PLASMA CONCENTRATIONS OF SOME MINERALS IN EGYPTIAN BALADI DOES DURING PREGNANCY AND LACTATION

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ABSTRACT

The present study was carried out at Maryout Research Station (35 km north western of Alexandria), belonging to the Desert Research Center. Twenty pregnant Baladi goats (2-3.5 yrs old and average body weight 28.2 ± 0.94 kg) were used to investigate the changes in some blood minerals (calcium, phosphorus, magnesium and zinc) concentration during pregnancy (early and late) and lactation (early, mid and late) periods. Does were synchronized for estrus using Estrumate $PGF_{2\alpha}$ (Estrumate analogue) and pregnancy was diagnosed by plasma progesterone determination on day 22 postmating.

Results revealed that calcium increased significantly in the late gestation and early lactation periods and ranged between 8.7 to 11 mg/dl then declined to 7.3 mg/dl at parturition.. Magnesium tended to decrease significantly either at late gestation or at parturition as compared to lactation period. From early to mid lactation period, the magnitude changes in Ca, P and Mg concentrations were found to be 27.2, 27.1 and 13.1 %, respectively. On the other hand, calcium: phosphorus ratio (1.7:1) was found to be within the normal level. The maximum level of zinc was recorded at the last month of gestation then declined at parturition.

Positive correlation coefficients were found between Ca and P during the different physiological status. Also, negative correlations between Mg and other minerals were noticed during gestation period while the corresponding correlations were positive during the lactation period.

The present study concluded that The results concluded that Ca, P, Mg and Zn concentrations decreased to minimum levels at parturition time whereas its increased at mid and late of lactation. However P profile parallel to Ca profile throughout the studying period which reached to maximum levels at the late of pregnancy and mid of lactation and decreased to minimum levels at parturition time.

keywords: Baladi goats, Minerals, gestation, lactation.

INTRODUCTION

The world goat population is about 375 million, of which approximately two thirds are distributed in the tropics. In Egypt, goat population reaches 3.261 million head and produce 15 metric ton of milk (FAO, 1999).

Calcium is important for milk production and preventing milk fever in sheep (Doney *et al.* 1979). Magnesium is associated with calcium and phosphorus metabolism (Razifard, 1971, 1972 a,b). However, information on minerals nutrition of goats is scant. Mineral concentrations in goat blood are different from those of other ruminants such as cattle and sheep, (McDowell, 1985) and are dependent on the physiological state (dry, pregnant and

lactation) of the animal (Haenlein, 1980 and McDoweil, 1985). Regardless of dietary level of minerals the needs of goats of minerals during pregnancy and lactation periods are differ significantly compared with dry ones (Haenlein, 1980). The role of individual trace elements and in combination with other trace elements has not been completely documented. There is a need to undertake further studies in the filed Pathak and Kapil (2004).

This study aimed to investigate the effect of physiological status (early and late gestation; and early, mid and late lactation) on some blood minerals concentration as well as the relations between such minerals within each physiological state in terms of correlation coefficients.

MATERIALS AND METHODS

Twenty pregnant Baladi does (aged 2-3.5 years and of average body weight 28.2 ± 0.94 kg) were chosen randomly from the main flock of Maryout Research Station (35.0 km north western of Alexandria) that belongs to Desert Research Center to study changes that may occur in some plasma minerals during pregnancy and lactation periods. Physiological status was defined as early gestation (first 3.5 months of pregnancy), late gestation (last 1.5 months of gestation), parturition, early lactation (first 3 weeks after parturition), mid lactation (4-8 weeks) and late lactation stage (8-12 weeks). Before mating, does were synchronized for estrus by injected with a dose of 1 ml intra-musculary $PGF_{2\alpha}$ (Estrumate; cloprostenol; prostaglandins synthetic analogue, , Imperial chemical Industries limited, UK); Each ml of this analogue contains 263 µg Cloprostenol Sodium BP (vet) equivalent to 250 µg Cloprostenol. Does were mated at the first standing post-treatment estrus by a fertile buck within heat period, after 11 days of the first injection Pandey (1985) the remainder animals (animals did not responded to the 1 st injection) were injected with the second dose (1 ml intra-muscular) and pregnancy was diagnosed according to the plasma level of progesterone at day 22 postmating according to Hashem *et al.* (2002).

