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Relationships between Live Weight and Body Condition in Heavy and Light *Rembi* Ewes under Common Feeding Conditions

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Abstract: The purpose of this study was to investigate live weight (LW) and body condition (BC) variation in two lines of *Rembi* sheep reared in extensive and semi-intensive alimentary management. The heavy ewes of the first group were fed with 800g per head/day during winter and spring months. However, the light ewes of the second group received, in winter season, a survival diet regimen consisted of 300g of barley grain and 500g of barley straw per head/day. In spring months, light ewes were grazing on fallow, without any food supplement. Results showed a high significant difference in LW and BC between both groups at beginning of trials. Hence, variations of the studied parameters during all the 20 weeks *postpartum* (PP) were moderate and almost all the initial LW was recovered in the late experiment period. Light and heavy ewes, under extensive and semi-intensive feeding mode, respectively, followed the same general LW and BC change pattern. In particular, the light ewes showed a high ability to overcome the undernourishment, sustained for a long time. Thus, *Rembi* sheep showed an important adaptability to the undernourishment conditions and high and rapid recovery in LW and BC.

Key words: Rustic sheep breed · Common feeding conditions · Live weight · Body condition

INTRODUCTION

In the Algerian highland, sheep farming is mainly conducted under extensive feeding system. Owing to the lack of feeding supplementation, the diet of the sheep flock is based only on fallow and young growths of barley grazing in autumn and spring. In summer, the flocks are maintained on post-harvest stubble. Thus, for several months (From Mars to September) the sheep feeding depends solely on the soil availability. Which make rainfall a determinant factor in this sheep production system. However, under the lack of rain seasons breeders are obliged to ensure a daily food ration to their flocks. The diet consisted usually of ground barley and/or wheat bran, with an amount ranged between 300 g and 1 kg, according to the physiological status of ewes and, particularly, to the financial capacity of the sheep owners.

In order to meet the nutrient requirements, principally in gestation and suckling periods, the undernourished ewes have recourse to their fat reserves, mobilize the muscular protein and demineralize the skeleton's bones. These successive processes involve weight and body condition losses. So, critical food shortages situation conduct to developing severe metabolic disorders, like pregnancy toxemia [1] and lamb death, due to starvation [2]. Under a better nutrition regimen, the suckling ewes overcome the difficult periods; recover losses' weight at the third suckling month, which corresponds to milk production decrease, as observed by Benchohra *et al.* [3] in *Rembi* sheep.

The body condition scoring (BCS) is a key to manage sheep flocks; thus, BCS is used to diagnose the health status and sheep welfare [4]. BCS offers an alternative to weighing, which is a cumbersome practice with uncertain outcomes, due to the variance in placental and fetal

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weight between pregnant ewes [5]. Moreover, the technique is easy and does not require any equipment [6,7]. On the other hand, BCS is well correlated to fertility [8,9] and production parameters of sheep [10,11]. In our contest, sheep sector operators' recourse to estimate BCS only for wheeling and dealing in livestock markets.

The purpose of this study is to contribute to know the variations of live weight and body condition in unimproved *Rembi* sheep's subjected to two common alimentary diets, in *in situ* management conditions; then, to assess the relation between the studied parameters.

MATERIAL AND METHODS

Study Area: The study was conducted on two farms, far from each other about 35km, located in Tiaret District (Cereal plane in western highland of Algeria), between 35°22' N and 1°19' E, with 1000 m of altitude.

Animal's management

Trial1: The first group of 13 ewes, belonging to the experimental farm of Tiaret University, weighed 67 ± 6kg, with 2.5 ± 0.6 BCS and aged around 46 months. The animal's diet consisted of 800g/head/day of barley grain, on average, provided the whole study period. Some of sheep breeders have recourse to this practice in the event of lack of pasture, or due to the low rainfall periods.

Trial 2: Furthermore, a group of 13 ewes, appertained to a private sheep farm, was studied. The mean weight of the ewes was 50 ± 7kg; with 1.5 ± 0.4 BCS and aged around 32 months. During the winter period, the ewes were maintained in sheepfold and feeded 300g of barley grain and 500g of barley straw /head/day. At the beginning of spring season, the animals were placed on pasture grazed herbaceous plants, without any supplement feed. This extensive alimentary mode is the most followed in agro-pastoral area of Algerian highlands.

