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Effect of alternate supplementary feeding on semen and sexual behavior traits of Barbarine rams

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Abstract. Alternate supplementation with energy and protein could be an interesting saving option to cut on feeding costs in low input systems. The aim of this trial was to assess the effect of alternate (every 2 days) distribution of a flushing supplement above maintenance requirement on semen and sexual behavior traits of Barbarine rams. Fifteen adult rams were allocated to three groups of five animals. Rams in C group were fed a diet composed of 1.2 kg of hay/ram/day calculated to provide the metabolisable energy for maintenance for the studied breed. Rams in D group and in addition to the basal diet, were each, daily supplemented with 0.450 kg of a concentrate containing 80% barley, 17% faba bean and 3% a mineral and vitamin supplement. Rams in A group received the same diet as D rams but the concentrate was distributed every 2 days. The feeding regimes lasted 8 weeks. Both absence of supplementation and its distribution pattern (daily or alternate) did not affect semen traits such as volume and concentration of ejaculates. However feeding at maintenance requirements negatively affected sexual behavior by impairing anogenital sniffing, flehmen, penis erection, lateral approaches, reaction time and libido score Furthermore, alternate in contrast to the daily distribution of the supplement depressed reaction time, number of lateral approaches and libido score. In conclusion, these results suggest that supplementation above maintenance has not a major effect on sperm quality but enhances sexual behavior expression. Alternate feeding could be an interesting option to costly daily supplementation during 2 months prior to the mating season.

Keywords. Alternate supplementation – Sexual behavior – Semen characteristics – Rams.

Effet d'une supplémentation par intermittence sur les caractéristiques séminales et le comportement sexuel du bélier de race Barbarine

Résumé. *La supplémentation alternée en aliment concentré pourrait être une alternative pour diminuer le coût de l'alimentation dans les systèmes à faible intrant. Le but de cette étude était d'évaluer l'effet de la supplémentation en alternance (tous les 2 jours) par des apports en énergie et protéine au-dessus des besoins de maintenance, sur les paramètres spermatiques et le comportement sexuel des béliers de race Barbarine. Quinze béliers adultes ont été répartis en trois lots de 5 béliers. Les béliers du lot C ont reçu un régime alimentaire calculé pour fournir les besoins d'entretien des béliers, il est composé de 1,2 kg/bélier/jour de foin. Les béliers du groupe D reçoivent, en plus de la même quantité de foin, 0,450 kg de concentré composé de 80% d'orge, 17% de fèverole et 3% de complément minéral et vitaminé. Les béliers du groupe A reçoivent le même régime que le groupe D mais distribué seulement un jour sur deux. L'application du traitement a duré 8 semaines. La supplémentation, quotidienne ou en alternance, n'a pas d'effet significatif sur les paramètres spermatiques tels que le volume et la concentration. Par contre, l'alimentation selon les besoins de maintenance affecte le comportement sexuel des béliers (flairage ano-génital, flehmen, érection du pénis, approche latérale, temps de réaction et score de libido). La supplémentation des béliers un jour sur deux seulement, affecte le nombre d'approches latérales, le temps de réaction et le score de libido. En conclusion, cette étude montre que la complémentation énergétique et protéique des béliers au-dessus des besoins de maintenance, quotidienne ou par intermittence, n'a pas un effet significatif sur les paramètres spermatiques mais améliore le comportement sexuel des béliers. L'alimentation alternée pourrait présenter une alternative intéressante pour diminuer le coût de la supplémentation avant la lutte.*

Mots-clés. *Alimentation par alternance – Comportement sexuel – Caractéristique spermatique – Béliers.*

I – Introduction

Drought is common in arid and semi-arid regions of the world. In the Mediterranean regions. For successful mating of farm animals under these conditions, supplementary feeding has to be targeted to achieve the optimum level of reproduction (Boukhliq and Martin, 1997). Several studies have demonstrated that underfeeding can reduce semen quality and sexual activity (Murray *et al*., 1990; Brown, 1994). Supplementation can be expensive, and the cost of feeding is an important factor influencing profitability of flocks mainly in such system. Research has shown that providing protein supplements in a less frequent pattern to ruminants may reduce costs without negatively affecting performance (Huston *et al*., 1999; Farmer *et al*., 2001; Currier *et al*., (2004). There are few data available concerning the effects of improved diet and infrequent supplementation feed on animal performances, especially with regard to effects on reproduction traits. Therefore, the aim of this study was: (i) to determine whether or not supplementation above maintenance improves semen quality and testicular size (as a direct indicator of sperm production) and sexual behaviour traits; and (ii) to assess if daily or alternate (every 2 days) distribution of the supplement affects the same traits.

