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Estimation of biochemical parameters in clinical hypocalcaemia in Iraqi cows

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Abstract:

The study amid to evaluate the status of calcium and changes in some biochemical parameters at parturition in thirty local breed cows which were divided randomly into three groups (I, II, and III). The first and second group showed increased calcium ions level and alkaline phosphatase (ALP), parathyroid hormone (PTH) and calcitonin (CT) at calving and were significant ($p< 0.05$) ,while Hydroxyproline (HYP), PTH, CT, 1,25-dihydroxyvitamin D (DHVD) in the third group were decreased during parturition. The results of cows fed rich diet had greater calcium concentrations at parturition than the lowest concentration of serum Ca in cows fed on poor diet during the prenatal period. However, there was no significant difference in serum 1,25-(DHVD) and hydroxyproline concentration of the cows among three groups. This study was to confirm that hypocalcaemia is very prevalent at calving period in Iraqi dairy farms and major risk factors may reduce the ability of the cows to maintain Ca homeostasis.

Key word: hypocalcaemia, calcium homeostasis, parturient, biochemical changes

تقييم معايير البيوكيميائية في نقص كالسيوم الدم السريري في الأبقار العراقية

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الخلاصة:

هدفت الدراسة لتقييم النقص الحاصل من الكالسيوم والتغيرات للبعض المعايير البيوكيميائية في حالة اثناء الولادة لثلاثين بقرة من السلالة المحلية والتي قسمت عشوائيا إلى ثلاث مجموعات (الأول والثاني والثالث) . وأظهرت المجموعة الأولى والثانية زيادة مستوى أيونات الكالسيوم و الفوسفاتيز القلوية (ALP) ، هرمون الغدة الدرقية (PTH) و الكالسيتونين (CT) في ولادة و كانت معنوية ($p < 0.05$) ، في حين انخفضت هيدروكسي برولين CT, DHV, HYP ,PTH ثنائي هيدروكسي في المجموعة الثالثة خلال الولادة. وكانت نتائج الأبقار ذات التغذية الجيدة والغنية بالكالسيوم في الولادة اعلى تركيز الكالسيوم في الدم مقارنة بالتي تغذت على سوء التغذية خلال فترة ما قبل الولادة ومع ذلك ، لم يكن هناك اختلاف كبير في المصل 1 ،25 - (DHVD) وتركيز الهيدروكسي برولين من الأبقار بين ثلاث مجموعات. وكانت هذه الدراسة للتأكد من أن نقص كالسيوم الدم شائع جدا في الفترة الولادة في مزارع الابقار العراقية و عوامل تساعد و قد يقلل من قدرة الأبقار الكالسيوم للحفاظ على التوازن.

Introduction:

The occurrence of subclinical hypocalcaemia was assessed to be up to 50% of all mature dairy cows to the time of parturition (1). Periparturient hypocalcaemia is a metabolic disease of females caused by the inability of homeostatic mechanisms to maintain normal blood Ca level which demand after calving rises to multiple values of that during the dry period due to intensive colostrum and milk production, which puts cows at risk of developing milk fever if all homeostatic mechanism for Ca balance are not functioning properly (2). Milk fever in dairy cows is one of the most economically important metabolic diseases. Dairy cows are programed to go into a state of osteoporosis of lactation to maintain normal blood Ca level in early lactation. As much as 9 – 13% of skeletal Ca can be lost for milk production in the first month of lactation (3). Biochemical indicators of bone tissue formation for instance bone alkaline phosphatase are products of osteoblastic activity. In the present research, bone metabolism in healthy mature dairy cows and dairy cows with milk fever was studied by using biochemical markers of bone metabolism. Parturient paresis is an acute to per acute, a febrile, flaccid paralysis of mature dairy cows that occurs most commonly at or soon after parturition (4). It is manifested by changes generalized paresis, and circulatory collapse. Hypocalcaemia is a major metabolic disease when calcium (Ca) homeostatic mechanisms fail to maintain normal blood Ca levels around calving; evaluation of Ca homeostatic mechanisms has increasingly contributed to the understanding of the fundamental mechanisms involved in milk fever (5). The aim of the study is to investigate the status of calcium (Ca) homeostasis and biochemical parameter in cows suffering from hypocalcaemia.

