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STIMULATIVE FEEDING INFLUENCE OVER MILK PRODUCTION AT KARAKUL OF BOTOSANI BREED

Constantin PASCAL[1, 2], Ionică NECHIFOR[2], Marian Alexandru FLOREA[2]

[1]"Ion Ionescu de la Brad" University of Life Sciences Iaşi, 3 Mihail Sadoveanu Alley, Iasi, Romania
[2]Research and Development Station for Sheep and Goat Breeding Popăuți, 312 Principală Street, Răchiţi, Botoșani, Romania

Corresponding author email: pascalc61@yahoo.com

Abstract

The main objective of the research carried out, was to determine the impact due to additional feeding on the specific performance of milk production in Botoșani Karakul sheep breed. In order to achieve the main objective of the research, two groups of adult females between three and six years of age were formed. Both lots were maintained under similar conditions, applying a traditional technology based on feeding them from the stock during the cold season and on pasture during the warm season. The experimental treatment was represented by the fact that L2 benefited from additional feeding applied 25 days before the mating date. This batch received a 170 g amount each morning consisting of a mixture of cultivated cereals (ground corn, sunflower meal, barley and oat grains). Live weight and body condition evaluation at mating time indicates a 2.41 kg higher live weight at L2 but also an improvement in body condition by 0.31 points. For live weight, a significant difference between groups was obtained for P≤0.05. Regarding the milk production obtained from the females in relation to the BCS assigned to L1 the biggest difference was between BCS = 3.0 and BCS = 1.5 and in L2 between BCS = 2.5 and BCS = 1.5, both situations being significant for P<0.01.

Key words*: body condition, Botoșani Karakul Sheep Breed, ewes milk, flushing, milk production.*

INTRODUCTION

The area where the research was carried out is located in the North Eastern of Romania. As in other areas of Europe, climate change is evident in this area and exerts a negative influence not only on the environment but also on the behavior and level of production obtained from small ruminants. Since the main climatological factors, represented by temperature and precipitation, contribute to the increase of annual periods in which drought and high temperatures exceed critical levels, it is found that in that area there are changes in the composition of the green mass on the pasture, affecting the body condition of the ewes exactly in the period preceding the breeding season (Nechifor et al., 2022).

In order to maintain herds in favorable conditions, especially in areas that tend to become arid after the climatic conditions have changed, and the periods of high temperatures and drought are prolonged and affect the vegetation of the plants, it is necessary to apply some activities to support the body condition in the females that form the livestock at the farm level. Therefore, alternative feeding strategies are needed in these arid areas based on supplementary feeding in critical periods with feed that varies greatly from season to season and from year to year due to the evolution of precipitation (Rekik et al., 2020). In these conditions, sheep preparation for a new production cycle will start already in the period preceding the breeding period and most of the time it is based on additional feeding by administering cultivated cereals in quantities that vary according to their nutritional value. Typically for small ruminants the source of additional energy varies greatly and includes in addition to grains and easily digestible fiber sources and other very good quality forages (Simeanu et al., 2018).

By means of additional feeding, the aim is to restore the body condition of the sheep to an optimal level. After a period of flushing, the additional food factors will have a positive effect and will have a major nutritional intake, contributing to the support of some metabolic functions and the secured reserves will be

stored in the body tissues, especially in the fat tissue and in the intramuscular fat, being able to be mobilized when necessary (Martin et al., 2009).

Sheep body condition is extremely important because metabolic factors manifest themselves intensely and can exert highly variable effects, from increasing the level of basic productions (milk, wool, meat) to increasing reproductive indices, when the ensured minimum requirements become favorable, or it can reach a complete block of reproduction when circumstances become critical (Rekik et al., 2020; Martin et al., 2009; Caton & Dhuyvetter, 1997).

The purpose of the research was to perform a detailed analysis to highlight both the impact of additional feeding and the relationship between body condition score (BCS) and some productive traits in Botosani Karakul Sheep Breed.

