Comparative Calcium and Magnesium Status in Adult and Young Camel (*Camelus Dromedaries*)

Barri, M.E.S., Al-Busadah, K. A. and Homeida, A.M.

Department of Physiology, Biochemistry and Pharmacology,
College of Veterinary Medicine, King Faisal University.
Al-Hasa, Saudi Arabia

Abstract

Serum calcium (Ca) and magnesium (Mg) concentrations were measured in 30 calf camels at different 5 age groups (1 – 12 month), and were compared to that of adult camels. At the age of 1 – 4 month, serum Ca and Mg concentrations were found to be higher than adult values. Inorganic phosphorus concentration was found to be comparable to adult values. At the age above 4 month, serum calcium and magnesium concentrations started to decline to values below the adult ones. The results of this study may suggest that, the hypercalcaemia and hypermagnesaemia observed in other mammals late in pregnancy and early reonatal life may persist in the calf camel up to the age of 4 month emphasizing a role for calcium and magnesium in the young growing calf camel.

Introduction:

Many investigations have strengthened the suggestion that the foetal parathyroid hormone (PTH) is involved in the maintenance of hypercalcaemia in the foetus. This may involve the stimulation of foetal production of 1,25-dihydroxycholecalciferol and the consequent stimulation of the placental calcium (Ca) pump (Care and Ross, 1984). This hypercalcaemia in the sheep and cattle may persist until plasma Ca concentration has declined to the adult level during the two weeks after birth, whereas, in the pig and human, adult levels of Ca concentration are rapidly attained after birth (Care *et al.*, 1982). In the camel calf, Hussein *et al.*, (1992) observed low serum Ca level at birth, this was followed by a gradual increase where it attained its peak serum level at the age of 3 month. The plasma magnesium (Mg) concentration in human umbilical cord is similar to that in maternal plasma (Bogden, Thind, Kemp and Catorini, 1978), but in the sheep during the last trimester of pregnancy, the foetal plasma Mg concentration was shown to be higher than the maternal Mg concentration (Mellor and Matheson, 1977). The foetal parathyroid glands were shown to have a role in Ca and Mg metabolism during intra-uterine

life. Foetal thyroparalhyroid-ectomy during the last trimester of pregnancy resulted in the reversal of the existing transplacental Ca gradient (Care and Ross, 1984) as well as transplacental Mg gradient (Barri *et al.*, 1990).
No information is available with regard to the foetal camel calcaemia and magnesaemia during intra-uterine life; also the situation after birth remains unclear. This study was initiated to compare the young calf camel calcaemia and magnesaemia with the adult Ca and Mg concentrations.

Materials and Methods:

Blood samples were collected from 30 adult she-camels 4-5 years old and from 30 young camels grouped in 5 age groups (1 –12 month) old. The blood was collected by venipuncture into clean plain silcon coated vacutainer tubes and the separated sera were kept frozen at 4°C until analyzed.

Serum Ca concentration was measured using atomic absorption spectroscopy (Pye-Unicam SP 90, spectrophotometer, Unican Instruments Ltd., Cambridge, England) an air / acetylene flame. The standards and samples were prepared in 0.78% Ethylene diamine tetra-acetic acid (EDTA) solution to reduce phosphate interference.

Serum Mg was also measured by atomic absorption spectrophotometery. Standards and samples were treated the same as Ca.

Serum inorganic phosphorus (P) was measured according to the method of Varley (1967). The principle of the method is based on the reaction of phosphate to form a coloured complex with molybdate and vandate in the presence of nitric acid.

Statistical analysis:

The results of serum Ca, Mg and P concentrations in adult and young calf camels were statistically analyzed according to Gomez and Gomez, (1984) using the analysis of variance (ANOVA) procedure.

Results:

The results of this study are summarized in Table 1. Figures 1 and 2 clearly show that the levels of serum Ca and Serum Mg in the young calf camel at the age of 1 – 4 month are non-significantly greater than adult values ($P > 0.05$). However, the concentration of Mg at the age of 1 – 4 month is significantly greater than that at the age of 4-5 month, 5 – 6

month, 6 – 9 month and 9 – 12 months ($P < 0.01$). Likewise, the concentration of serum Ca at the age of 1 – 4 month was 11.2 mg/dl is significantly greater than that at the age of 5 – 6 months, 6 – 9 months and 9 – 12 months ($P < 0.04$). The concentration of Serum P in the calf camel at different ages (1-12 month) is non-significantly different from adult concentration.

