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Effects of Abortion and Stage of Lactation on Chemical Composition and Mineral Content of Goat Milk from Mixed-Breed Goat on Rangeland

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Abstract

The objective of this study was to analyze the chemical and mineral composition of aborted goats as well as goats with normal kidding for an entire lactation (five months; rainy season under range conditions), and the effect of stage of lactation on various raw milk components. Thirty one multiparous goats of mixed-breed goats were used, 16 carried their pregnancy to term and 15 aborted about the fourth month of pregnancy. Percentage of milk fat fluctuated greatly ($P<0.01$) throughout lactation with no differences between aborted and non-aborted goats (5.0 vs. 4.8 g/100 g). Percentage protein was higher ($P<0.05$) in aborted goats compared to non-aborted goats (4.7 vs. 4.5 g/100 g). During the early stage of lactation, milk contained higher ($P<0.01$) lactose levels which then decreased gradually towards the end of lactation. No difference in this milk component was detected between groups of goats (4.6 vs. 4.5 g/100 g). Both magnesium and manganese in goat milk were higher in aborted than non-aborted goats. It was concluded that some milk components are increased in milk from goats whose lactation initiate with abortion, compared with milk from goats whose lactation derive from normal kidding.

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Keywords: Lactation, Calcium, Phosphorus, Protein, Goats

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1. Introduction

Goats in the arid zones of northern Mexico are kept for both meat and milk production [1]. A great deal of this milk is used for cheese and candy production. Given that milk with high milk components results in higher cheese yield as compared to milk with lower components [2], it is important for goat producers to raise goats with high milk components. In order to obtain the maximum milk yield, goat producers under extensive systems must program the breeding period during the dry season, in order to make coincide parturitions with the onset of the rainy season. This practice leads to a great deal of abortion of nutritional etiology [3]. Abortion is perhaps the single biggest cause of economic loss to goat farmers when gestation takes place during the dry season [4]. In these pastoralist systems, aborted goats are milked together with goats with pregnancy "at term". Little is known about milk composition of aborted goats. Also, there is a paucity of information on milk quality of mixed-breed goats raised in arid ecosystems. Therefore, the objective of this study was to analyze the chemical and mineral composition of aborted goats as well as goats with normal kidding for an entire lactation (five months; rainy season), and the effect of stage of lactation on various milk components.

2. Material and methods

Thirty one pluriparous mixed-breed does (body weight 39.4 ± 2.8; mean ± SD) were selected at parturition (mid July; n= 15) or abortion about one month before the expected parturition (n=15) from a commercial goat herd under extensive conditions. Goats grazed on open range year round driven by a herdsman for 7 h per day. Goats were penned near the household at night without access to supplemental feed and water. No salt mineral mix was provided to the goats throughout the year, and animals had access to water only once a day.

Milk samples were obtained at monthly intervals throughout the five-month lactation. The day prior to milk sampling, all kids were placed in a separate pen during 24 h, and were reunited with their mothers the next day after milking. Goats were completely hand-milked once daily early in the morning. For the analysis of milk composition, samples of 30 ml of milk were taken and these samples were taken in a cooler with ice to the laboratory. No preservatives were added to milk samples, which were refrigerated until analyses. Milk samples were analyzed using a milk-analyzer (Milko Scan 133B; Foss Electric, DK-3400 Hillerød, Denmark) to determine the percentages of fat, protein, and lactose. For mineral analyses milk samples (2.5 mL from each) were wet ashed in 50 mL of concentrated nitric acid followed by mixing with HNO3/HClO4 (1:4, v/v) until the total elimination of organic matter. The concentrations of Ca, Mg, K, Fe, Cu, Mn and Zn in the milk samples were determined by atomic absorption spectrophotometry (Perkin-Elmer 1100 B; Perkin-Elmer, Shelton, CT). Serum inorganic phosphorus was determined according to the technique described by Fiske and Subbarow [5].

Statistical analysis was performed using the general linear models procedure of SAS (SAS Inst., Inc., Cary, NC). The model accounted for variation caused by group, month of lactation, and the interaction of group x month.