MATERIALS AND METHODS

The biological material belonged to the Botosani Karakul sheep breed growing at the Research and Development Station for Sheep and Goat Breeding, Popăuți - Botoșani. In order to evaluate the impact due to additional feeding on body condition and milk production, two batches (L1 and L2) were formed. Each batch consisted of 100 females from the base herd aged between three and six years. The established batches had the same experimental treatment, being maintained during the entire period of research in the traditional breeding system. This system relay on keeping ewes in shelter from December to May and on pasture during the warm season, i.e. from May to the end of November.

The experimental factor was represented by the fact that group L2 benefited for 25 days additional feed before the beginning of the breeding season. Lot L2 benefited from a supplemental feed based on administrating in each days morning of a 170 g quantity of a mixt cultivated cereals (ground corn, sunflower meal, barley and oat grains). The supplementary cereals feed mixture was intended to improve the body condition of the females before the start of the breeding season. Through this additional feeding, the aim was to ensure an additional energy intake of 15% compared to the feeding level benefited by the females that constituted L1.

Water and salt were provided at discretion. The breeding season was carried out between September and October, with managed natural breeding being used, with 25 females assigned to one ram. The calving season took place between March and April and the lambs were weaned 70 days post-partum.

The assessment of the body condition of the two groups was carried out by palpating the muscle mass and the fat deposits located on the upper line of their body (back, saddle and rump) being given marks from 1 (for the thin ones) to 5 (for the very fat ones) with subunits of 0.5. using a method developed by Russel (1991). Body condition was assessed at the time of ewes mating and the date of ewes weaning. The assessment was carried out by two experienced persons. If different opinions or certain controversies were recorded, the evaluation was extended until a total consensus and the same point of view was obtained. Live weight was determined using an electronic scale that had an accuracy of ± 100 g.

The performance evaluation for milk production resulted from lactation analyze was based on the application of successive periodic inspections, and using for the lactation period the Nica method and for the milking period exclusively the method AT4 in compliance with the technical specifications suggested by International Committee for Animal Recording. Estimation of the average total production of milk was carried out using the Fleischmann method.

$$\mathrm{TMY} = \mathrm{L}_1.\mathrm{int}_1 + \sum_{i=2an} \left(\frac{\mathrm{L}_i + \mathrm{L}_{i-1}}{2}.\mathrm{int}_i\right) + \mathrm{L}_n.14$$

where:

TMY= Milk yield (kg)

L1 = milk yield of the 1st monthly test;

Li = milk yield of the 2th monthly test (i = 1,..., n);

Ln = milk yield of the last test;

int1 = number of days from kidding to 1st monthly test;

inti= number of days between monthly tests (i-1) and i (i = 1,...,n);

n = total number of monthly tests for a specific animal.

Data were statistically evaluated with the algorithm REML (REstricted Maximum Likelihood), which provides the achievements of the statistical parametric estimators within the normal range.

RESULTS AND DISCUSSIONS

Supplemental feeding sheep with grain, hay or silage is necessary when pasture or stubble is deficient in energy and protein. The passage of longer periods of time in which nutritional requirements are not ensured at an optimal level affects body condition, with negative effects on the main indicators specific to production or reproduction.

According to the research protocol, the main objectives referred to evaluation of supplementary feeding influence on the changes that occur during a season on sheep live weight, on body condition and on specific performances of milk production.

Evaluation of Body Condition Score and Average Body Weight as an effect of additional feeding

Achieving higher milk yields requires higher energy consumption because the amount of energy required to maintain body tissue functions and milk production exceeds what lactating sheep can consume (Pascal, 2015).

Metabolic processes increase if milk productivity increases and in conditions where nutritional requirements are not ensured, they can trigger an increase in metabolic stress that negatively affects not only sheep production but also their health (Farman et al., 2018). Milk productivity and reproductive traits then decrease. The body energy reserves mobilization during early lactation allows ewes to bridge the gap between dietary energy intake and its loss through milk production (Schroder & Staufenbiel, 2006). As changes in energy reserves have a considerable influence on productivity, health and reproduction in ruminants reared for milk (Ucar et al., 2011; Whay et al., 2003), an optimal management of energy reserves is required in all ewes in lactation. The indicators, which characterize the metabolic processes of dairy cows, are body condition score (BCS) and live weight (ELW).

