Body condition scoring and body measurements of ewes with gastrointestinal nematode infection from Bulgaria

Victoria Marincheva, Andrey Kurtenkov
Faculty of Veterinary medicine, University of Forestry – Sofia, Bulgaria
Corresponding author: natyarasa@abv.bg

Citacion: Marincheva, V., & Kurtenkov, A. (2022). Body condition scoring and body measurements of ewes with gastrointestinal nematode infection from Bulgaria. *Zhivotnovadni Nauki*, *59*(4), 10-15 (Bg).

Abstract

Body condition scoring is a valuable tool for assessment of nutritional and health status in sheep herds. It can also be used to recognize consequences from disease. The study views the practical application of BCS and some body measurements in correlation to fecal egg count during natural infection with gastrointestinal nematodes in ewes.

Key words: body condition scoring (BCS), body measurements, ewes, gastrointestinal nematodes

Оценка на телесното състояние и телесни измерения при овце майки с гастроинтестинална нематодоза от България

Виктория Маринчева, Андрей Куртенков
Факултет по Ветеринарна медицина, Лесотехнически университет – София
E-mail: natyarasa@abv.bg

Резюме

Оценката на телесното състояние (BCS) представлява важен метод за проследяване на хранителния и здравния статус на овчите стада, който може да бъде използван също за разпознаване на последствията от заболяване. Настоящето проучване разглежда практическото използване на BCS и някои телесни измерения в корелация с изследването на брой паразитни яйца (FEC) по време на естествена инфекция с гастроинтестинални нематоди при овце майки.

Ключови думи: оценката на телесното състояние (BCS), телесни измерения, овце майки, гастроинтестинални нематоди

Introduction

Gastrointestinal nematodes of sheep present a serious concern for farmers worldwide. Fecal egg count (FEC) is the most widely used method to indicate the prevalence of infection and rates of pasture contamination (Bishop, 2009). However other traits such as body condition scoring (BCS) have been mentioned as a useful tool for clinical assessment of individual health. The system describes the physical status by estimating the muscling and fat deposition in the loin area. It depends on skeletal size, breed and physiological state rather than body weight (Kenyon

et al., 2014). According to Thompson and Meyer (1994) animals can be classified as obese (score 5), fat (score 4), average (score 3), thin (score 2) and emaciated (score 1). Russel (1984) also recognizes an extremely emaciated state or score 0. Condition can be changed due to inappropriate husbandry, insufficient food intake or illness with gastrointestinal parasitism being one of the common causes.

Flocks often include several breeds with varying frame sizes, fleece cover and genetics, which makes it difficult to assess body reserves by visual inspection (Williams and Macdonald, 2018). Using BCS overcomes differences in body size and weight between individuals within a flock and between breeds (Russel, 1984).

There is a well-established positive relationships between BCS and live weight (Kenyon et al., 2014). The increase in live weight required to raise ewe BCS by 1.0 unit varies in the majority of studies; however a linear relationship is expected.

Correlation between live weight and other body measurements is also well established (Afolayan et al., 2006; Sabbioni et al., 2020). These can be taken using a meter and include the following: height at withers (the distance from the top of the withers to the ground) , height at hips (the distance from the top of the hips to the ground), length (the distance between the point of the shoulder corresponding to the outer and central tuberosity of the left humerus to the left tuber ischii; the distance along the media line from the anterior edge of the spinous process on the first thoracic vertebra to the posterior edge of the tuber ischii according to Kiyanzad (2004), and girth (the body circumference immediately posterior to the front leg).

From all body measurements live weight is the most variable, while body dimensional traits (height, length, girth) remain constant within a homogeneous group. The highest correlation coefficient is found between chest girth and body weight (Afolayan et al., 2006).

The aim of this study is to demonstrate or exclude correlation between BCS, body measurements and FEC during natural infection with gastrointestinal nematodes.

Materials and methods

Experimental animals comprise of 25 ewes from milk breeds (predominantly assaf crosses with local breeds and a few awassi crosses) from the Thracian valley, Haskovo region in Bulgaria. Data was taken in February 2021 during the periparturient period and May 2021 during the active grazing season. Assessment of BCS follows the categories given by Thompson and Meyer (1994). Body measurements include height at withers, length from the central tuberosity of the left humerus to the left tuber ischii (oblique body length) and girth (Andreev et al., 1993; Kurtenkov, 2011). These were compared to results from FEC. For the purpose of this article FEC in egg per gram (EPG) is described as low (up to 250 EPG), medium (250–750 EPG) and high (above 750 EPG).