According to weight disparity we have identified the fist group as heavy (HG) and the second as light (LG).

Both animals groups were clinically healthy at the onset and through all the 20 weeks of the experimental period (From December 2014 to May 2015) and lambing occurred during the second half of December.

Measurements: Ewes were weighed, before feeding, using an electronic scale of 100g precision. The BCS was determined by only one evaluator on a 5-point scale with the accuracy of 0.5 point according to Russel *et al*. [12]. Controls were performed at 4thwk prior to lambing and every month to the end of experiment.

Statistical Analysis: Collected data (Absolute body live weights, absolute body condition, relative evolution of body live weights and relative evolution of body condition) for each ewes group were analyzed by t-Student and correlation tests. Means were considered significantly different when $P<0.05$ and high significant when $P<0.01$. Statistical analysis was performed using the Statistica 5.1 software (Tulsa, Ok., USA).

RESULTS

Ewes Live Weight: The values of body changes occurring during suckling months and days are shown in tables 1 and 2.The average live weight of ewes in HG was higher of 17kg than those in LG; the difference was highly significant (P=0.0000), this trend was observed during the whole study period. So, the variation coefficient in LW was upper for LG (14 vs 9).

The weight losses due to lambing are close with 9.5kg (14.2% of LW; P=0.000) and 7kg (14% of LW; P=0.000) for HG and LG, respectively. After a month of lambing, decrease of weight was not significant in HG (2.2kg; P=0.06); so, it was highest in LG 3.3kg (P=0.013). At 8 weeks PP, the loss was very important in HG (3.5kg; P=0.001 vs 1.2 kg; P=0.10); it corresponds to the maximum cumulative losses occurred after lambing: -7.7kg (P=0.002); 13.3% of LW for HG, against -4.5kg (P=0.004); 10.3% of LW, for LG. Afterward, body weight recovery has started in the 3rd suckling month, heavy and light ewes

Table 1: Evolution of means (±SD) live weight and body condition in whole study period

Weeks	-4	0 (L)	4	8	12	16
Live weight (kg) in HG	67.3 ± 5.8	57.8 ± 6	55.6 ± 7.4	52.1 ± 8.2	59.1 ± 10.4	63.4 ± 8.9
Live weight (kg) in LG	50.5 ± 6.9	43.5 ± 7.1	40.2 ± 6.5	39 ± 5.8	46.7 ± 6.2	52.9 ± 6.9
Condition Scoring in HG	2.5 ± 0.6	2 ± 0.7	1.5 ± 0.8	2.1 ± 0.9	2.4 ± 0.8	3.2 ± 0.6
Condition Scoring in LG	1.5 ± 0.4	1.1 ± 0.4	0.6 ± 0.3	0.6 ± 0.4	1.3 ± 0.8	2.2 ± 0.8

HG: heavy ewes; LG: light ewes; L: lambing day.

Table 2: Monthly evolution of live weight and condition scoring with daily weight variations

Weeks of *postpartum*	4	8	12	16
Weight changes (kg) HG	- 2.2	- 3.5**	+ 7**	+ 4.3**
Weight changes (kg) LG	- 3.3*	- 1.2	+ 7.7**	+ 6.2**
Daily weight change (g) HG	- 73	- 116	+ 233	+ 143
Daily weight change (g) LG	- 110	- 40	+ 256	+ 206
BCS in HG	- 0.5*	+ 0.6**	+ 0.3	+ 0.8**
BCS in LG	- 0.5**	0.0	+ 0.7**	+ 0.9**

BCS: body condition scoring, * = significant (P < 0.05), **= significant (P < 0.01).