Management and feeding:

Animals were housed in semi-opened shed yards for the protection against radiant solar radiation and air drafts.

The daily ration consisted of a concentrate mixture (bran 33%, corn 22%, cotton seed cake 35%, calcium carbonate 2% and sodium chloride 1%) and berseem (*Trifolium alexandrinum*) hay (without any salt lick) at the ratio of 1:1 according to NRC, (1981) to cover their nutrient requirements during the different physiological states.

Blood sampling:

Weekly blood samples were taken after pregnancy diagnosis from each animal in the early morning (before feed and water were offered), using jugular vein puncture technique into tubes containing EDTA Na2 (Ethylene diamino tetra acetic acid, sodium salt) as anticoagulant. Blood samples were centrifuged at 3000 rpm for 15 minutes and plasma was harvested and stored at –20 °C in a deep freezer till analysis.

Calcium and phosphorus determinations were carried out with a colorimetric method utilizing available kits supplied by Diamond Diagnostics Company according to Tietz (1970) and Bauer (1982) respectively, while magnesium and zinc were determined using atomic absorption (UNICAM 929 AA spectrometer, England).

Statistical analysis:

The statistical computer package of SAS (1995) was used to analyze the data of the present study. Analysis of variance was performed to examine the difference due to the sources of variations. Simple correlation coefficients among various traits were also calculated and tested.

RESULTS AND DISCUSSION

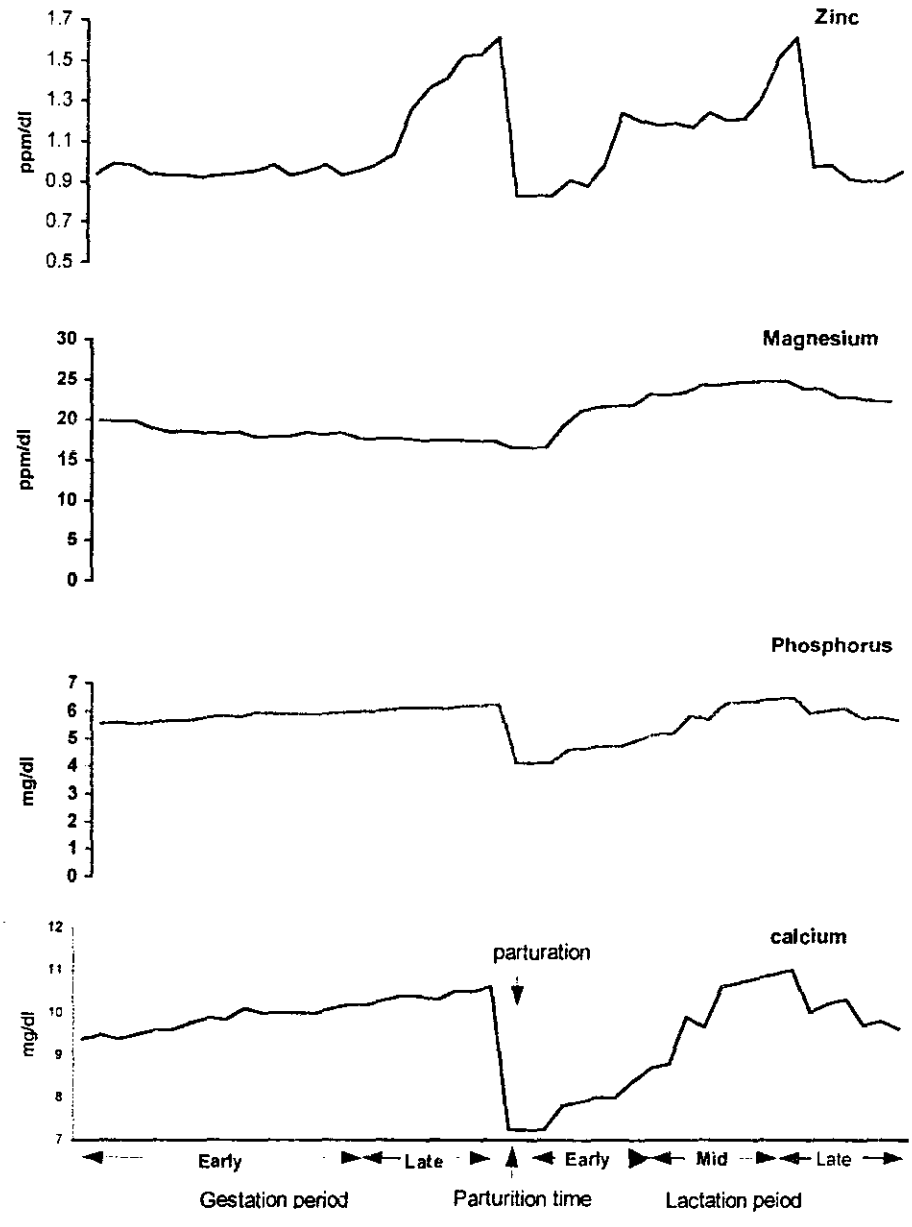
Results revealed that calcium increased significantly ($P \leq 0.05$) from early gestation to late gestation period and early stage of lactation with mean values ranging between 8.1 and 10.4 mg/dl, while it decreased at the time of parturition to reach its minimum level of 7.3 mg/dl (Table1 and Fig.1).