II – Materials and methods

The experiment was carried out in the sheep experimental station of Bou Rebiaà of the National Institute of Agricultural Research (INRAT). The station has a semi-arid climate and is located 25 km south of the town of Tunis 36°38 ' N latitude, 10°07' E longitude.

Fifteen adult Barbarine rams with an average initial body weight of 61.2±7.49 kg were allocated to three groups of five animals each balanced for age and live weight. Experiment was conducted between April and June and the feeding regimes lasted 8 weeks. The rams were housed in individual pens. Rams in C group were fed a diet composed of 1.2 kg of hay/ram/day calculated to provide the metabolisable energy for maintenance for the studied breed. Rams in D group and in addition to the basal diet, were each, daily supplemented with 0.450 kg of a concentrate containing 80% barley, 17% faba bean and 3% a mineral and vitamin supplement. Rams in A group received the same diet as D rams but the concentrate was distributed on an alternate basis every 2 days. Measurements of live weight and body condition score (BCS) were performed every 15 days. Scrotal circumference and semen traits were performed every 20 days and sexual behavior traits were tested once at the end of the experimental period by exposing the rams individually to a group of ewes induced to exhibit estrus in a small enclosure for a predetermined period of time (Price *et al.*, 1987).

III – Results and discussion

Changes in Body Condition Score (BCS) are represented in Fig. 1. No statistical differences were observed between the groups during the study.

Variation of live weight and body condition scores of the rams during the experiment were similar in all groups. Live weights at the end of the experiment were (63.5±10.5; 64.6±8.5 ; 59.7±9.0 kg for respectively D, A and C rams; $p>0.05$).

As shown in Table 1, there was a tendency for SC to increase in D group in comparison to C group, however, this difference was not statistically significant between groups. Throughout the experiment, there was an increase in sperm concentration from the beginning of the trial to the end of the experiment ($p>0.05$). Relationship between SC and sperm production is not established contrary to study of Gherardi *et al.* (1980).

In general, most of the nutritional- induced changes to reproductive function in adult rams are temporary but their severity can vary from little effect on seminal characteristics and/or libido to infertility. Fertility trials were not carried out in the present study. However, fertility in the ram has

been reported as closely related to semen quality. Data obtained in the present study indicated that semen traits (quality) were in general favourably comparable to traits observed in breeds of sheep from temperate climates. Despite the differences recorded for the testicular characteristic, no significant differences were recorded between the 3 nutritional groups regarding the different quantitative and qualitative semen parameters evaluated, namely semen volume, sperm cell concentration, overall motility and individual Motility. Our results are in agreement with those obtained by Bielli *et al. (*1999) and Lindsay *et al.* (1984), who found no significant effect between improved pasture or high dietary protein on testicular dimensions. Although these results are inconsistent with those obtained by Fernandez *et al.* (2004) and Boukhliq *et al.* (1997) or described by Brown (1994) that when rams are not in good body condition, supplementary feeding in the 2 months prior to joining may improve their reproductive performance. However, as the spermatogenic cycle in rams takes about 50 days, an effect on sperm quality could have been expected given a longer treatment period.