So, by ensuring this energy nutritional surplus of only 15%, an improvement in body condition was obtained, which from a biological point of view was based both on the restoration of body reserves and on the storage of some energy resources that the animals metabolized in later periods.

Table 1. Descriptive statistics for Body Condition Score (BCS) and Ewe Live Weight (ELW)

Time of assessment								
Mounting					Weaning lambs			
L_1			L_2		L_1		L_2	
Character	$\bar{x}$	$\pm s_{\bar{x}}$	$\bar{x}$	$\pm s_{\bar{x}}$	$\bar{x}$	$\pm s_{\bar{x}}$	$\bar{x}$	$\pm s_{\bar{x}}$
BCS	2.48	0.059	2.79	0.055	2.21	0.061	2.57	0.063
ELW	46.61	0.548	49.02	0.505	45.09	0.566	47.44	0.551
The difference and its significance for BCS (points)								
Trait 1	Trait 2	Dif. med.	Q1	Q2	W1	W2	*P* value	
BCSL2W	BCSL1M	0.09	0	0	0	0	ns	
BCSL2W	BCSL1W	0.36	0	0	0	0	0.01	
BCSL2W	BCSL2M	0.22	0	0	0	0	0.05	
BCSL2M	BCSL1M	0.31	0	0	0	0	0.01	
BCSL2M	BCSL1W	0.58	0	0	0	0	0.01	
BCSL1W	BCSL1M	0.27	3.63	4.4	0.22	0.26	0.01	
The difference and its significance for ELW (kg)								
ELWL2W	ELWL1M	0.83	0	0	0	0	ns	
ELWL2W	ELWL1W	2.36	0	0	0	0	0.05	
ELWL2W	ELWL2M	1.57	0	0	0	0	ns	
ELWL2M	ELWL1M	2.41	0	0	0	0	0.01	
ELWL2M	ELWL1W	3.93	0	0	0	0	0.01	
ELWL1W	ELWL1M	1.52	3.63	4.4	1.97	2.39	ns	

Notes: BCSL1M and BCSL2M: body condition score at mounting;
BCSL1W and BCSL2W: body condition score at weaning lambs.
$ELWL_1M$ and $ELWL_2M$; average body weight at mounting;
$ELWL_1W$ and $ELWL_2W$ average body weight at weaning lambs.

The research carried out clearly highlights the positive impact due to additional feeding and its effect on the body condition both at the time of lambing and at the time of lambs weaning

(Table 1). Except for the difference between BCS determined for L2 at lambing time (BCSL2W) and BCS determined for L1 at lambing time (BCSL1M) all other differences were significant for P≤0.01 and P≤0.05, respectively. Regarding live weight, only the difference between ELWL2W and ELWL1M and respectively ELWL1W and ELWL1M was insignificant for the statistical thresholds considered.

Following the evaluation of body condition, carried out in the two periods, some statistical differences were recorded between the batches for the considered thresholds. The statistical processing of the data obtained as a result of body condition assessment at the time of lambing indicates that the ewes forming L2 had a better body condition because the average score assigned was 11.11% higher than L1. This aspect was due to the fact that the additional feed provided in the period preceding the mount allowed a better restoration of body reserves.

However, by applying supplemental feed for 25 days prior to mating, an improvement in body condition was achieved. In a similar research in which the effect of flushing treatment applied for three weeks was followed, the BCS increased from 0.75 to 0.87. It is also found that following the application of a flushing based on energy intake there were significant effects on the primary follicles, the diameters of the large follicle and the corpus luteum. Plasma concentrations of glucose and cholesterol during the flushing period were significantly different (P<0.05) between all applied treatments (Nurlatifah et al., 2019). The role, importance and effect of additional feeding applied in the pre-mount period are special and it should be an indispensable measure used in the application of management that supports the achievement of positive results. This is possible because with increased nutrient intake, especially energy, the sheep can reach the ideal BCS so that they are ready for breeding. Animals with high BCS have better ovulation rates than animals with low BCS. Animals that have good BCS are not inhibited by the production of reproductive hormones such as GnRH, estrogen, FSH and LH (Scaramuzii et al., 2006).

