University of Thi-Qar Journal of agricultural research

Thi-Qar Journal of agricultural research

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 13, Issue 2 (2024) PP 202-207

https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/utjagr.v13i1.323*

Effect of Iraqi ewes' physiological responses, productivity, and reproductive success at various induced body condition scores

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Abstract

In order to maximize output and make it economically feasible, this study examined the effects of induced body condition score (BCS) changes on the physiological responses, productive, and reproductive performance of Iraqi ewes. Twenty-four healthy Iraqi ewes were used in the trial, which lasted a year (2–3-year-old). Three groups, G1 (BCS 3; n = 8), G2 (BCS 3.5; n = 8), and G3 (BCS 4.0; n = 8), were formed by randomly dividing the animals. Allometric measures, physiological response, wool output, and reproductive efficiency were the study's parameters. Allometric measures, respiration rate, and other reproductive parameters were significantly impacted by BCS. The results showed that reproductive success was highest among Iraqi ewes with a body condition score (BCS) between 3.0 and 4.0. The results of this research provide credence to the hypothesis that breeding sheep flocks may be managed to achieve a Body Condition Score (BCS) of 3.0–3.5, which might lead to a financially viable return.

Keywords: BCS, Performance, Iraqi ewes.

I. Introduction

Breeding small ruminants is one of the most important agricultural pursuits in the world, and it has profound effects on the economy, ecology, environment, and culture (1). It represents a successful conversion of thousands of marginal hectares into high-quality animal protein, especially in the Mediterranean region (2).

In nations in the Near East, small ruminants make around 30–40% of the value of agricultural output (3). However, throughout the past several decades, the production of small ruminants in the region of the Near East has encountered significant challenges, particularly feed shortages (4). As a result, these systems' viability is in jeopardy (5).

Low BCS ewes have been linked to reduced lamb survival and increased prenatal and neonatal mortality (6). Low BW as well as BCS of donor ewes affect oocyte quality, which lowers the rate of cleavage and impairs a number of reproductive processes, including hormone synthesis, fertilization, and early embryonic development (7).

Undernutrition in sheep during late pregnancy or in the first few months after birth can permanently and irrevocably lower the ewes' lambing rates throughout adulthood (8). Additionally, nutritional quality has been linked to ewes' embryo survival and considered as a major factor affecting the effectiveness of animal reproductive technologies. There are several studies on the relationship between BCS and ewes' reproductive success (9).

To the best of our knowledge, there are little findings on how BCS affects ewes' fertility when they are kept in a hot, semi-arid climate. The objective of this research was to examine the effects of artificially produced disparities in BCS on the productive, physiological, as well as reproductive status of ewes.

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II. Materials and Methods:

In the study, twenty-four cyclic, healthy ewes (2-3 years old) with mean weights of 24.5 kg were employed. The animals were housed in 2.4 m tall, open-sided, asbestos-roofed shelters that were maintained clean and well-ventilated. The animals have free access to excellent drinking water at all times. To ensure that the animals remained healthy during the trial, preventative interventions against sheep illnesses such sheep pox, ppr, enterotoxaemia, endo and ectoparasitic infestations were implemented in accordance with the institute's health schedule.

The BCS method that described by (10) was used in the cureent study. When the trial began, the ewes BCS chosen for the investigation ranged from 3.0-3.5. These ewes were subjected to varying concentrations of concentrate throughout the first three months while being given the same forages in order to induce the desired BCS changes in them. The animals were randomly separated into three groups for this reason according to condition score (G1= BCS 3, G2= BCS 3.5, BCS= 4).

All animals fed on natural vegetation for 8 to 10 hours each day, alternating with seasonal shrubs and forbs. Concentrate was given to the ewes in G2. The concentrate was freely available to the ewes in G3. G3 ewes consumed 500 g of concentrate feed on average per day.

Utilizing locally created intravaginal sponges, oestrus synchronization was accomplished in all of the animals with progesterone 350 mg (11).

