Probiotic effect on reserve mobilization in late stage pregnancy in goats

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Abstract

This study was carried out to evaluate a probiotic effect on the mobilisation of body reserves in goats towards the end of gestation by measuring ketone body production in blood and calculating the body condition score (BCS). Ketone body production was monitored by measuring the betahydroxybutyrate BHB levels in the blood using a portable kit (PRECISION XTRA Blood ketone test). The results revealed that the use of the probiotic SYMBIOVEBA® (association of *Saccharomyces cervicae* and *Lactobacillus*) did not decrease the formation of blood BHB in goats, and therefore did not decrease mobilization of the body reserves of goats in late pregnancy.

Key words: *BCS; Betahydroxybutiric acid; goats; peripartum; probiotic; reserve mobilization*

Introduction

Food deficiency towards the end of gestation can cause a nutritional imbalance, which can have a negative impact on health and compromise gestation (El-Deeb and El-Bahr, 2017). The measurement of ketone bodies, mainly betahydroxybutyrate (BHB), allows for monitoring the animal's energy balance (Sadjadian et al., 2012; Folnožić et al., 2015; Vince et al., 2017; Aladrović et al., 2018; Szenci et al., 2018; Folnožić et al., 2019; Đuričić et al., 2020). However, there are currently few standards in effect for the use of this biochemical marker in goats. Threshold values used to prevent metabolic disorders are often extrapolated from values for dairy cows or ewes (Đuričić et al., 2011; Doré et al., 2013).

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The antibiotics previously widely used as additives in livestock feed have since been banned from use. Indeed, their consumption exposes the animal and the consumer to antibiotic resistance from certain pathogens (Cvetnić et al., 2016; Saidi et al., 2021). In this context, probiotics, as more natural additives, present an interesting alternative (Haimoud-Lekhal et al., 1999).

Probiotics are living microorganisms that can have beneficial effects by improving the intestinal flora (Fuller, 1989). It has been shown that the provision of probiotics (yeasts or bacteria) improves the digestibility of nutrients, and optimizes ruminal fermentation, which leads to high growth performances of animals (Cole et al., 2008). Therefore, the aim of this study was to evaluate the effect of a commercial probiotic (SYMBIOVEBA®) administered to goats on the mobilization of body reserves, by measuring the formation of ketone bodies, mainly BHB, and calculating the body condition score.

Material and methods

Study area

The study was carried out in the region of Bouaarfa, Blida, in northern Algeria, in the Blidean Atlas Mountains.

Animals

In this study, 91 local goats belonging to the Arbya population were divided into two groups: the first was given a probiotic at the rate of 10 mL/goat/month (the experimental group), and the second was the control group, without the administration of the probiotic. The dose of the probiotic was diluted in 10 mL water, and administered using a measuring device.

Food management

Goat feed was exclusively at pasture, except during harsh winter periods (rain or snow), with the ad libitum distribution of fodder (alfalfa hay), and the mandatory addition of 400 g concentrate per goat per day.

Flushing was applied four weeks before control to prepare females for service, with an average supplemental distribution of 400 g concentrate per goat per day for fat goats, and 500 g concentrate for lean goats. On the other hand, females were prepared for kidding and the lactation by steaming during the last two months of gestation (4th and 5th month), supplemented with 400 g concentrate per goat per day, and the experimental group also received 10 mL probiotic per goat per month (SYMBIOVEBA®, MarcoPolo Environmental-group, Italy). Goats received two meals, distributed at 7 a.m. and 5 p.m.

Reproduction management

The protocol followed the synchronization method established by Cognie (1988) that is based on blocking the cycle in the luteal phase by progestogens. Fluorogestone acetate (FGA) was incorporated into vaginal sponges at a rate of 20 mg per sponge. It stimulates the luteal phase and ensures blockage of follicular growth. Intramuscular injection of 400 IU Pregnant Mare Serum Gonadotropin (PMSG) after 9 days of sponge placement then stimulates follicular growth and maturation. The sponges were removed on the 11th day.

Goats were presented for mating on the 13th day after the start of treatment, and remained for 2 days. When the females returned to heat after few weeks, they were presented again for the males.

Blood ketone measurement

Blood ketone levels were evaluated using a portable PRECISION XTRA BLOOD KETON TEST device (Abbott). The measurement of BHB rates showed a high correlation (r=0.95) with standard

laboratory analyses of goats reported by Doré et al. (2013).

BHB measurement began 6 weeks before the expected delivery date, then every 15 days (4 measurements at -6, -4, -2 weeks and on the day of parturition). Blood samples were taken and BHB measurements were performed on site at the farm, in the early morning (6 a.m.).