3. Results and discussion

Changes observed in milk protein content throughout lactation are shown in Fig. 1. Milk protein content was higher in aborted than non-aborted goats ($P<0.05$). This milk component was responsive to stage of lactation, with the same level during the first four months of lactation and a rise during the last month of lactation ($P<0.01$). Compared to some of the tropical breeds with comparable milk production [6, 7], the mixed-breed goats of the present study had similar milk protein content and with the same tendency. The high

milk protein content is an indication of the high potential of milk from these goats for cheese production [8]. The high milk protein content in the present study is accounted by the reduced milk yield as concentration of milk components increases when milk yield decreased [9]. Milk fat did not vary between aborted and non-aborted goats (Fig. 2). The lowest level of this milk component was observed at the middle of lactation and the highest content was found at the end of the fifth-month lactation (P<0.05).

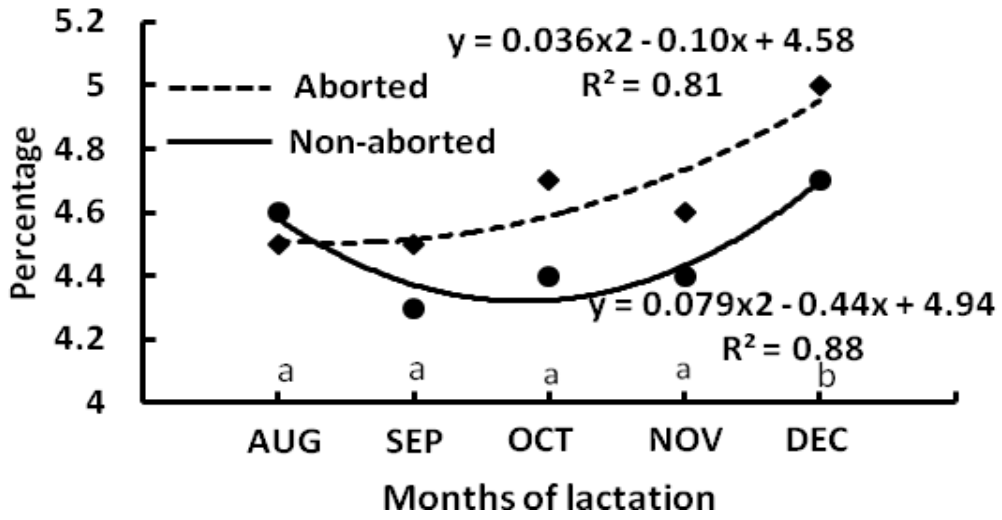

Fig. 1. Protein percentage of mixed-bred (mixture of local x dairy breeds) goat milk throughout a five-month lactation (August to December) in an arid rangeland (26°N). For month effect, means within months followed by different letters differ at $P \leq 0.01$.

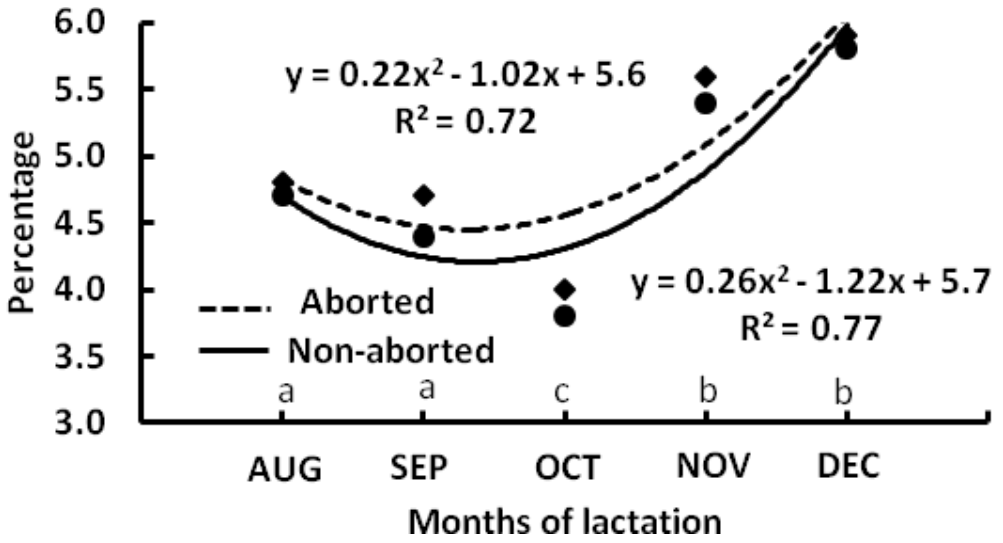

Fig. 2. Fat percentage of mixed-bred (mixture of local x dairy breeds) goat milk throughout a five-month lactation (August to December) in an arid rangeland (26°N). For month effect, means within months followed by different letters differ at $P \leq 0.01$.