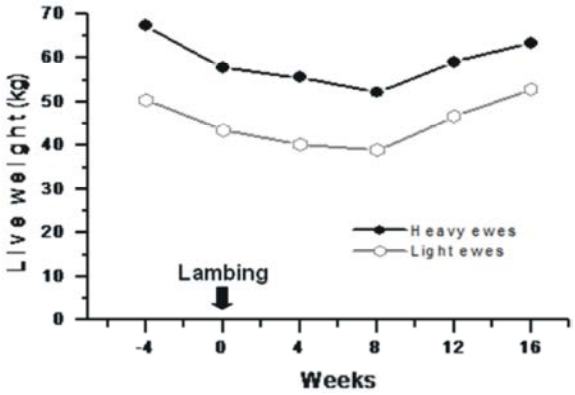

Fig. 1: Evolution of body weight in heavy and light ewes during whole trials period.

recovered 11.3 and 13.9kg during the last 8 weeks, respectively; that was high significant in both studied groups (*P*=0.000), with a slight superior gain in LG (Table 2).

At the end of the trials period, light ewes reached an LW upper than recorded before lambing. While for the heavier, LW had exceeded that recorded at lambing (Table 1). The traced shapes of body weight changes, in heavy and low weight groups, at different periods, showed, in general, a same evolution with a constant gap (Fig. 1).

Ewe body condition score: At the trial's beginning, the difference in BCS between heavy and light ewes was significantly high (*P*=0.000) in favor of HG; which presented a better body condition (Table 1).

The body condition setting follows a comparable evolution to that of LW. Overall, the body condition variations were similar in both ewes groups throughout the study period (Table 2). The diminishment of BCS occurred at late gestation and extended in early suckling period with a close values, but the significances were different, *P*= 0.004 vs *P*=0.000 and *P*= 0.016 vs *P*=0.000, for HG and LG, respectively. Then, between 4 and 8 weeks PP, BCS increase was high in HG (0.6; *P*=0.000), but remains unchanged in LG. Next, body condition increase notably for LG at 12wk (0.7; *P*=0.004). In both groups gain extended for the remaining trial period (Table 2). So, at last, both studied groups have won more than 1point (1.2 and 1.1 respectively for HG and LG), compared to their beginning status.

Relationship between live weight and body condition: The LW and BC are well correlated, though, the coefficient was higher in the heavy group compared to the light (r = 0.7 vs r = 0.5). Therefore, nearly throughout the entire study period, evolution of LW parameter was synchronous to that of BC, except for the period from 4 to 8week in which we have seen a diminishment of 3.5kg in LW and, in contrast, an improvement of 0.6point in BCS in the heavy group. However, from lambing to the end of trials, we have estimated that each point change of BCS corresponds to a change of approximately 4.6 and 8.5kg, for heavy and light ewes, respectively.

DISCUSSION

The choice of the studied animals has been done randomly and the wide live weight disparity (17 kg) between groups was not premeditated. However, the heavy ewes showed a low LW variation coefficient, because in the experimental farm it has been no introduction of external animals in the flock for many years. Conversely, the private breeders resort commonly to renewal the male reproducers for improving the flock efficiency. On the other hand, the superior weight of the heavy ewes group can be explained, also, by their highest BCS [9] and by their advanced age [13].

Thomson *et al*. [14] have used the terms of "light" and "heavy" to describe the ewe's differences in live weight and body condition. Moreover, in a study carried out on *Rembi* sheep, in the same region, Benchohra *et al*. [15] identified two different lines of body weight (Heavy and low) within one flock. Hence, our current trials corroborate the results of the previous.

In the late pregnancy month, we noted that ewes of both groups showed a loss in LW and BC as observed by Radunz *et al*. [16] what appear more significant in light ewes which were submitted to a severe restricted diet; suggesting that a part of gestation needs were covered by the recourse to body components, considering the insufficient diet ration provided during winter period. It is expected that ewes earn more weight during the last month of *prepartum* if well nourished [17].

The high decrease in live weight noted after parturition is due, mainly, to the fetus and placenta expulsion [18], add to that weight losses related to body reserve mobilization. The loss was higher for LG at the 4th PP week. The possible explanation is the underfeeding occurred before day 100 of pregnancy, as observed by Mavrogenis *et al.* [19].

Body losses continued during the first 8 weeks PP in both groups; however, it was more marked in heavy ewes, probably due to the maximum milk production reached at this time, as reported in *Rembi* ewes [15].This decrease in LW is all the more important in heavy ewes because of the favorable effect of diet energy on milk production [20-22]. Then, LW losses showed in our study were highest to those reported by Benchohra *et al*. [15].