Statistical analysis is conducted by Microsoft Excel 2016. Mean values in standard deviation ($X \pm SD$), correlation coefficient by the CORREL function and significance value ($p < 0.05$) have been calculated.

Deworming was performed in August 2020 with levamisole/oxiclosanide oral suspension and later in December 2020 with ivermectin subcutaneously. No treatment was performed during the test period.

Due to the warm weather the pasture season began early in March 2021.

Results and discussion

Body measurements of ewes were obtained during the periparturient period in February 2021. On the basis of body length, height at withers and girth, the stretch and compactivity indexes were calculated. The stretch index is equal to body length divided to the height at withers and multiplied by 100; the compactivity index is equal to the hearth girth divided by the oblique body length (Andreev et al., 1993; Kurtenkov, 2011). Body measurements reflect the similarities between animals in the herd which can be an indicator for the quality of husbandry, food intake and overall health status. Slight differences

are mostly due to the mixed breed structure of the population.

Body condition scoring was estimated in February during the periparturient period and May 2021 when sheep are already on the pasture.

The mean BCS in February was 2.6 ± 0.28. There were two animals with BCS 2 (№ 1 and 4), seven with BCS 3 (№ 3, 8, 11, 17, 18, 21, 22) and the rest with BCS 2.5. Mean values for May are similar: BCS 2.58 ± 0.27. There are two individuals with BCS 2 (№ 9 and 20) and six with BCS 3 (№ 3, 8, 11, 18, 21, 22). The p value between the two measurements equals 0.07 (p above 0.05), which indicates low level of statistical significance.

There are several animals that show changes in their BCS. Results have increased in sheep № 1 and 4 (from 2 to 2.5) and decreased in sheep № 9 and 20 (from 2.5 to 2) and № 17 (from 3 to 2.5). A tendency toward low BCSs in a herd may be indicative of inadequate nutrition or management-related diseases such as internal parasitism

Table 1. Body measurements of ewes during the periparturient period

Body measurements	Body length (oblique)	Height at withers	Hearth girth	Stretch Index	Compactivity Index
MEAN	62.92	72.12	94.24	87.56	1.5
± SD	5.13	4.55	5.32	8.04	0.12
MIN / MAX	57 / 80	58 / 80	83 / 106	75 / 103	1.26 / 1.72
1	66	66	87	100	1.32
2	66	71	97	93	1.47
3	72	77	99	94	1.38
4	62	73	89	85	1.44
5	63	69	83	91	1.32
6	60	80	100	76	1.67
7	70	70	88	100	1.26
8	80	77	106	103	1.33
9	60	72	90	83	1.5
10	61	73	89	84	1.46
11	59	74	97	80	1.64
12	58	77	91	75	1.57
13	57	69	96	83	1.68
14	67	68	99	99	1.48
15	57	74	98	77	1.72
16	63	78	90	81	1.43
17	61	78	97	78	1.59
18	64	71	101	90	1.58
19	60	70	87	86	1.45
20	58	58	97	100	1.67
21	62	72	98	86	1.58
22	59	68	96	87	1.63
23	65	72	92	90	1.42
24	63	74	96	85	1.52
25	60	72	93	83	1.55

(El-Ashram et al., 2017). On the other hand poor body condition is associated with decreased immunity and predisposition to disease as it greatly increases susceptibility to and severity of infections (França et al., 2018). Defects in both the innate and adaptive pathways of the immune response have been consistently demonstrated in undernourished individuals (Bourke et al., 2016).

Results from FEC are represented in the next table and will be discussed together with changes in BCS.

There are several animals that show constantly high FEC: № 9, 10, 20. Among these the BCS of sheep № 9 and 20 is decreased from 2.5 to 2, while BCS of № 10 remains constant (2.5). In sheep № 17 FEC has changed from high to medium; however BCS has worsened from 3 to 2.5. In sheep № 1 the FEC is high in February, but low in May; BCS has also been improved from 2 to 2.5.

Animals that show constantly low FEC include № 3, 4, 12, 13, 24 with BCS equal to 2.5 (except № 3 with BCS 3 and № 4 with BCS from 2 to 2.5). Most other individuals from the experimental group are also estimated as BCS 2.5.