Regarding the body condition evaluation at the time of lambs weaning, the score difference is higher by approximately 14% in the group that benefited from additional feed. This aspect is due to the fact that the sheep of this batch used in a more efficient way the body reserves accumulated and stored during the period in which the experimental treatment was applied.

The live weight registered different average values, being higher in the lot that benefited from flushing. Thus, at the time of mounting to L2, the average live weight was 49.09±0.505 kg. Practically, this batch recorded a 5% increase compared to L1, and this accumulated increase was based on the restoration of tissues and the establishment of some stores that will be used during the period when physiological and metabolic processes require high energy consumption.

On the day of lambs weaning, although the live weight decreased in both groups, the difference remains at approximately the same level, being superior by approximately 5% to L2, being significant for P≤0.5.

The results obtained represent a basic support for obtaining milk production superior performance. The argumentation of this statement is supported by several researches which show that the ewe body weight at mating, influences not only the number and weight of the lambs at lambing (Gordon, 1997) but also the productivity of the sheep (Vatankhah & Salehi, 2010).

In other research conducted on Kivircik sheep, significant effects of BCS on pregnancy rate, lambing rate (P < 0.05) and fecundity (P < 0.05) were found. The BCS for the highest pregnancy, lambing rate, and fecundity was determined between 2.01 and 3.00, while the lowest rates for these traits were ≤1.50. The highest rates of the pregnancy rate, lambing rate, and fecundity and gestation productivity were 75.9%, 70.9%, 1.11 and 3.34 kg, respectively (Yilmaz et al., 2011).

Evaluation the Milk Yield in relation with BCS and as an effect of additional feeding

In order to obtain conclusive data, data obtained from the BCS assessment at weaning lambs were used. Milk production resulting during the period when the sheep were in the exclusive milking situation was determined for

each sheep according to the score obtained when determining the BCS (Table 2).

In the case of the batch that did not benefit from additional feed (L1), the highest milk production obtained during controlled lactation was recorded in ewes that had BCS = 3.0 points. In this case, the total amount of milk was higher by 23.18 kg compared to the level of milk obtained from sheep that obtained BCS = 1 and by 8.27% compared to the amount of milk milked from ewes with BCS = 3.5. The obtained data also highlight the fact that the amount of milk milked was obtained from the groups of ewes that had BCS between 2.0 and 3.0.

Table 2. Statistical indicators for Milk yeld in relation with BCS (kg)

BCS Points	n	$\overline{X}$	$\pm s_{\bar{x}}$	S	V%
L1					
1.0	6	53.68	0.255	0.624	1.163
1.5	18	55.45	0.865	3.672	6.622
2.0	28	56.22	0.238	1.257	2.236
2.5	26	66.72	0.535	2.728	4.089
3.0	20	69.88	0.911	4.074	5.83
3.5	2	64.1	2.100	2.97	4.633
L2					
1.5	11	56.65	0.376	1.247	2.201
2.0	15	63.73	0.496	1.923	3.017
2.5	32	77.62	0.672	3.804	4.9
3.0	33	76.65	0.513	2.948	3.846
3.5	6	67.01	1.915	4.69	7.001
4.0	3	67.33	2.333	4.041	6.002

In the L2 group that benefited from stimulating feed in the period before lambing, the proportion of sheep that obtained a score higher than 2.5 points was higher by approximately 35% compared to L1. In the case of this batch (L2) the maximum milk production level is obtained from the sheep that obtained BCS = 2.0.

Concretely, the obtained results indicate that the assessment of BCS at the time of lambing offers more valuable indications on the level of milk production in the respective lactation.

Given that BCS is likely to change in a given ewe during pregnancy, it is not too surprising that both Hossamo et al. (1986) reported that in Awassi sheep BCS before calving had a positive effect on milk yield and lactation duration, whereas BCS measured before breeding had no effect.

According to the data obtained from the research carried out, it appears that the stimulating feeding had an influence on the productive level and the information obtained from the evaluation of body condition at the time of weaning provides more relevant indications regarding the specific performances of milk production from the respective lactation. The dynamics of milk production obtained from the ewes that formed the two experimental groups clearly shows that L2 had a higher level of performance for each group based on the BCS determined at weaning of the lambs (Figure 1).