Pin shoulder length, wither height, and body weight of sheep were the allometric measures examined. 3 months after the study's commencement, these measurements were made soon before mating after the ewes had gotten their individual BCS.

For the duration of the trial, the physiological responses, including respiration rate (RR), pulse rate (PR), as well as rectal temperature (RT), were tracked on a monthly basis.

Oestrus response, foetal sac volume, conception rate, lambing rate, birth weight, as well as weaning weight of the lambs were the reproductive metrics investigated in the study to assess the efficacy of reproduction in these different BCS ewes.

The statistical analysis was done by using SPSS software version 23.

III. Results:

In comparison to the higher BCS sheep, the ewes in Group I showed smaller ($p \leq 0.05$) allometric measures. Additionally, the G2 ewes' allometric measures were inferior to the G3 ewes' ($p \leq 0.05$). The mean ewes BW in all three groups varied after receiving induced BCS ($p \leq 0.05$). Group III had the greatest mean BW, Group I had the lowest, and Group 2 had a medium mean BW (Table 1).

Table 1. different parameters among groups of study

Parameters	G1	G2	G3
P.S length (cm)	59.4±3.1b	62.5±8.3b	69.3±2.4a
Height(cm)	61.2±7.4b	61.8±3.3b	62.7±2.1a
B.W(Kg)	28.1±1.6b	31.5±3.7b	35.7±0.9a

For RT, the various BCS groups showed a similar tendency to that seen in PR. The temp. of the ewes from various BCS didn't substantially vary from one another. This is clear from the outcome, which shows that the PR values for all three groups are similar. In comparison to G1, the RR was both considerably greater in G2 and G3 (Table 2).

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Table 2. Vital parameters among groups of study

Parameters	G1	G2	G3
Temp. (℃)	38.8±1.3a	38.9±1.1a	38.8±0.9a
Pulse (beats/min)	65.4±0.8a	63.9±1.1a	64.2±0.2a
RR (breaths/min)	62.2±2.5b	68.8±0.4a	72±1.8a

The proportion of ewes displaying oestrus after oestrus synchronization therapy was statistically highest in G2 (90%) compared to G1 (65%) and G3 (70%). In comparison to G1 and G3, which did not statistically vary, In the ewes belonging to the G2 group, there was a higher conception rate ($p \leq 0.05$). In G1 only 4 animals concept and in G3 3 animals concept, but in G2, 6 animals who had shown an oestrus response conceived. G3 had the largest and smallest differences in the volume of the foetal sac ($p \leq 0.05$) across the BCS groups (Table 3).

Comparing G2 ewes to G1 and G3 ewes, the lambing rate was greater in G2 ewes ($p \leq 0.05$). Additionally, compared to G2 ewes, lambing rates for G1 and G3 ewes were much lower. Lambs delivered to G3 ewes had an average birth weight that was greatest, middle, and lowest ($p \leq 0.05$). In comparison to G1 ewes, the weight of weaning lambs in G2 and G3 was comparable and greater ($p \leq 0.05$) (Table 3).

Table 3. Reproductive parameters in different groups

Parameters	G1	G2	G3
Ewes in heat (%)	62.5	87.5	75
Conception rate (%)	50b	82.5a	42.9b
Foetal sac volume	153±3.1c	184.5±12.4b	217±6.1c
Lambing rate (%)	42.9b	87.5a	42.9b
Birth weight of lamb (kg)	2.9±0.1c	3.7±0.4b	4.6±0.2a
Weaning weight of lamb (kg)	14.7±1.1b	15.8±0.8a	16.2±1a

IV. Discussion:

Ewes with low BCS values had lower H, PSL, as well as BW values than ewes with higher BCS values, the study's results showed. A significant positive association between BCS and allometric measures may be seen from this. A favorable connection between BCS and HG as well as other allometric parameters of ewes was also observed by (12). The different BCS groups' considerable improvements in BW point to the accuracy of the condition grading approach used in this study. This will serve as a hint in future planning to satisfy the precise nutritional needs of the ewes according to various production phases.