Table (1)

Mean ± SE for adult and young serum calcium, magnesium and inorganic Phosphorus concentrations

Item	Age (months)					
	Adult	**1 – 4**	**4 – 5**	**5 – 6**	**6 – 9**	**9 - 12**
Mg mg/dl	$3.54^{ab} \pm 0.59$	$4.50^{a} \pm 0.57$	$2.60^{b} \pm 0.19$	$2.62^{b} \pm 0.05$	$3.04^{b} \pm 0.26$	$2.74^{b} \pm 0.29$
Ca mg/dl	$10.48^{ab} \pm 0.30$	$11.20^{a} \pm 0.20$	$10.28^{ab} \pm 0.31$	$9.60^{b} \pm 0.40$	$9.86^{b} \pm 0.40$	$9.82^{b} \pm 0.42$
P mg/dl	$6.12^{a} \pm 0.47$	$6.46^{a} \pm 0.56$	$5.78^{a} \pm 0.29$	$6.70^{a} \pm 0.23$	$6.26^{a} \pm 0.52$	$5.58^{a} \pm 0.42$

Means with the same letter are not significantly different ($P > 0.05$)

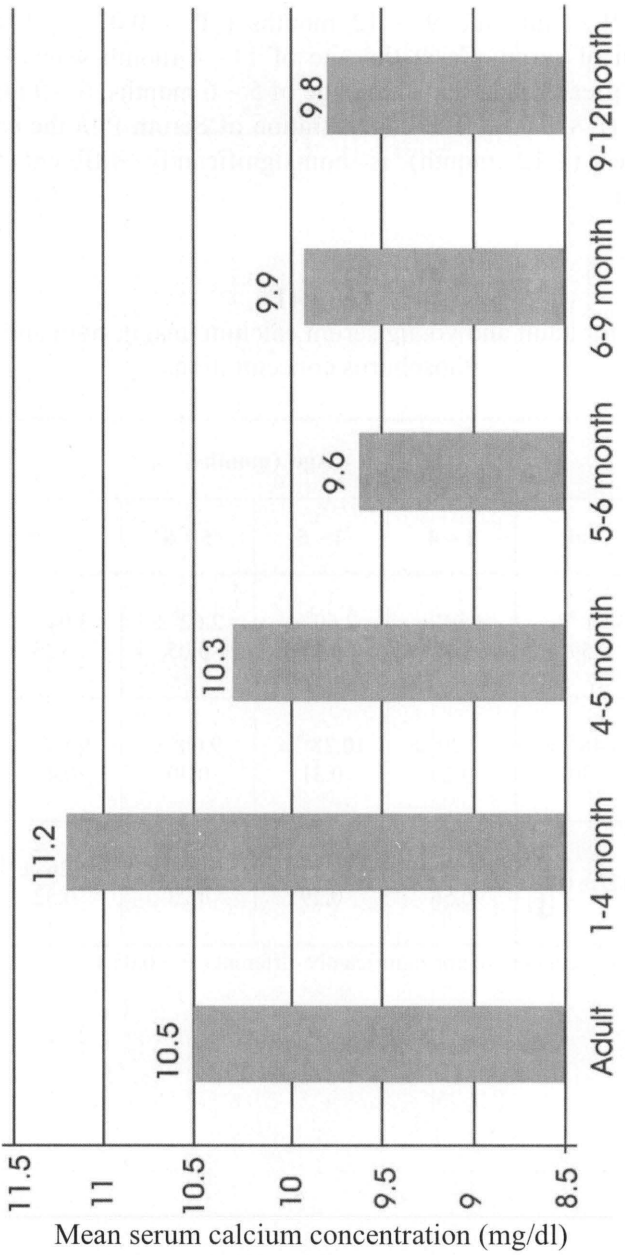

Fig. 1 comparison between adult and young serum (calcium)