In the research undertaken by Chemmam *et al*. [23] the Algerian sheep breed Ouled Djellal, with comparable LW and BCS, incurring losses in both parameters in the 11 week PP despite the feeding based on grazing with a slight energy food supplement. On the contrary, we observe an overall and clear enhancement at 12 week PP. This upward trend concord with the period of the placement of light ewes on pasture, which mean that the diet regimen based only on grazing, during spring season, provided them essential nutrients needs and allowed them a best body condition enhancement. In fact, the rainfall (120 mm) recorded from January to April [24] was considered as adequate for grass-growth season [8]. Osoro *et al*. [25] noted similar responses of grazing ewes in weight gain with those of our study during whole spring period. Compared with the results showed by the same breed feeded with high-energy diet [15] the light ewes of our study have made a superior live weight enhancement in the late suckling period; maybe due to an inferior milking capacity. Additionally, heavy ewes have gained more weight probably because of the high crude protein concentration of feed barley [26].

The *postpartum* BCS in both studied groups were less than 2.5 points, which is in disagreement with INRA recommendation [27]. In spite, losses accumulated in the 42 first days of suckling period were acceptable; they have not exceeded 1 point [28]. Bocquier and Chilliard [29] and Chay-Canul *et al*. [30] found a greater loss in LW and BC, in ewes receiving 60% of their energy needs, compared with those of our study. Though, no research was carried on the energy requirement of the suckling *Rembi* sheep.

Increase in body condition achieved in both groups, throughout the trials' period, was equal (0.7 point); hence, the heavier ewes reached the higher BCS at the end, regarding their good state at the beginning. According to Atti *et al.* [31] enhancement of body condition would be due, in part, to the maternal behavior of ewe, relating to its genetic trait. This suggests that unimproved *Rembi* sheep has a good ability as regards to the moderate weight and body condition changes. This situation is all the more clearly evident in light ewes, even though they were submitted to a long under-nourishment time. Thus, Thomson *et al*. [14] suggested that light and heavy ewes selected from within a flock are likely to show similar live weight responses to generous feeding. However, the studied animals are selected from two distinct flocks and were fed with two different diets; despite these facts their response to feeding was close.

Regarding the relationship between live weight and body condition, Sezenler *et al*. [32] and Yilmaz *et al*. [33] observe a high coefficient ($r > 6$), in agreement with that of our heavy ewes. The possible reason of the slightly lower coefficient value of the light ewes was an evenmore filling of their digestive tract [34]; whose can make up a high proportion of an animal's mass to 17% of total live weight [35]. While, Vatankhah *et al*. [36] explain their weak relationship ($r = 3$) by the skeleton weight and sheep body size.

Furthermore, Sezenler *et al.* [32] reported in *Gokceada* breed, during a part of the suckling period, a slight decrease in LW against an increase in BCS, as we have observed in heavy ewes at the 3rd suckling month. Conversely, Lakhssassi and El Fadili [37] showed the opposite in *D'man* breed. So, in both alimentary conditions, *Rembi* ewes seem to be able to recover their energy status after lambing, with no negative effect of feed restrictions endured during the pregnancy period [38].

Finally, the body condition status reached by the ewes of both trials allows starting flushing, as suggested by INRA [27] and ewes may return to mating.

CONCLUSION

This study has shown that the light and heavy *Rembi* ewes, submitted to the extensive and semi-intensive feeding management, respectively, have followed the same change pattern in live weight and body condition. The light ewes, in particular, could overcome the undernourishment, endured the whole gestation period, without a huge decline in body condition. Hence, improvement in weight and body condition occurred, in spring season, when ewes were turned out to pasture. On the other hand, the amount of barley grain insured to the heavier enabled them to reach an acceptable body

condition status during the late suckling period. So, that is why this unimproved sheep was considered as rustic and was the most reared in harsh climate and nutrition conditions of the Algeria highland. In addition, body condition scoring was the best method to assess the energy status of *Rembi* ewes, it may provide improved tools for managing this breed to increase its production and it should be extended for flock managing.

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