Table 1. Least squares means (LSM ± SE) of some plasma minerals level during different physiological status.

Period	Calcium (Ca,mg/dl)	Phosphorus (P, mg/dl)	Ca:P ratio	Magnesium (Mg, ppm)	Zinc (Zn, ppm)
Early gestation	9.8±0.09 ^{b}	5.8±0.06 ^{b}	1.7:1	18.5±0.18 ^{a}	0.9±0.03 ^{bc}
Late gestation	10.4±0.14 ^{a}	6.1±0.08 ^{a}	1.7:1	17.4±0.26 ^{b}	1.3±0.05 ^{a}
Parturition	7.3±0.23 ^{d}	4.1±0.14 ^{d}	1.8:1	16.4±0.42 ^{c}	0.8±0.08 ^{c}
Early lactation	8.1±.16 ^{c}	4.8±0.10 ^{c}	1.7:1	21.3±0.30 ^{d}	1.1±0.05 ^{b}
Mid lactation	10.3±0.14 ^{a}	6.1±0.08 ^{a}	1.7:1	24.1±0.26 ^{e}	1.3±0.05 ^{a}
Late lactation	9.9±0.16 ^{ab}	5.9±0.10 ^{ab}	1.7:1	22.8±0.30 ^{f}	0.9±0.05 ^{bc}
Overall mean	9.6±0.15	5.7±0.09	1.7:1	20.0±0.29	1.1±0.05

$^{a\ b\ c}$ **within a column, means followed by the same superscript, are not significantly different.**

Fredeen and Van Kessel (1990) attributed such increase in Ca during pregnancy and lactation to the high levels of plasma parathyroid hormone during this period which activate osteoclasts and increase the level of calcium by mobilizing skeletal calcium reserves in order to meet the high demand of calcium by the fetus during last part of gestation period as a time of fetus skeleton is formed. On the other hand, a rapid depression of calcium to reach its minimum value (7.3 mg/dl) was noticed at parturition time then tended to rise again, in short time, to reach the previous level (10.4 mg/dl) at mid lactation stage and finally decreased towards the late stage of lactation period (Table 1). The fall in plasma Ca level at parturition may be due to increased demand of calcium ions for the uterine and abdominal muscle contraction during kindling. The previous results were in agreement with those reported by Haenlein (1980).