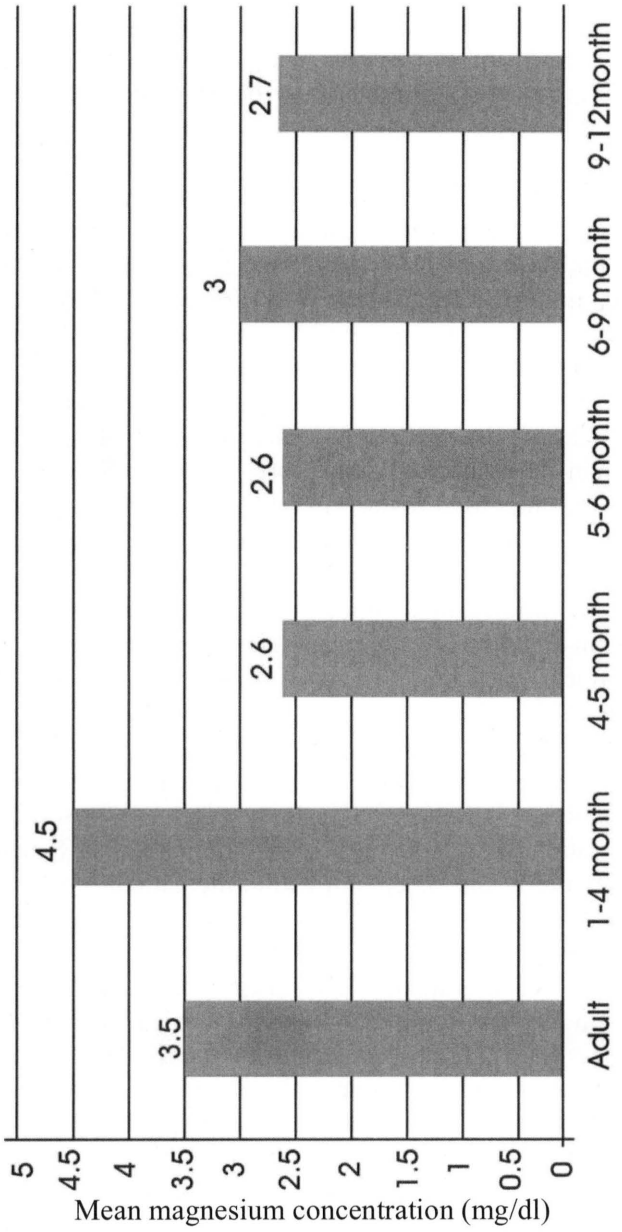

Fig. 2 Comparison between adult and young serum magnesium

Discussion:

In the present study Ca and Mg ions concentrations in the blood of young camels were found to be higher than adult values up to four months after birth. The accepted hypotheses is that, the foetal camel, like other mammalian foeti is hyper- calcaemic and hypermagnesaemic relative to its mother and this hypercalcaemia and hypermagnesaemia persisted up to 4 months after birth emphasizing a vital role for Ca and Mg in the growing young calf camel. Increased intestinal absorption and decreased renal excretion of both Ca and Mg may have contributed to the observed hypercalcaemia and hypermagnesaemia in this study. However, at the age of 4 – 5 month serum Ca and serum Mg concentrations became similar or slightly below adult values. Perhaps this is the age at which the homeostatic mechanism for both Ca and Mg in the young calf and adult animal works at the same capacities. However, the administration of Mg sulphate in the treatment of human eclampsia during pregnancy can produce three fold increases in plasma Mg levels in the mother and similarly high concentrations in the plasma of babies at birth, especially if the period of Mg infusion is prolonged prior to delivery (Lipsitz, 1971).

There is lack of information concerning the regulation of Ca and Mg concentrations in blood during the foetal life and afterwards in the camel.

In different mammals, Ca and Mg ions are transferred from mother to foetus against a concenration gradient, presumably reflecting active transport mechanisms for both cations by the placenta with the result that the foetus in late pregnancy is rendered hypercalcaemic and hypermagnesaemic in relation to its mother. In humans, at birth the placental Ca source is lost and the Ca concentration declined over the first 24 to 48 hours (Schauberger and Pitkin, 1979), while in the sheep and cattle, the Ca concentration persisted and declined two weeks after birth (Care *et al.*, 1982). This fall in Ca concentration could be attributed to residual parathyroid suppression as a result of foetal hypercalcaemia late in pregnancy. The plasma Mg concentration in human umbilical cord is similar to maternal plasma (Bogden *et al.*, 1978). Inorganic phosphorus is also involved in Ca metabolism. In camels as in other animals, plasma P concentration is higher in young animal and it increases by cereal feeding (Snow *et al.*, 1988). In this study P levels in both adult and young calf camels were similar suggesting same homeostatic mechanisms for both adult and young calf camel.

