyon et al., 2014). The body conditionscore can be easily learned and is cost-effective and requires no specialist equipment. Knowledgeof BCS ensures that available feed resources are efficiently utilized, subtle differences in bodycondition not visibly noticeable are determined, there is instant awareness by producers about majorchanges in body fatness, and the monitoring of trends in nutrition and body weight. BCS is most widely used method to assess changes in body fat reserves, which reflects its high potential to be included in on farm welfare assessment protocols (Vieira et al., 2015). Body condition scoring could be an effective method for the breeders to optimally manage body reserves and thus increase the reproductive and productive traits of flocks (Oldham et al., 2011; Vatankhah et al., 2012, Aliyari et al., 2012). Managing ewes to achieve a high BCS at lambing time is likely to improve lamb growth to weaning (Mathias- Daviset al., 2013). There exists a positive relationship between BCS at lambing and birth weight and weaning weights of lambs (Anusha et al., 2018, Everitt-Hincks et al.2013). The relationship between BCS and live weight is documented in sheep (Van Burgel et al., 2011, Kenyon et al., 2014, Anusha et al., 2017, Mc Hugh et al., 2018, Semakula et al., 2020). Body measurements are positively correlated with body weight and BCS (Eyduran et al., 2017; Mohsan et al., 2019). However, the studies on the utility of the Body Condition Score system in goats is very meager in India. There is a need to evaluate the fitness of goats using body condition scoring and suggest the farmers regarding the BCS to be maintained for optimum productivity of their` goat flocks. Thus a study was undertaken to assess the utility of BCS for the assessment of body weights and measurements in goats under field conditions.

2. MATERIALS AND METHODS

The study was carried out during the year 2019 on 6 goat flocks of farmers in Gundlasamudram and Marripudi villages of Prakasam district, Andhra Pradesh, India. A total of 100 does maintained under semi-intensive production system and fed daily with concentrate mixture @ 350 g $head^{-1}$ in addition to grazing were studied. The does were in the age of 2–4 years and divided into 2 years (n=37), 3years (n=52) and 4 years (n=11) age groups. A BCS scale of 1–5 (Carlson, 2017) was used to score the does. This method considers the muscle and fat over shoulder region, ribs, spinous and transverse processes of lumbar vertebrae and hip bones. A score of '1' is considered as emaciated condition and a score of '5' considered as obese condition. Scoring was done by using the hand to feel for the fullness of muscling and fat cover over and around the vertebrae in the loin region. The skeletal check points observed by palpation were 1: The degree of fleshing from the withers to the point of shoulder; 2: The degree of fleshing over the ribs; 3: The degree of muscle and fat cover on the transverse processes of lumbar vertebrae; 4: The degree of muscle and fat cover on the spinous processes of lumbar vertebrae; 5: The degree of muscle and fat cover between spinous and transverse processes and 6: The degree of fill created by muscle and fat at the hip bones (Figure 1). After palpation of each checkpoint the scores were recorded and an average BCS was assigned to the does.

Body weights of does were recorded in the morning before the animals were let out for grazing. Pin–shoulder length was measured from the point of shoulder to the pin bone. Height at withers was measured from the ground to the level of withers. Chest girth was measured as circumference around the chest just behind the point of elbow. In addition, abdominal girth and thigh circumference were also measured. The relationship between BCS, body weight and physical measurements was obtained using Pearson's correlation coefficient.

3. RESULTS AND DISCUSSION

The overall BCS values of the test flock ranged from 2.00–4.00. Majority of the does (32) scored BCS of 2.50 while only 2 does scored BCS of 3.75. The body

