Total protein and some minerals in late stage of gestation and early lactation in dairy cows

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Abstract

The study was conducted on 50 dairy crossbred pregnant cows from January until May 2014, for evaluating the total protein and some minerals parameters. Blood samples were collected from the jugular vein three times; at one week pre parturition, at parturition, and at a week after parturition, for measurement of serum total protein, calcium, and phosphorus, magnesium and iron concentrations. The results were indicated a significant ($P<0.05$) decreases of total protein, calcium, phosphorus, magnesium and iron concentrations in calving period compared to pre calving and post calving periods. In conclusion, there was a significant decrease in minerals concentration (calcium, magnesium, phosphorus, iron) during pregnancy and lactation periods.
Key words: Total protein, late cow pregnancy, early cow lactation, Ca, P, Mg, Fe.

البروتين الكلي وبعض المعادن في المرحلة الاخيرة من الحمل وبداية الرضاعة في الابقار الحلوبة

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الخلاصة

اجريت الدراسة على 50 بقرة من الابقار الحلوبة المضربة الحوامل وللفترة من شهر كانون الثاني حتى شهر ايار2014 وذلك لقياس البروتين الكلي وبعض المعادن في الابقار. جمعت نماذج الدم من الوريد الوداجي للأبقار في ثلاث فترات: سبعة ايام قبل الولادة ، واثناء الولادة ، وسبعة أيام بعد الولادة وذلك لقياس البروتين الكلي في مصل الدم وقياس تراكيز الكالسيوم والفسفور والمغنسيوم والحديد. اظهرت النتائج انخفاض معنوي بتركيز البروتين الكلي والكاليسيوم والفسفور والمغنسيوم والحديد في فترة الولادة مقارنة بفترات قبل الولادة وبعدها. نستنتج مما سبق ان تركيز المعادن والبروتين الكلي ينخفض خلال فترة الحمل والولادة.
الكلمات المفتاحية: البروتين الكلي ، الفترة الاخيرة من الحمل ، بداية الرضاعة ، الابقار الحلوبة ، الكالسيوم ، الفسفور، المغنسيوم ، الحديد.

Introduction

Pregnancy and lactation are physiological status considered to modify metabolism in animals and induce stress (1, 2). The per parturient period is important in terms of its influence on the health and the subsequent performance of dairy cows, since cows develop serious metabolic and physiological changes during these periods (3). It is well known that during the pregnancy all the metabolic pathways are involved in sustaining the fetus growth (4). Most metabolic diseases occur during the per partum period (5). The transition period (from 3 weeks before to 3 weeks after parturition) (6), is critically important for health, production and profitability of dairy cows, this period is characterized by tremendous metabolic and endocrine adjustments that the cows must experience from late gestation to the early lactation (7) (8). The most important physiological changes occurring during this period are the reduction in dry matter intake around parturition and a sudden increase in nutrients

that the cows need for milk production. In late pregnancy, the growing uterus occupies an increasing amount of the abdominal cavity and leads to the physical compression of the rumen, which reduces the volume of rumen. After calving, the uterus retracts back toward the pelvic inlet (9). All animals require minerals such as calcium (Ca), magnesium (Mg), and phosphorus (P) for growth, reproduction and lactation which often affect specific requirements, and serve as catalytic components of enzymes or regulate several mechanism involved just in pregnancy and lactation (10). It well known that proteins play an important role in the production and metabolism of many enzymes, and important hormones of the body. Proteins contribute in hemoglobin synthesis, which participates in red blood cell formation (11). Total protein concentration affected by many factors such as animal age, dehydration, some hormones, nutrition status, liver and renal function (12). The total serum proteins levels were affected from the physiological period and increased during lactation compared to late gestation. The variations reflect the maternal requirements of proteins need for milking and providing immunoglobulin's (4, 13, 14). Minerals are inorganic elements that are required for normal body function and growth and highly dependent on its physiological state. For most dietary minerals, the current Nordic recommendations for dairy cows are based on a factorial division of the requirements for maintenance, growth, gestation and lactation (15). Especially at the beginning of lactation, Ca homeostatic mechanisms have to react to a tremendous increase in demand for Ca, mobilization of Ca from bone and increased absorption from the gastrointestinal tract are required to re-establish homeostasis (16). So, if it is well known that cows need, especially for the high milk yield, more nutrients and energy supply than other animals (17). Little information is available about how this need affects the physiological phase. During the last years, the average milk production increased, and conversely, due to the negative energy balance, the reproducibility decreased (18). During the transition period, several hormonal changes take place, primarily to regulate parturition and initiate lactation, and secondarily to adapt metabolism to those events (19). Therefore, this experiment was aimed to investigate and estimation of serum total protein and some minerals in crossbred cows.

Materials and methods

The study was conducted from January until May 2014, on 50 dairy crossbred pregnant cows (15 cows in the College of Agriculture, 3 cows in College of Veterinary Medicine-University of Al-Qadisiya, and 32 cows from Hilla local farms). Blood samples (10 ml) were collected aseptically from the jugular vein three times; At parturition, and one week before and after parturition for measurement of serum total protein, calcium, phosphorus, magnesium and iron concentrations. 7.5 ml of blood was put in gel tubes to separate the serum from the blood, then serum was transferred into small tubes and kept in refrigerator at (-20) C˚ until used. The total protein and minerals were determined in serum by using colorimetric methods in semiautomatic chemistry spectrophotometer (cyanstar) by using commercial kits (Mb H company, Germany), following the manufacture information.