Other than PR and RT, RR demonstrated notable differences in the physiological response in relation to the various BCS. This may be because homoeothermic animals first respond to stress by strengthening thermoregulatory systems like RR in order to prevent an increase in RT. These results are in line with the earlier investigation carried out in our lab (13). The physiological reaction changed significantly between morning and afternoon (14). The spike in physiological responses in the afternoon compared to morning levels may be explained by the rise in ambient temperature during the morning and into the afternoon (15).

Numerous data point to a connection between BCS and reproductive efficiency. For instance, the reproductive efficiency of ewes was significantly impacted by the BCS during mating (16). The synchronization strategy worked extremely well in G2 since it was clear that this group's oestrus response was higher than that of the other two groups. This might provide some hints as to how the synchronization technique and BCS interact to improve ewes' reproductive efficiency. Similar results were found by (17) in a study done with cows. Anoestrus was more common in G1 because to the undernutrition. This result is consistent with what (18) found. The oestrus activity was observed to be negatively impacted by further

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excessive fat buildup in higher BCS ewes (19). These results confirm our findings that ewes with optimal physical conditions displayed more oestrus activity compared to those with lower and higher BCS.

The impact of BCS on conception rate has been the subject of several studies (20; 17). Our findings appear to support previous studies' findings that increased conception rates might come from stronger BCS during mating. Reduced gonadotrophin releasing hormone (GnRH) production in malnourished ewes, which in turn impacts pre-ovulatory luteinizing hormone (LH) surge, fertilization, and early embryonic development, may be the cause of the lower conception rate in low BCS ewes (21). Researchers discovered a positive correlation between BCS and fetal development in sheep (22). They came to the conclusion that diets and breed effects, which vary across experiments, might have an impact on such a connection.

This study showed that BCS had a considerable impact on lambing rate. More lambs were born to pregnant Merino ewes when their body condition score (BCS) was maintained between 3.0 and 3.5 during the whole pregnancy, as shown by a meta-analysis of (23) studies. The ewes in the group with a BCS of 3.0-3.5 had the highest documented lambing rate in this research. Twinning's less noticeable impact on litter size is supported by data that show a somewhat larger litter size in G2 when it happens rarely (24). According to a general finding by (20), ewes react to flushing best when their BCS is in the middle and not either lean or fat.

Embryo donors who were superovulated with FSH had a higher rate of prolificacy if their BCS was between 3.5 and 4.9, as determined by (25). More ovulation occurred in ewes with a higher BCS (3.2 vs. 2.9) after mating, but the litter size was the similar for both groups (24).

It was discovered that the birth weight of lambs was significantly influenced by the BCS of the ewes. This could be the result of lower BCS ewes receiving inadequate nourishment during the latter stage of pregnancy (26). When ewes with BCS (2.5 and 3.5) identical to those utilized in our experiment were compared, (27) found that the higher BCS ewes delivered lambs with greater birth weights. Low birth weights have been linked to inadequate or limited nutrition throughout the middle or later stages of pregnancy in some cases.

However, other studies (28; 29) did not succeed in demonstrating a connection between BCS and birth weight. A lower average weaning weight was also seen in the low lambs birth weight in G1, but differences between the other groups vanished. According to this, lambs from

No long-term disadvantage exists between offspring born to ewes with a BCS of 3.0-3.5 and those born to ewes with a BCS of 4.0.

V. Conclusion:

For the majority of the criteria examined, ewes with a BCS between 3.0 and 3.5 outperformed ewes with lower as well as higher BCS. This shows that the presence of an ideal BCS of ewes, in particular, Additionally, as a sub-maximal feed intake, it decreases wastes and expenses associated with supplemental feeding. As a result, it is recommended that the ewes reared in hot, semi-arid environments be kept at moderate (3.5-4) BCS both at the Instead of feeding to raise the BCS to even greater levels, it is preferable to harvest the animals at the optimal time, which is during the mating and lambing stages. A breeding sheep flock should be actively managed to maintain an ideal BCS in order to ensure a profitable production system

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