Materials and Methods:

The study included thirty pregnant cows local breed, aged 2-3 years which were divided randomly into three groups (I, II and III), complete clinical examination according to Jackson and cockeroft (2002) were done. Blood samples were collected aseptically from each pregnant cow by jugular vein after sterilizing the area and put in tubes to separate blood by centerfiguration to obtain serum served at 8 ˚C (6).

- Calcium ions was measured by using enzymatic colorimetric methods according to the linear chemicals kits (7). HYP and ALP were determined using commercial kits. Serum concentration of PTH was measured, by using a commercially available radioimmunoassay kit.
- Serum concentrations of DHVD were measured using a high performance liquid chromatography .
- Statistical analysis: Data were analyzed by using statistical analysis system SAS (8). Least significant difference (LSD) test was used to compare the significant difference between means.

Results:

Results indicated that hypocalcaemia was clinically present in cows because of badly nourishment during calving. The clinical signs appeared after parturient were subnormal temperature, tremor of muscles, recumbence, depression, retorting of neck to one side flank , the respiratory and pulse rate were weak, the blood level of Ca ion was with in normal range before calving but it decreased significantly ($p< 0.05$) in all groups after calving table (1). The highest concentration of serum ALP, PTH and CT before calving significantly ($p<0.05$) in all groups table (1) . However, there was no significant difference in serum 1,25-(OH)D and hydroxyproline concentration before calving in all groups. The ALP, PTH , CT , DHVD and HYP concentrations during after calving in I and

II groups showed significant decrease compared with III group (table 2).

Table (1) Level of blood Ca (mg/dl) in groups I , II and III .

Groups	Before Calving	After Calving
I	8.7±0.12 Aa	5.5±1.10Ab
II	8.9 ±1.14Aa	6.4±0.12Ab
III	8.6±0.10Aa	6.8±1.17Ab

* Mean ±SE, number animals 10 / group.
*Different capital letters mean significant difference ($p < 0.05$) between column numbers.

Table (2) Levels of blood (ALP), (HYP), (PTH), (CT), 1, 25-(DHVD) in groups (I, II&III)

*Different small letters mean significant difference ($p < 0.05$) between row numbers
* Mean ±SE, number animals 10 / group.

Groups / Parameters	I		II		III	
	Before Calving	After Calving	Before Calving	After Calving	Before Calving	After Calving
ALP (U/L)	68±1.16Aa	87±0.37Ab	67±0.29Aa	83±0.19Ab	71±0.21Aa	88±0.25Ab
HYP (μg/Ml)	2.3±0.22Aa	1.7±1.25Aa	2.1±1.32Aa	1.9±1.18Aa	2.1±0.20Aa	1.8±1.10Aa
PTH (pmol/L)	188±0.32Aa	172±0.22Ab	194±0.27Aa	176±0.28Ab	190±1.24Aa	174±0.20Ab
CT (pmol/L)	38±1.30Aa	27±0.32Ab	36±1.29Aa	27±0.22Ab	37±0.27Aa	28±0.32Ab
DHVD (ng/mL)	25±0.19Aa	21±1.34Aa	24±1.11Aa	21±0.32Aa	23±1.12Aa	22±0.12Aa

*Different capital letters mean significant difference ($p < 0.05$) between column numbers.
*Different small letters mean significant difference ($p < 0.05$)between row numbers

Discussion:

Inadequate blood Ca concentration can cause inability to stand, which is just the tip of the iceberg. Many more cows in the herd with less severe form presented reduced food intake, poor rumen and intestinal motility, poor productivity, and increased susceptibility to other metabolic and infectious diseases; these results were agreed with (3). Low calcium diets, regardless dietary phosphorus, seemed to activate calcium homeostatic mechanisms before parturition by stimulating both bone and gut (7,9). It seems possible that the beneficial effect of low dietary phosphorus, when dietary calcium is high, may be a result of a prenatal increase in efficiency of absorption of calcium and phosphorus from the gut caused by increased binding of 1,25-(DHVD) to intestinal receptors**.** Ca homeostasis around

parturition cannot only be maintained by intestinal absorption of Ca, but also from reabsorption of mineralized bone tissue (3, 10).