The milk fat content in this study was higher than most of the reported results [2, 8], but was close than finding by others [6, 10].

Milk lactose concentration tended to decrease toward the end of lactation (Fig. 3), which is in line with findings by others [6, 7]. A lower (P<0.05) level of calcium was observed at the middle of lactation in comparison to the beginning (107 mg/100 ml) and end (113 mg/100ml) of lactation, with no difference between groups of goats (Table 1). The highest (P<0.05) milk Na concentration was observed at the end of lactation (4th and 5th month of lactation; 53 – 55 mg/100 ml of milk), while the lowest was found at the beginning of lactation (46 mg/100 ml), with no difference between aborted and non-aborted goats. The concentration of K increased linearly during lactation P<0.05) with higher milk K content in aborted than non-aborted goats. Milk Mg did not differ between goat groups and the highest (P<0.05) concentration of this element was found in the last month of lactation (12.1 mg/100 ml) whereas the lowest level was observed at the beginning of lactation (9.0 mg/100 ml). The variation in milk mineral content at different stages of lactation reported in this study is in line with that reported by other researchers [7, 11].

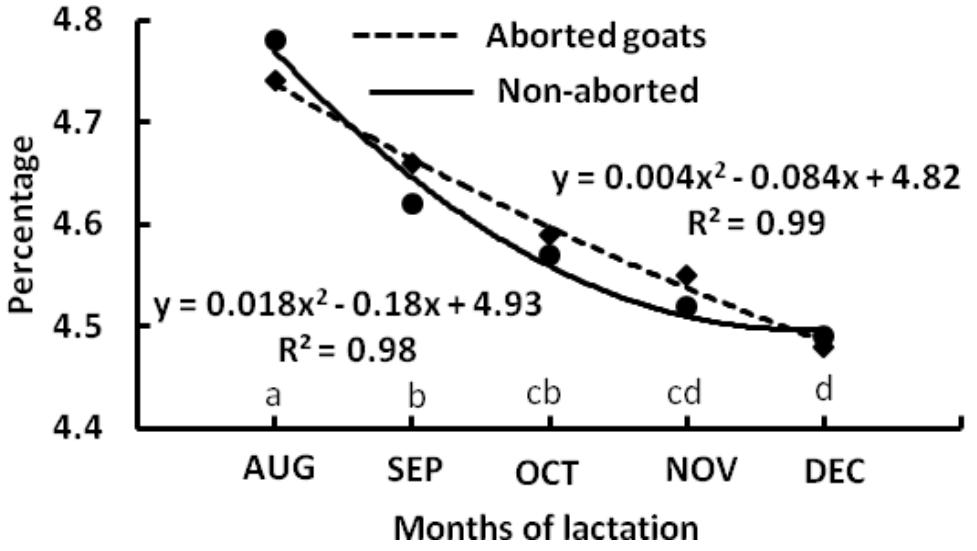

Fig. 3. Lactose percentage of mixed-bred (mixture of local x dairy breeds) goat milk throughout a five-month lactation (August to December) in an arid rangeland (26°N). For month effect, means within months followed by different letters differ at P ≤ 0.01.

Table 1. Mineral composition of aborted (n = 30) and non-aborted (n = 30) goat milk from mixed-breed goats under range conditions in northern Mexico (25°N).

	Aborted	Non-aborted	SEM	Group effect	Month effect
Calcium, mg/100 ml	106	104	9.8	NS	<0.0001
Phosphorus, mg/100 ml	72	70	7.9	NS	0.0026
Magnesium, mg/100 ml	11	10	1.4	0.0228	<.0001
Potassium, mg/100 ml	166	164	7.9	NS	<.0001
Sodium, mg/100 ml	56	55	5.7	NS	<.0001
Copper, µg/100 ml	30	30	9	NS	<.0001
Zinc, mg/100 ml	0.15	0.15	0.02	NS	<.0001
Iron, µg/100 ml	530	490	160	NS	<.0001
Manganese, mg/100 ml	0.02	0.01	0.006	0.0153	0.0122

NS=No significant; SEM= Standard error of the mean

4. Conclusions

Lactations derived from abortion in range goats substantially increased milk protein, magnesium and manganese content compared with lactations derived from normal kidding. A high potential exists in these goats under range condition for high quality milk for cheese making. Also, a substantial variation exists in milk components throughout the lactation stages.

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