Fig(1): Some blood plasma minerals profiles of Egyptian Baladi goat during different physiological status

Fig. (1) showed that P profile parallel to Ca profile throughout the studying period. Calcium and phosphorus decreased by 30 and 33% respectively from the peak of late gestation period to parturition time. Braithwaite (1983) and Robinson (1983) reported that fetal skeletal growth results in a high demand for major minerals, notably Ca, P, Mg. Mild deficiencies in these elements do not affect fetal growth, as mobilization of maternal skeletal tissues appears to be physiological normal and caters for such demands. Barlet *et al.*,(1995) reported that P is a major constituent of bones. It also plays an important role in energy metabolism. In most mammalian species, inorganic P is absorbed at the duodenal and jejunum level and the mechanism is modulated both by endocrine (calcitriol, triiodothyronine). In most species, Ca and P requirements are closely interrelated. A dietary relationship of Ca to available P of 1.5-2: 1 is widely accepted Vandelli (1995).

Magnesium, which preserved in skeleton (about 60-70%) is considered to be a very active component for several enzyme systems required especially at the third part of gestation period (McDonald *et al.*., 1987). The previous explanation could clarify the decrease of magnesium at last part of gestation period and parturition, as shown in figure 1, compared with lactation period. Magnesium is closely associated with calcium and phosphorus. Calcium, phosphorus and magnesium increased by 27.2, 27.1 and 13.1 % from early to mid stage of lactation period, respectively. The significant decrease in calcium and phosphorus level during early lactation period compared with mid lactation period might be attributed to the excretion of both elements into colostrum which was high during early lactation (Toverud *et al.*., 1976; Ballantine and Herben, 1989). Similarly, Uddin and Ahmed (1984) reported the same trend in Black Bengal goats. Results of magnesium were in agreement with those of Anges and Tozzi (1986). Mbassa (1991), they found that magnesium which was associated with the high amount of magnesium being secreted into milk during early lactation with concomitant decrease in magnesium level in the blood.

In the present study, calcium to phosphorus ratio was found to be 1.7:1 (Table 1) and lies within the normal range from 1.2 – 2 : 1 reported by McDonald *et al.*. (1995).

Results indicated that the higher level of plasma zinc (1.3 ppm) during late gestation period might reflect the importance of this element as a co-factor, for the synthesis of a number of enzymes, DNA and RNA which are essential for growth and development of the fetus (McDonald *et al.*, 1995). The present results were in harmony with those found out by Georgieveskii *et al.*. (1982). After reaching the maximum level of zinc during the last month of gestation, zinc declined significantly ($P \leq 0.05$) at parturition time. Similar finding was reported by Vergenes *et al.*, (1990). Plasma zinc level increased during lactation might be due to the mobilization of body zinc reserves.

The present results showed that Ca, P, Mg and Zn concentrations decreased to minimum levels at parturition time whereas its increased at mid and late of lactation. However P profile parallel to Ca profile throughout the studying period which reached to maximum levels at the late of pregnancy and mid of lactation and decreased to minimum levels at parturition time. It should be

noticed that for optimum performance of the female Baladi goats, the requirements of Ca, P, Mg, and Zn vary in tandem to the animal's physiological state (in gestation or lactation), so the quantification of the actual dietary supply of these minerals and their utilization by the animals in the various physiological states have to be established.

Table (2) showed that there were highly significant ($P \leq 0.01$) positive correlations between calcium and phosphorus through different physiological status. Parallel results were obtained by Park and Chukwu (1988) they noticed that there were significant ($P \leq 0.01$) positive correlations between calcium and phosphorus through lactation period, correlations between Mg and other minerals were negative (either highly significant, significant and non significant) during early and late gestation, however they were positive during early, mid and late lactation.

Table 2. Correlation coefficients between plasma minerals and cholesterol level within each physiological status.