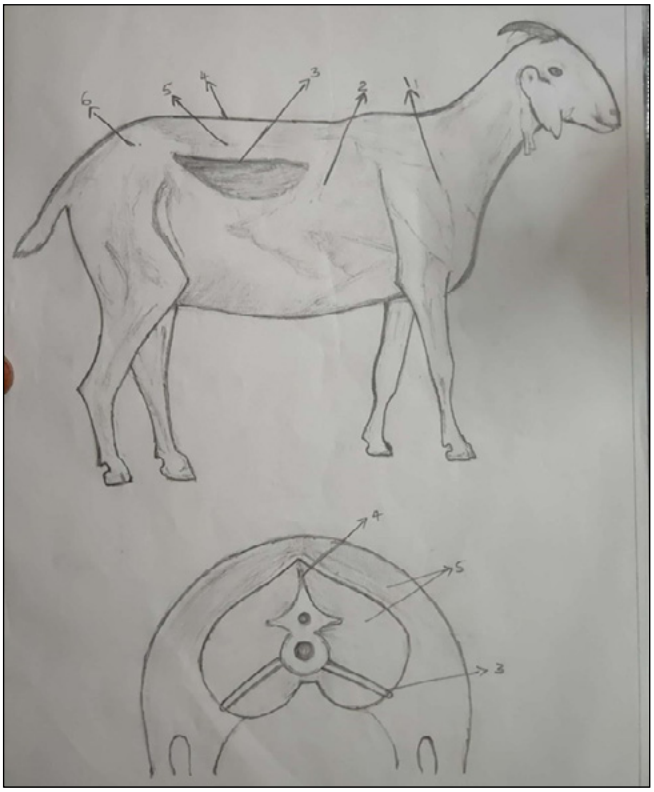

Figure 1:. Doe showing the skeletal check points for BCS; 1: Withers to the point of shoulder; 2: Over the ribs; 3: Transverse processes of lumbar vertebrae; 4: Spinous processes of lumbar vertebrae; 5: Between spinous and transverse processes; 6: Fill created by muscle and fat at the hip bones

weight of the does varies from 24.10–31.50 kg. Pin-shoulder length, height at withers, chest girth, abdominal girth and thigh circumference ranged from 62–69 cm, 70–78 cm, 67–80 cm, 82–98 cm and 33–39 cm, respectively. It was observed that there were no does in the test flock with the BCS of 1.00 and 5.00 considered as emaciated and obese, respectively. This showed that the overall condition of does in the test flock was good as majority of does were in desirable BCS range of 2.50–3.75 as suggested by Maurya et al. (2008) in sheep. The overall mean (±SE) BCS of the test flock was 2.88±0.05. The BCS of does of age group of 2 years ranged from 2.00–3.50 with a mean value of 2.82±0.77 (Table 1). The BCS of does of age group of 3 years ranged from 2.25–4.00 with a mean value of 2.96±0.75. The BCS of does of age group of 4 years ranged from 2.25–3.75 with a mean value of 2.75±0.16. The mean BCS was significantly (p<0.01) higher for the does of age group of 3 years compared to does of age group of 2 and 4 years. The results showed that does of age group of 2 years had more prominent check points with low body fat reserves at various check points examined and so were assigned less BCS values whereas the ewes of age group of 3 years had less prominent check points with high body fat reserves at various check points examined and so were assigned higher BCS values.

Table 1: Mean and SE of BCS and physical parameters of does of the test flock

Character	2 years of age (n=37)		3 years of age (n=52)		4 years of age (n=11)	
	Mean	SE	Mean	SE	Mean	SE
BCS**	2.82	0.77	2.96	0.76	2.75	0.16
Body weight (kg)**	26.53	0.22	27.30	0.22	27.50	0.39
Pin shoulder length **(cm)	65.07	0.33	65.35	0.20	66.36	0.39
Height at withers** (cm)	74.57	0.31	74.60	0.24	74.99	0.51
Chest girth (cm)**	73.34	0.40	73.98	0.36	74.27	1.23
Abdominal girth (cm)**	88.07	0.52	88.47	0.42	89.09	0.62
Thigh circumference** (cm)	36.07	0.28	36.70	0.20	37.63	0.51

**: Significant (p<0.01)

Measurements of physical characters for varying BCS of the test flock are presented in Table 2. An increasing trend in physical parameters with respect to BCS was observed up to BCS of 3.25 while beyond 3.50 BCS trend was reversed. The relationship of BCS and body weight of test flock showed that does having lower BCS had lower body weight compared to the does having more BCS. Thus, a positive relationship was observed between BCS and body weight. This was in accordance with the findings of Maurya et al. (2005), Sejian et al. (2010) and Anusha et al. (2017) in Avikalin, Malpura and Nellore ewes, respectively. The linear relationship between BCS and body weight was also reported by Kenyon et al. (2014) Morel et al. (2016), Ribeiro et al. (2016) and Semakula et al. (2020).