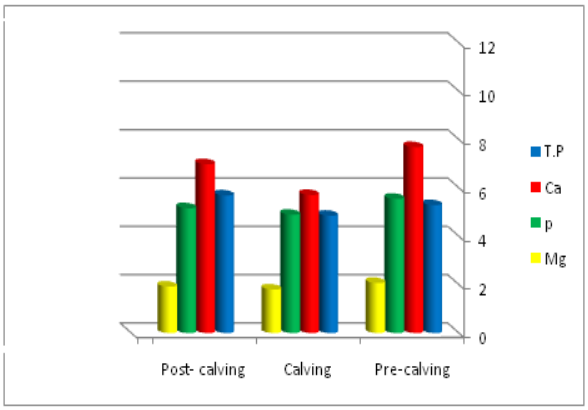
Statistical analysis

Duncan program used for statistical analysis**.** Data were subjected to Analysis of Variance, (X^2) Chi square, and significant means were compared by T-test ($P<0.05$).

Results

The values of total protein and minerals at pre-calving, calving and post calving in examined crossbred cows displayed (Fig. 1). The means of total protein concentrations were 5.29 g/dL (pre-calving), 4.85 g/dL (calving) and 5.69 g/dL (post calving). The means of Ca concentrations were 7.69 mg/dL, (pre calving), 5.71 mg/dL (calving), and 6.68 mg/dL (post calving). The means of phosphorus concentrations were 5.55 mg/dL (pre-calving), 4.89 mg/dL (calving), and 5.16 mg/dL (post calving). The means of Mg

concentrations were 2.07 mg/dL (pre-calving), 1.80 mg/dL (calving), and 1.92 mg /dL (post calving). The means of Fe concentrations were 89.48 µg/dL (pre-calving), 78.82 µg/dL (calving) and 84.80µg/dL (post calving).



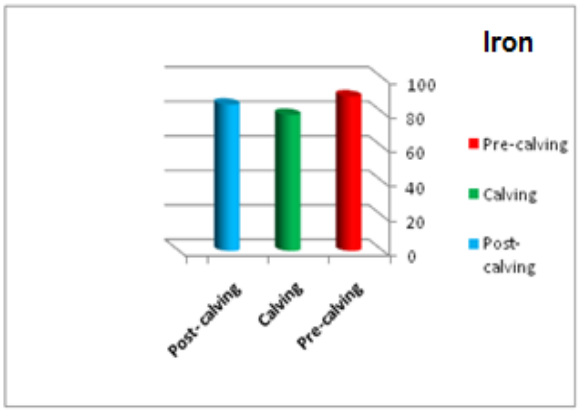


Fig. (1): The values of total protein(g/dL), and minerals (mg/dL, and µg/dL) in pre calving, calving and post calving cows.

Discussion

Total protein was significant ($p<0.05$) increase in post calving compared to pre calving, and calving. The variations reflect the maternal requirements of proteins need for milking and providing immunoglobulins (4, 12, 13, 16, 20). Also the increase in the concentration of serum protein through pregnancy refer to needs of mother to build fetus body tissues which consist in general from proteins so this push the mother body to increase production to supply needs proteins, and the animal also need to support uterus tissue which increase gradually during pregnancy (21). Calcium and Phosphorus were significant ($p<0.05$) decreased in pre calving, calving and post calving, all animals require minerals for growth, reproduction and lactation (10). The passage of calcium across the placenta is unidirectional; back transfer of this element is very limited, so the mobilization from bone and the increased absorption from the gastrointestinal tract are required to re-establish homeostasis (16). Also it is true that the requirement of calcium and phosphorus depends also on the physiological status and on the animal's productivity (22). A well-recognized pathophysiological event in dairy cows during the transition period is the drop in serum calcium concentrations that occurs at parturition or in the first days after calving (23). This reduction in calcium is caused by the onset of lactation, where an important loss of calcium in colostrum and milk occurs (24) It is known that older cows will have lower concentrations of calcium (24, 25). One of the reasons is decreased numbers of receptors for 1,25-dihydroxyvitamin D in the intestine, resulting in decreased absorption of minerals (27). The significant ($p<0.05$) decrease in the Phosphorus level during the late gestation might be due to increased utilization of "Phosphorus" at this stage and to enhance carbohydrate metabolism of pregnancy or might be due to meeting requirement of the P for the secretion of colostrum. Milk phosphorus and calcium output is directly related to milk yield, as milk phosphorus concentration is constant, increasing the milk production, more phosphorus from the ingested amount is transferred to milk and less is excreted with feces (26). Iron was significant ($p<0.05$) decreased in pre calving, calving and post calving periods which did according to (27) who suggested that the pregnant are more susceptible to iron deficiency due to fetus growth requirement, while (28) recorded that iron shading in colostrum could be 10-17 times more than in ordinary milk. The iron level in blood decreased in cows at the end of pregnancy and after parturition, magnesium level in blood effect by protein level, calcium and phosphorus in diet (29).

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