Table 2. BCS of ewes in February and May 2021

BCS	February	May
MEAN	2.6	2.58
± SD	0.28	0.27
MIN / MAX	2 / 3	2 / 3
1	2	2.5
2	2.5	2.5
3	3	3
4	2	2.5
5	2.5	2.5
6	2.5	2.5
7	2.5	2.5
8	3	3
9	2.5	2
10	2.5	2.5
11	3	3
12	2.5	2.5
13	2.5	2.5
14	2.5	2.5
15	2.5	2.5
16	2.5	2.5
17	3	2.5
18	3	3
19	2.5	2.5
20	2.5	2
21	3	3
22	3	3
23	2.5	2.5
24	2.5	2.5
25	2.5	2.5

Table 3. FEC of ewes in February and May

FEC	February	May
1	High	Low
2	High	Low
3	Low	Low
4	Low	Low
5	High	Medium
6	Medium	Low
7	Medium	Low
8	Medium	Low
9	High	High
10	High	High
11	Medium	Low
12	Low	Low
13	Low	Low
14	Medium	Low
15	Medium	Medium
16	High	Low
17	High	Medium
18	Medium	Low
19	High	Medium
20	High	High
21	Low	Medium
22	Medium	Medium
23	Medium	Low
24	Low	Low
25	Medium	Medium

BCS in lactating ewes is expected to be lower due to the negative energy balance and fat mobilization for milk production (Marques et al., 2018). Therefore values around 2.5 can be judged as normal for the specific physiological state. Furthermore the period coincides with the expected rise in FEC or the so called periparturient rise (Gibbs, 1986; Chaney, 2012). Decrease in BCS is observed in animals with constantly high FEC which accounts for the good reliability of this method during naturally occurring GIN infection (Calvete et al., 2020; Soto-Barrientos et al., 2018).

The correlation coefficient between FEC and BCS in this study is – 0.07 in February and – 0.61 in May. The dynamics between the two variables is negative in nature and it is better pronounced in the second measurement. According to the authors BCS remains a useful tool in animal husbandry and should be introduced as a routine practice in sheep herds especially for the assessment of common health problems such as gastrointestinal parasitism.

Changes in BCS and the correlation to FEC were investigated by Seyoum et al. (2018). Animals in poor body condition developed worse clinical signs than individuals in moderate and good body condition. Sheep with better scores showed the lowest mean FEC value.

It was suggested that BCS together with FEC can be implemented as indicators for targeted selective treatment (TST). Deworming of ewes with BCS lower than 3 was recommended approximately five weeks before mating and lambing. In case the flock mean strongyle FEC during the pre-lambing period is lower than 200 EPG, treatment may be postponed as the proportion of ewes with individual FEC > 400 EPG is expected to be very low (Calvete et al., 2020).

Drenching ewes on the basis of low BCS allows for increased production and reduces the risk of developing anthelmintic resistance (Johnson, 2012). Adult sheep of good body condition should be able to withstand parasite burdens and act as a source of worms in refugia.

BCS as correlated to FEC is also proposed as a potential selection criteria of sheep resistant to gastrointestinal nematodes (Idika et al., 2012).

To complement the study the correlation coefficient between body measurements and the other two variables – BCS and FEC was calculated. The relation is positive between BCS and body length (oblique), height at withers, hearth girth and the compactivity index. It is best pronounced between BCS and hearth girth. The relation to FEC is negative and again the value is highest in the case of hearth girth. Therefore the latter parameter seems to be most valuable in practical terms. The circumference of the thorax is easy to measure and may supplement the estimation by BCS as well as the assessment of FEC results.

Conclusions

The study was able to demonstrate the value of BCS as an indicator of body structure as well as health status. It is well correlated to FEC and can be used to predict the level of gastrointestinal nematode infection especially in individuals with constantly high EPG. Another promising parameter can be the hearth girth. The applica-

Table 4. Correlation coefficient: body measurements to BCS and FEC

Body measurements	Body length (oblique)	Height at withers	Hearth girth	Stretch Index	Compactivity Index
BCS	0.2	0.27	0.62	- 0.04	0.25
FEC	- 0.1	- 0.11	- 0.33	- 0.004	- 0.15

tion of several variables allows for better clinical assessment.

References

Andreev, A., Lfzanov, V., Sinivirski, G., Venev, I., Ovesenska, L., Netsov, N ., Todorov, N., Gotev, R., Grigorov, I., Kabakchiev, M., & Nechev, P. (1993). *Livestock, Textbook for agricultural schools, Dionysus.*,(BG)

Kurtenkov, A. (2011). Guide to exercises in genetics and animal breeding. SofiaP, (BG)

Afolayan, R. A., Adeyinka, I. A., & Lakpini, C. A. M. (2006). The estimation of live weight from body measurements in Yankasa sheep. *Czech Journal of Animal Science*, *51*(8), 343–348.

Bishop, S. C. (2009). A review: Assessing Evidence for Disease Resistance in Livestock. *Report of a workshop on disease resistance. FAO/INRA*. Page 8-9.