The body weight of does was found to change from 2.66–2.80 kg for each unit change in BCS. It was lower than change of 6.89–7.78 kg in ewes reported by Anusha et al. (2017) and 4.23–5.82 kg for each unit change in BCS reported by McHugh et al. (2018).

BCS was significantly (p<0.01) correlated with pin – shoulder length, height at withers, chest girth, abdominal girth, thigh circumference and body weight (Table 3). This shows a strong positive correlation between BCS and allometric measurements. These findings are in tune with that of Narender et al. (2019) and Paul et al. (2020).

Table 2: Physical parameters of does according to BCS of the test flock (Mean±SD)

BCS	N	Pin-Shoulder Length (cm)	Height at withers (cm)	Chest girth (cm)	Abdominal girth (cm)	Thigh circumference (cm)	Body weight (kg)
2.00	3	62.33±0.57	75.00±1.00	70.33±0.57	85.00±2.64	33.66±1.15	24.50±0.52
2.25	10	64.20±1.18	72.60±1.34	71.30±3.43	85.00±2.78	34.30±0.94	25.90±0.79
2.50	32	64.37±1.12	73.40±1.31	73.40±2.74	86.78±1.26	36.25±1.27	26.78±1.02
2.75	6	65.50±1.37	74.33±1.36	74.33±1.85	88.16±3.31	37.50±0.83	27.20±1.01
3.00	18	65.61±1.29	74.55±0.78	74.55±1.93	89.88±2.44	37.63±1.02	27.30±0.97
3.25	11	66.54±1.36	75.45±0.93	75.45±1.63	90.00±2.75	37.82±0.89	27.73±1.05
3.50	12	67.66±0.77	77.08±0.99	75.75±1.65	92.25±2.66	38.00±1.12	27.75±1.15
3.75	2	65.50±0.70	75.50±0.70	75.81±2.01	90.00±1.41	39.00±0.00	29.70±0.00
4.00	6	66.33±0.81	76.66±0.81	76.33±1.80	91.16±1.72	38.00±0.89	29.96±1.54

N: Number of does

Table 3: Correlation coefficients for BCS and physical parameters of does of test flock

	Pin-shoulder length	Height at withers	Chest girth	Abdominal girth	Thigh circumference	Body weight	BCS
Pin-shoulder length	1	0.55**	0.41**	0.55**	0.59**	0.59**	0.65**
Height at withers	0.55**	1	0.27**	0.58**	0.40**	0.45**	0.70**
Chest girth	0.41**	0.27**	1	0.53**	0.42**	0.40**	0.53**
Abdominal girth	0.55**	0.58**	0.53**	1	0.54**	0.45**	0.69**
Thigh circumference	0.59**	0.40**	0.42**	0.54**	1	0.50**	0.62**
Body weight	0.59**	0.45**	0.40**	0.45**	0.50**	1	0.70**
BCS	0.65**	0.70**	0.53**	0.69**	0.62**	0.70**	1

**: Significant (p<0.01)

Similar results were reported by Sejian et al. (2010) in Malpura ewes and Anusha et al. (2017) in Nellore ewes. The positive relation between body measurements and BCS was also reported by Vieira et al. (2015) and Mohsan et al. (2019) in dairy goats. Correlation coefficients between BCS and physical parameters indicated that BCS was highly correlated with height at withers (0.70) and body weight (0.70), followed by abdominal girth (0.69), pin–shoulder length (0.66), thigh circumference (0.62) and chest girth (0.53). Maurya et al. (2008) and McGregor et al. (2017) observed a linear correlation between BCS and chest girth which was in tune with the present findings. Thedoes of higher measurements of chest girth were assigned with higher BCS indicate the valid utility of BCS system in identifying the healthy animal because more chest girth is an index of the animal health and performance. In the present study highest correlation (r=0.59) was found between pin–shoulder length and thigh circumference among the physical parameters. This showed that pin– shoulder length and thigh circumference have the lowest deviation from their respective mean as well as highest coefficient of correlation.

4. CONCLUSION

BCS system (1-5 scale) could be easily applied to measure the fatness in does and for an immediate appraisal of body fat reserves. A positive relationship was observed between BCS and physical parameters studied. The study suggested that BCS can be an effective indicator of degree of fitness of does.

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