Body condition scoring

The estimation of the body condition score (BSC) on a scale of 6 grades (0 to 5) with an accuracy of 0.25 points as proposed by Santucci and Maestrini (1985) and validated by Hervieu et al. (1991). Lumbar palpation combined with a sternal palpation was performed at three time periods: at the time of mating, 2 months before kidding, and at the time of parturition.

Statistical study

Statistical analysis was performed using IBM SPSS (version 20.2013) and included descriptive analysis and comparison with the ANOVA test. The significance level was set at 5%.

Results and discussion

Effect of probiotic on BHB levels towards the end of gestation

The BHB blood concentrations changed throughout the experiment period (the final six weeks before parturition) (Table 1), for the control group (without probiotic) and the experimental group (with probiotic).

The results shows that the first group had similar levels of BHB compared to the control group at 6 weeks before parturition (0.28 mmol/L and 0.30 mmol/L, respectively, P=0.13). This

Table 1. Evolution of blood BHB (mmol/L) in both groups during the period of six weeks before parturition

Prepartum weeks	Group 1 (n=45)	Group 2 (n=46)	MSE	P
-6	0.28	0.30	0.07	0.13
-4	0.32	0.35	0.10	0.20
-2	0.37	0.42	0.13	0.10
0	0.47	0.51	0.18	0.23

MSE: Mean Standard Error

Table 2. Effect of probiotic on BCS between breeding and parturition

BCS at	Zone	Group 1 (n=45)	Group 2 (n=46)	MSE	P
Breeding	Sternal Lumbar	2.81 2.27	2.98 2.46	0.05 0.05	0.08 0.08
2 months before parturition	Sternal Lumbar	2.77 2.19	2.90 2.32	0.07 0.06	0.36 0.38
Parturition	Sternal Lumbar	2.18 1.49	2.25 1.61	0.07 0.07	0.67 0.41

similarity was further observed during the last month of gestation with the three measurements, which revealed a non-significant difference (P=0.20 and P=0.10, respectively at -4 and -2 weeks before parturition, P=0.23 at the time of parturition).

Probiotic effect on BCS

The assessment of the body condition score is a simple feeding management tool, that makes it possible to adjust rations at key periods (Domecq et al., 1997). The evolution of BCS during the gestation period in this experiment is presented in Table 2.

The BCS scores obtained show that the probiotic had no effect on the deposition of fat in the sternal and lumbar regions, and that there was no difference at the end of gestation between the two groups. During the final third of gestation and after probiotic supplementation, there was a decrease in BCS in both groups, and the averages recorded at the time of parturition for the group 1 (sternal BCS=2.18 and lumbar BCS=1.49) and the control group (sternal BCS=2.25 and lumbar BCS=1.61) revealed no significant difference (P=0.67 for the sternal BCS and P=0.41 for the lumbar BCS). In dairy cows, Temim et al. (2009) mentioned that *Saccharomyces cerevisiae* supplementation only slightly modified prepartum BCS, with a non-significant difference of 11% on average compared to control cows (P=0.32) and similar to that recorded between the start of supplementation (last two weeks of gestation) and parturition was revealed.

Conclusion

This study on the probiotic effect (*Saccharomyces cervicae* and *Lactobacillus*) on the mobilization of body reserves in the local Arbya goat at the end of gestation, carried out in extensive breeding in a mountainous area, revealed that this probiotic has no effect on reducing the accumulation of BHB in the blood at the end of gestation in local goats. Accordingly, the use of this product does not reduce the risk of mobilization of body reserves in either the sternal or lumbar regions. Further large investigations to confirm the data are required in the future.

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Probiotički učinak na mobilizaciju tjelesnih rezervi u kasnoj gravidnosti koza

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Ova je studija provedena da bi se procijenio probiotički učinak na mobilizaciju tjelesnih rezervi koza na kraju njihove gravidnosti, uzimajući u obzir proizvodnju ketonskih tijela u krvi i ocjenu tjelesne kondicije (BCS). Proizvodnja ketonskih tijela praćena je mjerenjem razina betahidroksibutirata (BHB) u krvi uporabom prijenosnog kompleta (PRECISION XTRA test za ketone u krvi). Dobiveni rezultati pokazali su da uporaba probiotika SYMBIOVEBA® (kombinacija *Saccharomyces cervicae* i *lactobacillus*) nije smanjila formiranje BHB-a u krvi koza te time nije smanjila mobilizaciju njihovih tjelesnih rezervi u kasnoj gravidnosti.

Ključne riječi: *BCS, β-hidroksibutirična kiselina, koze, peripartum, probiotik, mobilizacija rezervi*