Bourke, C. D., Berkley, J. A., & Prendergast, A. J. (2016). Immune Dysfunction as a Cause and Consequence of Malnutrition. *Trends Immunol. 37*(6):386-398. doi:10.1016/j.it.2016.04.003

Calvete, C., González, J. M., Ferrer, L. M., Ramos, J. J., Lacasta, D., Delgado, I., & Uriarte, J. (2020). Assessment of targeted selective treatment criteria to control subclinical gastrointestinal nematode infections on sheep farms. *Veterinary Parasitology*, *277*, 109018. doi: 10.1016/j.vetpar.2019.109018

Chaney, A. (2012). Identification of Internal Parasites of Sheep and Goats. *Honors College 26*. https://digitalcommons.library.umaine.edu/honors/26. Last visited: 12 March 2022.

Gibbs, H. C. (1986). Hypobiosis and the periparturient rise in sheep. *The Veterinary Clinics of North America. Food Animal Practice*, *2*(2), 345-353. : 10.1016/S0749-0720(15)31244-5

El-Ashram, S., Al Nasr, I., Mehmood, R., Hu, M., He, L., & Suo, X. (2017). Haemonchus contortus and ovine host: a retrospective review. *International Journal of Advanced Research*, *5*(3), 972-999. doi: 10.21474/IJAR01/3597

França, T. G .D., Ishikawa, L. L. W., Zorzella-Pezavento, S. F. G., Chiuso-Minicucci, F., da Cunha, M. L. R. S., & Sartori, A. (2009). Impact of malnutrition on immunity and infection. *J. Venom. Anim. Toxins incl. Trop. Dis* vol.15 no.3. doi: 10.1590/S1678-91992009000300003

Idika, I. K., Chiejina, S. N., Mhomga, L. I., Nnadi, P. A., & Ngongeh, L. A. (2012). Correlates of resistance to gastrointestinal nematode infection in Nigerian West African dwarf sheep. *Asian Pacific Journal of Tropical Medicine*, *5*(7), 529-532.

Johnson, G. (2012). A report investigating how to reduce the impact of gastrointestinal nematodes and their resistance to anthelmintic treatments in sheep production. https://meatpromotion.wales/images/scholarship-reports/Gwyn__Johnson_HCC_report_final_1-1.pdf. Last visited: 14 Jan 2021.

Kenyon, P. R., Maloney, S. K., & Blache, D. (2014). Review of sheep body condition score in relation to production characteristics. *New Zealand Journal of Agricultural Research*, *57*(1), 38-64. doi: 10.1080/00288233.2013.857698

Kiyanzad, M. R. (2004). Using linear body measurements of live sheep to predict carcass characteristics for two Iranian fat-tailed sheep breeds. *Asian-australasian journal of animal sciences*, *17*(5), 693-699.

Marques, C. A., Saraiva, L. A., Torreão, J. N., Silva, T. P., Bezerra, L. R., Edvan, R. L., ... & Nascimento, R. R. (2018). The use of targeted selective treatments on controlling gastrointestinal nematodes in different sheep categories under grazing system. *Pesquisa Veterinária Brasileira*, *38*, 470-476. doi: 10.1590/1678-5150-PVB-4997

Russel, A. (1984). Body condition scoring of sheep. *In Practice*, *6*(3), 91. doi: 10.1136/inpract.6.3.91

Sabbioni, A., Beretti, V., Superchi, P., & Ablondi, M. (2020). Body weight estimation from body measures in Cornigliese sheep breed. *Italian Journal of Animal Science*, *19*(1), 25-30. doi: 10.1080/1828051X.2019.1689189

Seyoum, Z., Getnet, K., Chanie, M., Derso, S., & Fentahun, S. (2018). Morbidity parameters associated with gastrointestinal tract nematodes in sheep in dabat district, northwest Ethiopia. *BioMed Research International*, *2018*. 9247439. doi:10.1155/2018/9247439

Soto-Barrientos, N., Chan-Pérez, J. I., España-España, E., Novelo-Chi, L. K., Palma-Ávila, I., Ceballos-Mendoza, A. C., ... & Torres-Acosta, J. F. J. (2018). Comparing body condition score and FAMACHA© to identify hair-sheep ewes with high faecal egg counts of gastrointestinal nematodes in farms under hot tropical conditions. *Small Ruminant Research*, *167*, 92-99. doi: 10.1016/j.smallrumres.2018.08.011

Thompson, J. M., & Meyer, H. H. (1994). Body condition scoring of sheep. *OSU Extension Catalog* 1433

Williams, K., & Macdonald, S. (2018). Body Condition Scoring of Mature Sheep. *Technical note TN702*.