Item	Gestation period		Lactation period		
	Early	Late	Early	Mid	Late
Ca vs. P	99.0**	92.6**	99.4**	99.8**	99.1**
Ca vs. Mg	-88.5**	-78.4*	85.0*	90.8**	59.5^{NS}
Ca vs. Zn	24.6^{NS}	86.7**	75.8^{NS}	59.0^{NS}	46.0^{NS}
P vs. Mg	-67.0*	-66.6	82.4*	91.7**	55.3^{NS}
P vs. Zn	28.3^{NS}	-82.5*	76.5^{NS}	60.9^{NS}	41.4^{NS}
Mg vs. Zn	-0.07^{NS}	-93.7**	75.4^{NS}	60.9^{NS}	95.2**

Ca; Calcium. P; Phosphorus. Mg; Magnesium. Zn; Zinc. Vs. versus. *. P<0.05. **;P<0.01. Ns; Not significant

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تركيز بعض المعادن فى دم الماعز البلدى المصرية اثناء فترتى الحمل و الحليب

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*** قسم فسيولوجيا الحيوان والدواجن – مركز بحوث الصحراء – المطرية - القاهرة**

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إستخدمت عشرون عنزة بلدى مصرية من قطيع الماعز الموجود فى محطة بحوث مريوط التابعة لمركز بحوث الصحراء .تم تنظيم الشياع لهذة الحيوانات بحقنهابالبروستاجلاندين. تم جمع عينات الدم اسبوعيا و قدرت تركيزات كل من الكالسيوم والفوسفور والماغنيسيوم والزنك للعنزات من الحمل وحتى الفطام. قسمت فترة الدراسة على حسب الحالة الفسيولوجية للحيوانات إلى الفترة الأولى من الحمل (ثلاثة شهور ونصف من التلقيح المخصب)والفترة الأخيرة من الحمل (شهر ونصف قبل الولادة) وفترة الولادة والفترة المبكرة من الرضاعة (الأسابيع الثلاثة الأولى من الرضاعة) والفترة الوسطى للرضاعة (و تمتد حتى شهرين من الرضاعة) والفترة الأخيرة من الرضاعة (حتى نهاية الشهر الثالث من الرضاعة). كانت النتائج كالتالى: زاد تركيز الكالسيوم زيادة معنوية خلال الفترة الأخيرة من الحمل وكذلك خلال فترة الرضاعة المبكرة وقد بلغت التركيزات مابين ٨,١ وحتى ١٠,٤ ملجم/١٠٠ملى بينما انخفضت عند الولادة إلى ٧,٣ ملجم/١٠٠ ملى. كانت تركيزات الفوسفور موازية لتركيزات الكالسيوم طول فترة الدراسة. إنخفض الماغنيسيوم معنويا فى الفترة الأخيرة من الحمل وعند الولادة مقارنة بفترة الرضاعة. زادت تركيزات الكالسيوم والفوسفور والماغنيسيوم بنسب 27.2 ، 27.1 , 13.1 % على التوالى من الفترة المبكرة إلى الفترة الوسطى للرضاعة. النسبة مابين الكالسيوم والفوسفور تراوحت مابين ١: ٢ إلى ١:١ على التوالى. وصل الزنك لأعلى تركيز خلال الشهر الأخير من الحمل ثم إنخفض معنوي عند الولادة.

معاملات الإرتباط مابين الكالسيوم والفوسفور كانت عالية المعنوية و موجبة طوال فترة الدراسة. معاملات الإرتباط مابين الماغنيسيوم والأملاح الأخرى المدروسة كانت سالبة (سواء كانت عالية المعنوية أو المعنوية أو غير المعنوية) خلال فترة الحمل وموجبة خلال فترة الرضاعة.

نستخلص من هذه الدراسة ان:

تركيز كل من الكالسيوم و الفوسفور و المغنسيوم و الزنك انخفض عند الولادة بينما يكون عاليا عند منتصف و نهاية فترة الحليب، بينما تركيزا الكالسيوم و الفوسفور اخذا اتجاها متشابها حيث وصل التركيز الى اقصاة فى نهاية فترة الحمل و منتصف فترة الحليب و يكون اقل تركيز لهما عند الولادة.