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MACROMINERALS SERUM LEVELS IN THE POST-PARTUM PERIOD IN DAIRY COWS RAISED IN ALGERIA

HADJ FEGHOUL HALLOUZ[1], SAMIA MELIANI[2*] AND BOUABDELLAH BENALLOU[1]

[1]Department of Animal Health Sciences, Veterinary Institute, University of Tiaret, 14000, Algeria.
[2]Department of Biology, Faculty of Life Science, University of Tiaret, 14000, Algeria.
Email: melianisamia@hotmail.com

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ABSTRACT

The aim of this study was to determine the evolution of some serum macrominerals in dairy cows, in order to determine the relation with milk fever (MF), and retained placenta (RP) occurrence. The present study was conducted on 15 Prim Holstein dairy cows during 2015 in Tiaret at the west of Algeria. All cows were subjected to a general clinical examination before taking blood samples. In all samples Calcium (Ca), Inorganic phosphorus (P) and Magnesium (Mg) were determined for each cow at the dry period (DP), in the immediate post-partum (IPP) and 15 days post-partum (PP). The data obtained were subjected to statistical analysis using the ANOVA procedure. The analysis of variance and LSD test were used to estimate the probability of the significance of statistical differences. In this work Ca and P serum levels were significantly the lowest in IPP cows with 78.4±20.2 mg/l and 33.0±24.6 mg/l respectively ($p<0.05$). However serum Mg levels in this study was lowest in postpartum cows with 18.9±2.9 mg/l compared with other peripartum stages but not significantly ($p>0.05$). In this work we concluded that a decreasing in Ca, P and Mg occurs in dairy cow mostly in peripartum.

Keywords: Hypocalcaemia, peripartum, retained placenta, serum macrominerals.

INTRODUCTION

Algerian development policy of dairy production is based on a massive introduction of exotic cattle breeds originate from temperate regions (Madani et al*.,* 2008). The metabolic disorders observed of production are caused by an imbalance of proteins, minerals and water, due to metabolism and excess loss of minerals through feces, urine, milk and fetus (Wubishet et al*.* 2016). Nutritional imbalances affecting livestock are produced because the supply or use of feed does not meet nutritional demands for maintenance, growth, production and reproduction (Martinez et al., 2014). The lack of adaptation of exotic breeds to Mediterranean breeding conditions and management practices are generally

advanced as main justifications of limited productivity of cows (Srairi and Baqasse, 2000).

During last 2 to 4 weeks of gestation there is an increase substantial energy demand due to fetal development and the needs of colostrum synthesis. These two circumstances are often responsible for the development of a negative energy balance that initiates a few weeks before delivery. Cattle have the ability to compensate for deficits energy through the mobilization of body fat. However, an excess mobilization of fat leads to metabolic disease and reproductive problems (Bezerra, 2014).

The majority of cows develop a mild degree of hypocalcaemia during the peripartum period, generally, linked to calving problems as retained placenta, uterine prolapse, metritis, mastitis, ruminal stasis, depression of the immune system which reduced reproductive performance, resulting in reduction of productive life (Khan, 2015).

The mineral requirements of an animal are highly dependent on its physiological state. For most dietary minerals, the recommendations for dairy cows are based on a factorial division of the requirements for maintenance, growth, gestation and lactation (Nielsen and Volden, 2011). The level of minerals in forages varies according to properties of the soil, level and type of fertiliser applied to the crop, botanical composition, and maturity of the plant. Generally, forages contain high levels of potassium, fairly high levels of calcium and lower levels of magnesium and phosphorus (Swift et al*.,* 2007).

The purpose of this work was to determine the variation of some serum macrominerals in dry period (DP), in the immediate post-partum (IPP), 15 days post-partum (PP) and the relation with milk fever (MF), and retained placenta (PR) occurrence.

MATERIALS AND METHODS

The present study was conducted on 15 Prim Holstein dairy cows from January to November 2015, in Tiaret at the west of Algeria. The climate is of continental type, dry and rigorous in winter and hot in summer; the seasonal averages are 6°C for the winter and 25.9°C for the summer.

All cows were subjected to a general clinical examination before taking blood samples and all animals were free of disease. The reproductive status of each cow was recorded according to its recorded history and clinical investigation after rectal examination and the ultrasonography. All cows used in this study were in the dry period at the beginning of the experiment. Animals were fed an average of 9 Kg of corn concentrate and hay.

Each cow was sampled three times (In the dry period, immediate post-partum and 15 days post-partum). Jugular blood samples were collected via heparined vacutainer tubes early in the morning before feeding. The blood samples were brought to the biochemical laboratory within two hours for analysis. Serum was immediately separated by centrifugation. In all samples Calcium (Ca), Inorganic phosphorus (P) and Magnesium (Mg) were determined using a Roche® COBAS Integra 400.

The data obtained were subjected to statistical analysis using the ANOV A procedure. The analysis of variance and LSD test were used to estimate the probability of the significance of statistical

differences in means for blood parameters across experimental groups of cows at P<0,05 and P<0,01(Microsoft STATISTIC A ver.5.0 Stat.Soft.Inc. 1995).