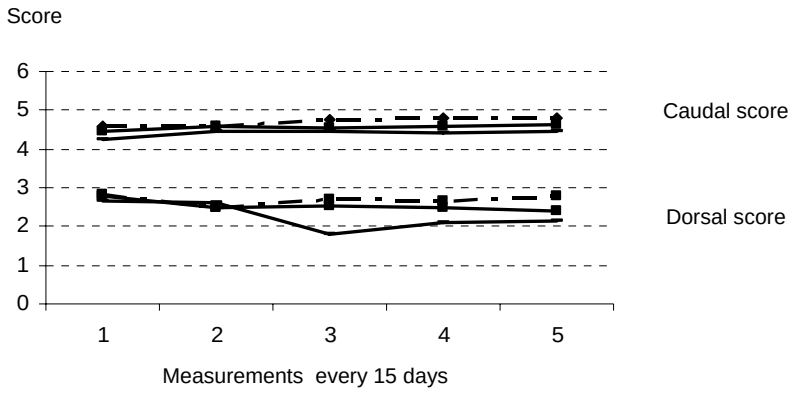

Fig. 1. Changes in Body Condition Score of Rams subjected to daily or alternate supplementation.

Table 1. Effect of regimes on scrotal circumference (SC), ejaculate volume (EV) sperm concentration (SC), Mass Motility (MM) and Individual Motility (IM), Mean (± SEM)

	SC (cm)		EV (ml)		CC (×10^9)		MM		IM	
	Initial	**Final**	**Initial**	**Final**	**Initial**	**Final**	**Initial**	**Final**	**Initial**	**Final**
D	27.6 ±1.51^a	28.6 ±2.07	1.15 ±0.25	0.55 ±0.21	5.6 ±2.19	6.22 ± 1.4	3.50 ±0.58	3.5 ±0.64	1.63 ±1.11a	2.85 ±0.57
A	30.4 ±1.51^b	30.4 ±2.41	0.86 ±0.56	0.57 ±0.41	4.63 ± 1.13	6.54 ± 0.90	4.41 ±0.14	4.15 ±0.48	2.75 ±1.39^{ab}	3.19 ±0.55
C	30.2 ±2.28^b	28.6 ±2.07	0.80 ±0.45	0.64 ±0.22	5.27 ±0.4	7.81 ±1.21	4.05 ±0.37	4.75 ±0.31	3.25 ±0.61^b	3.5 ±0.31

Means with different superscripts (a, b) within each column are significantly different (P<0.05).

According to James (1968) semen production appears to be related to live weight and in our study the diets had no effect on body weight which may explain the absence of any observed effect in sperm parameters. As described by many authors, the evidence suggests that when rams are not in good body condition, supplementary feeding in the 2 months prior to joining may improve their reproductive performance (Brown, 1994).

The sexual behaviour in terms of genital sniffing, flehmen reaction intensity, reaction time,

lateral approaches and libido score were positively affected (P<0.05) by supplementation. Therefore the nutrients' supplies provided by concentrate improved sexual behavior traits. These results are not consistent with those reported by Al-Hobby *et al.* (1999) who showed that protein supplementation did not influence sexual activity in Awassi rams. Similarly Fernàndez *et al.* (2004) showed that Assaf rams treated by different levels of protein had similar sexual behavior during the mating season.

Table 2. Effect of supplementation and alternate feeding on sexual behavioural traits

Groups	Genital sniffing	Flehmen reaction intensity	Erection of penis	Reaction time (s)	Lateral approaches	Libido score
D	1.8^{a}	1.6^{a}	2^{a}	6.4^{a}	2.8^{a}	7^{a}
A	1.6^{a}	1.6^{a}	2^{a}	11.2^{b}	2^{b}	4^{b}
C	0.6^{b}	0.6^{b}	0.8^{b}	18.6^{c}	1.2^{c}	1.4^{c}

Means with different superscripts (a, b,c) within each column are significantly different (P<0.05).

The other important result revealed by this work is that the frequency of supplementation is important for sexual behavior since alternate distribution of concentrate slightly depressed the libido score and increased the reaction time when compared to daily distribution of the supplement.

IV – Conclusion

In conclusion, these results suggest that supplementation above maintenance requirements has not a major effect on sperm quantitative and qualitative traits of Barbarine rams raised in a semi arid environment. This finding stresses once again the good reproductive ability of rams of this breed. Nevertheless, supplementation improved expression of sexual behavior and this can be related tot eh overall mating ability of the rams under field conditions. Alternate distribution of the supplement did not affect sperm quality and quantity and despite a slight effect on some behaviour traits, it remains an interesting option to cut on the cost of feed in low input systems of semi arid Tunisia.

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