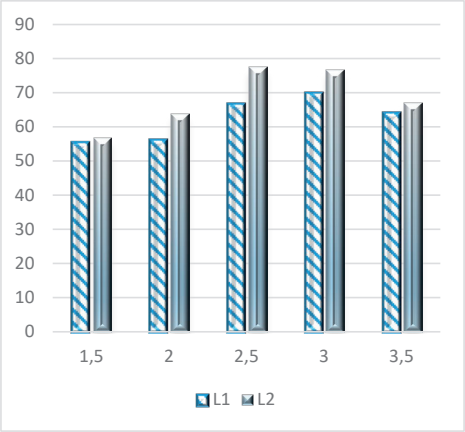

Figure 1. Graphic representation of milk production in relation to BCS (kg)

Contrary to the general picture emerging from these studies, under stimulant feeding the milk production of Sarda ewes with higher BCS in mid-lactation was lower than it was in ewes with lower BCS (Pulina et al., 2012). When feed was restricted, milk production was similarly adversely affected in both groups of BCS ewes. Cannas (2002), cited by Kenyon et al. (2014), questioned whether there is a possibility that ewes achieving a BCS≥4 (very fat) provide lower milk production due to large amounts of visceral fat compressing the rumen, thereby reducing intake. If this is true, it could help explain the results of Pulina et al. (2012).

It could also be assumed that ewes with high BCS in mid-lactation are those that are metabolically programmed not to mobilize accumulated body reserves to be used to

support increased milk production, thus explaining the lower level obtained of milk production.

The nutrition provided in critical periods for the batches that form the core of production has a positive influence on the future productive level. If daily nutritional requirements are not provided at a suboptimal level, metabolic reactions occur that have negative effects not only on daily milk production but also on the total duration of lactation (Jordan & Mayer, 1989; Langlands, 1977).

Table 3. The Difference and its meaning for Milk Yeld (kg)

BCS (points)	BCS (points)	Dif. med.	*P* value	BCS (points)	BCS (points)	Dif. med.	*P* value
L1				L2			
1.5	1.0	1.77	ns	2.0	1.5	7.08	0.01
2.0	1.0	2.53	ns	2.5	1.5	20.96	0.01
2.0	1.5	0.77	ns	2.5	2.0	13.89	0.01
2.5	1.0	13.04	0.01	3.0	1.5	20	0.01
2.5	1.5	11.27	0.01	3.0	2.0	12.92	0.01
2.5	2.0	10.5	0.01	3.0	2.5	0.96	ns
3.0	1.0	16.2	0.01	3.5	1.5	10.35	0.01
3.0	1.5	14.43	0.01	3.5	2.0	3.27	ns
3.0	2.0	13.66	0.01	3.5	2.5	10.62	0.01
3.0	2.5	3.16	0.05	3.5	3.0	9.65	0.01
3.5	1.0	10.42	0.01	4.0	3.0	9.32	0.01
3.5	1.5	8.65	ns	4.0	3.5	0.33	ns
3.5	2.0	7.88	ns	4.0	2.0	3.6	0.05
3.5	2.5	2.62	ns	4.0	2.5	10.29	0.01
3.5	3.0	5.78	0.01	4.0	1.5	10.68	0.01

The comparative analysis of the milk production obtained from the groups based on the BCS evaluation (Table 3) indicates that in L1 the biggest difference was between BCS = 3.0 and BCS = 1.5 being 14.43 kg, being significant for $P<0.01$. At L2 the biggest difference was found between BCS = 2.5 and BCS = 1.5 significant for $P<0.01$.

CONCLUSIONS

The results obtained clearly show that the score assigned to the BCS evaluation is an important factor in farm management. The additional feed provided to the sheep in the period preceding the lambing has a double role, i.e. it allows obtaining higher indicators for the reproductive activity, but it will also represent an effective mean of supporting the performances for milk production.

The inclusion of additional feeding among farm management activities to maintain adequate body condition for all ewes will allow appropriate decisions to be made for feed stock allocation.

The final results confirm that both in L1 and L2 the highest milk productions are obtained from ewes with BCS = 2.5 and BCS = 3.0, thus proving that the sheep state of maintenance is an extremely important factor in order to obtain productive performances.

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