RESULTS AND DISCUSSION

Results on serum levels of macrominerals in dairy cows during DP, IPP and PP are presented in Table 1, all values were in the physiological limits.

Macrominerals are essential to maintain the normal function of vital biochemical processes in the dairy cow's. Deficiency of these inorganic substances can lead to clinical and subclinical symptoms, and significantly reduce reproductive and productive performance in dairy cows (Spears, 2003).

The regulatory mechanisms for Ca and inorganic P homeostasis in dairy cows are adapted to the increased mammary gland demands. Ca mobilization from bone and absorption from the intestinal tract increases to enable the cow to create homeostasis. Highyielding cows mobilize larger amounts of Ca and P from bone compared to lowyielding cows (Liesegang, 2007). Early lactation imposes sudden high demand for Ca and P vital for the synthesis of milk ingredients. Some cows exhibit a marked decrease in blood Ca and P levels in early lactation, resulting in a dramatic decline (<1.5 mmol/L), leading to hypocalcemia, reduced neuromuscular excitability and milk fever/puerperal paresis (Sharma et al., 2006).

In this work Ca serum level was significantly lowest in IPP cows with 78.4±20.2 mg/l (p<0.05) due to a sudden increase in mammary gland activity and increase in Ca mobilisation from both the blood and the body depots, in concordance with authors reports (Sevinc et al., 1997, Stanton et al., 2000, Đokoviæ et al. 2010). Those results indicate the high risk for hypocalcaemia leading to milk fever and it well shown in Table 2 with Ca levels 56.7±28.5 mg/l significantly lower in IPP cows with milk fever than others.

The contents of inorganic phosphates in physiological terms in dairy cows' blood is different and range from 3.35 to 8.55 mg/dl (Bires et al., 2003). Phosphorus contents during the periparturient period may play an important role in the incidence of hypocalcemia (Goff, 2008, Garis and Lean, 2009). In this study a lower level of inorganic phosphorus in IPP cows was observed but not significantly different (p>0.05). However one cow showed an extremely low level of 6 mg/l out of the physiological limits and it had milk fever at calving. MF cows had a P level about 33.0±24.6 mg/l the lowest at IPP period.

Magnesium homeostasis depends on an optimal supply from alimentary sources; accordingly, Mg concentration is dependent on Mg absorption in the rumen (Kurćubić et al., 2010). Serum Mg levels in this study was lowest in postpartum cows with 18.9±2.9 mg/l compared with other peripartum stages but not significantly (p>0,05).

Postpartum cows having the lowest Mg serum level, in the cows with milk fever, suggest a higher degree of Mg utilization in the blood by the mammary gland during early lactation. The results are in agreement with the findings reported in a number of studies (Sharma et al*.,* 2006, Sevinc et al*.,* 1997). However, no differences were found in blood parameters when Silymarin was supplemented to rations (Ülger et al*.* 2017).

Table 1. Means±SD levels of serum calcium, inorganic phosphorus and magnesium instead of peripartum phases in dairy cows

Parameter		Ca mg/l			P mg/l			Mg mg/l	
Period	**DP**	**IPP**	**PP**	**DP**	**IPP**	**PP**	**DP**	**IPP**	**PP**
N	15	15	15	15	15	15	15	15	15
Mean± SD	90.1±10.1	78.4±20.2**	90.1±6.98	63.1±13.9	46.7±16.2	64.4±13.5	23.3±7.8	22.2±8.1	18.9±2.9
Minimum	75	35	77	41	6	44	11	14	12
Maximum	105	99	101	95	71	88	41	42	24

*Significant difference p<0,05, ** Significant difference p<0,01

Table 2. Mean±SD levels of serum calcium, inorganic phosphorus and magnesium instead of normal, milk fever and retained placenta dairy cows

Parameter	N	Ca mg/l			P mg/l			Mg mg/l		
Period		**DP**	**IPP**	**PP**	**DP**	**IPP**	**PP**	**DP**	**IPP**	**PP**
Normal	**9**	87.8±10.9	85.4±8.2	90.4±7.8	63.1±15.3	52.2±10.6	65.4±11.4	25.1±9.8	24.1±9.7	20.2±2.5
Milk Fever	**3**	92.3±11.2	56.7±28.5*	91.7±8.1	70.7±14.1	33.0±24.6	65.7±16.5	21.3±0.6	20.0±5.57	16.3±3.8*
Retained Placenta	**3**	95.0±6.1	79.0±28.8	87.3±4.0	55.7±6.3	44.0±19.0	60.0±21.2	20.0±3.5	18.7±3.5	17.7±1.5
All groups	**15**	90.13±10.1	78.40±20.2	90.07±6.9	63.1±13.9	46.7±16.2	64.4±13.5	23.3±7.84	22.20±8.13	18.93±2.96

*Significant difference p<0,05

CONCLUSION

In this work a decreasing in Ca, P and Mg occurs in dairy cow mostly in peripartum. It can be detected and avoided by a preventive mineral supplementation.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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