The amount of present dietary plasma calcium and phosphorus concentration may influence the concentrations from decreasing below critical vitamin D metabolism and the incidence of levels (1). Low dietary intake of calcium during the prenatal period also is associated with high PTH contents in the parathyroid glands, (4,10) suggested that greater plasma PTH and 1,25-(DHVD) concentrations during the prenatal period provide an effective calcium homeostasis at parturition in cows fed on low calcium diets. Sommerville *et al.* (11) showed that low dietary phosphorus increases the localization of 1,25-(DHVD) in gut mucosa without causing any measurable increase in plasma concentrations of 1,25-(DHVD), In against to Radar *et al.* (12,13) reported that a low phosphorus, with adequate calcium, diet decreased plasma PTH concentrations. The present parturient paresis can be prevented effect- study examines the influence of different levels feeding a prepartum with low combinations of calcium and phosphorus in diet (2, 3). Although plasma calcium is the primary parameter in the pathogenesis, other parameters may play subsidiary roles in the pathophysiology and clinical cases of parturient paresis which have even been credited with an influence on the clinical signs (5). Prenatal feeding of either low calcium or low phosphorus diets had a beneficial effect on maintenance of normal plasma calcium concentrations during the prenatal period,

References:

1. Horst RL, Goff JP, Reinhardt TA, Buxton DR. (1997). Strategies for preventing milk fever in dairy cattle. J. Dairy Sci, 80:1269-1280.

2. Goff, J. P. (2000). Pathophysiology of calcium and phosphorus disorders. Metabolic disorders of ruminants. 16:319-337.

3. Goff, J.P., (2008). The monitoring, prevention, and treatment of milk fever and subclinical hypocalcemia in dairy cows. The Veterinary Journal 176: 50–57.

4. Goff JP. (2006). Major advances in our understanding of nutritional influences on bovine health. J Dairy Sci, 89 :1292-1301.

5. Radostits,O.M. ; Blood,D.C. and Gay,C.C. (2000). Textbook of veterinary medicine ,Dously, USA.

6. Coles, (1986). Clinical pathological veterinary textbook .

7. Kessler, G., Wolfman, M. (1964). An automated procedure for the simultaneous determination of calcium and phosphorus. Clin. Chem. 10:686–703.

8. SAS. Institute, I. (2000). S.A.S Users Guide, Version 8.1. Cary, NC.

9. Haussler, M.R. ;Whitfield, G.K. ; Haussler, C.A. ; Hsieh, J.C.; Thompson P. D. ;Selznick, S.H. ; Dominguez, C.E. and Jurutka, P.W. (1998). The nuclear vitamin D receptor: biological and molecular regulatory properties revealed J Bone Miner Res. 3:325-49.

10. Geen, H. B.; Horst, R. L.; Beitz, D.C. and Littledike, E. T. (1981). Vitamin D metabolites in plasma of cows fed a prepartum low calcium diet for prevention of parturient hypocalcaemia. J. Dairy.Sci. 64:217-226 .

11. Sommerville, B. A. ; Swaminathan, R. and Care, A. D. (1978). A comparison of the effects of dietary calcium and phosphorus deficiency on the invitro and invivo metabolism of 25-

hydroxycholecalciferol in the chick. Br.J.Nutr. 39:411-414.

12. Radar,J.I.;Baylink,D.J.;Hughes,M. R.(1979).Calcium of phosphorus deficiency in rats :effects on PTH and 1,25-dihydroxyvitamin D3.Am.J.Physiol. 236: E118-122.

13. M. A. Rahawy ; M.M.Hamdon and A.A. Mahmmod (2012).Comparative study on serum level calcium, phosphorus and magnesium in Iraqi cow buffaloes with retained placenta and abortion. AL-Qadisiya Journal of Veterinary Medicine Science .11 (2): 28-32.