Acknowledgments

We thank the Deanship of Scientific Research, King Faisal University for financial support and Abdel Razag A. Alwebari, Yousif Al-Hamdan and Khalid Al Swalim for technical assistance.

References:

1. Barri, M.; Abbas, S.K.; Pickard, D.W.; Hammonds, R.G.; Wood, W.I.; Caple, I.W.; Martin, T.J. and Care A.D. (1990). Fetal magnesium homeostasis in the sheep. *Experimental Physiology 75, 681-688.*
2. Bogden, J.D.; Thind, I.S.; Kemp, F.W. and Catorini, H. (1978). Plasma concentration of calcium, chromium, copper, iron, magnesium and zinc in maternal and cord blood and their relationship to low birth weight. *Journal of Laboratory and Clinical Medicine 92, 455-462.*
3. Care, A.D.; Ross, R.; Pickard, D.W.; Weatherley, A.J.; Garel, J.M.; Manning, R.M.; Allgrove, J.; Papapulos, S. and O'Riordan, J.L.H. (1982). Calcium homeostasis in the foetal pig. *Journal of Developmental Physiology, 4, 85-106.*
4. Care, A.D. and Ross, R. (1984). Fetal calcium homeostasis. *Journal of Developmental Physiology, 6, 59-66.*
5. Gomez, K.A. and Gomez, A.A. (1984). Statistical Procedures for Agricultural Research, ed. *John Willy and Sons, New York.*
6. Hussein, M.F., Basmaeil, S.M., Bakkar, M.N. and Gar El Nabi, A.R. (1992). Serum Levels of Some Electrolytes and Trace Elements in Camel Calves During the First Year of Life. J. Appl. Anim. Res. 2: 13-18.
7. Lipsitz, P.J. (1971). The clinical and biochemical effects of excess magnesium in the newborn. *Pediatrics 47, 501-509.*
8. Mellor, D.J. and Matheson, I.C. (1977). Variations in the distribution of calcium, magnesium and inorganic phosphorus within chronically catheterized sheep conceptuses during the last eight weeks of pregnancy 62, 55-63.
9. Schauberger, C.W. and Pitkin, R.M. (1979). Maternal-Perinatal calcium relationships. *Obstetrics and Gnecology 53, (1): 74-76.*
10. Snow, D.H.; Billah, A. and Ridah, A. (1988). Effects of maximal exercise on the blood composition of the racing camel. *Veterinary Record 123, 311-312.*
11. Varley, H. (1967). Practical Clinical Biochemistry. 4th edn. *William Heinamann, Medical Books Ltd. And Mter Science Books Inc. New York, PP. 802.*

مقارنه مستويات الكالسيوم في الجمال البالغة والصغيرة

محمد الشيخ بري ، خالد بن احمد ا لبوسعده ، عبدالقادر موسى حميده

قسم وظائف الأعضاء والكيمياء الحيوية والأقربازين

كلية الطب البيطري – جامعة الملك فيصل

الملخص :

لقد تم قياس الكالسيوم والماغنسيوم في مصل الدم في ٣٠ جمل صغير في اعمار مختلفه من شهر الى ١٢ شهر وتمت مقارنه ذلك مع مستوياتها في جمال بالغه . ولقد وجد أن مستويات المعادن في صغار الجمال من عمر ١ شهر الى ٤ شهر كانت أعلى من مستوياتها في الجمال البالغة بينما كانت مستويات الفسفور متساويه في الجمال الصغيرة والبالغة . وفي عمر ٥ أشهر انخفضت تركيزات الكالسيوم والماغنسيوم الى مستويات أقل من تلك في الجمال البالغة .

توضح هذه النتائج إلى أن التركيزات العالية للكالسيوم والماغنسيوم في صغار الجمال قد استمرت إلى عمر ٤ شهر مما يدل على أن لهذين المعدنين دوراً هاماً في النمو في الجمال الصغيرة.