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Transitional Period Effects on Some Biochemical and Hormonal Parameters in Libyan Cows

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ABSTRACT:

The aim of this study was to determine the changes in some biochemical and hormonal parameters in cows from late pregnancy to the early postpartum period (transition period). This study was carried out on 100 clinically healthy Libyan cows. Animals were divided into 3 groups, group 1 included 20 non-pregnant cows; group 2 contained 40 pregnant cows who were in the final stages of their pregnancies; and group 3 included 40 lactating cows in the first period of lactation. For biochemical analysis, serum samples were taken, including those of the minerals calcium, magnesium, and phosphorus, as well as glucose, AST, ALT, and cortisol. Significant differences in the values of biochemical and hormonal indicators, including calcium, magnesium, ALT, and cortisol, were seen between the pre- and post-partum periods (pregnant and lactating). There were no significant changes in phosphorus, glucose, or AST. These findings led to the conclusion that the transitional period affects some biochemical parameters and that cows should get mineral supplements such as calcium, phosphorus, and magnesium. Studies on major and minor components can be thought of as accurate health markers for cows during the transition period, and they can aid in the prevention of many diseases during this period.

Keywords: Biochemical's; Cows; Cholesterol; Transitional period

INTRODUCTION:

The three weeks prior to and three weeks following parturition are crucial for the health, productivity, and financial success of dairy cows. The majority of health problems happen at this time. Comparatively less is understood about the basic biological mechanisms that take place during the transition period compared to other lactation cycle stages should be clearly[1]. It is a time when endocrine state changes to allow lactogenesis and parturition. These alterations affect tissue metabolism and food use and are substantially more extreme than at any other point in the gestation-lactation cycle. During the prepartum transition period, feed intake is reduced, while nutrient requirements to sustain concepts growth and the start of milk synthesis are rising. Surprisingly, existing feeding recommendations do not take into account the cow's situation during this time; feed intake and nutrient needs are presumed to remain constant throughout the non-lactating period[2]. An increase in energy production compared to energy intake during the transitional period is classified as negative energy balance or negative caloric intake[3]. Ahomeorhetic regulation of the energy metabolism coordinates an adequate food supply (protein, fat, carbohydrate, vitamins, and minerals) from body tissue to the mammary gland throughout the transition period to support lactation[4-5]. The following adaptive modifications to lactation were observed in hormone

metabolism changes before calving: enhanced gluconeogenesis. improved mineral and nutrient absorption [4,6]. Within the first two weeks of lactation, milk fever, ketosis, retained placenta, and displacement of the abomasum are the most common metabolic problems in dairy cows. Additionally, early lactation insults can be linked to the development of numerous metabolic illnesses, including laminitis, which do not manifest clinically until after the first two weeks of lactation. The vast majority of infectious diseases, particularly mastitis, become clinically obvious within the first two weeks of lactation in addition to metabolic disorders[7]. To study ruminant metabolism disorders, metabolic blood profiles, including serum mineral and biochemical parameters, must be determined[8]. Understanding the complicated metabolic adaptations of transition dairy cows can be aided by analyzing longitudinal changes in the blood metabolism and finding novel biomarkers using this method [9]. This study's objective was to assess the impact of the transition period on some biochemical and hormonal parameters in the Libyan cows.

MATERIALS AND METHODS:

Animals:

This study carried out on 100 –Libyan cows (mixed breed) from different localities in Elgabal al akhdar Libya. The animals aged from 2-10 years. Cows were grazing on pasture in the morning and fed on concentrates and roughage fed in-barns , each group of animals was apparently clinically healthy after complete physical examination. Examination of the rectal temperature, pulse rate, respiration, conjunctiva mucous membrane, superficial lymph nodes, lung and heart sounds were determined according to the method described by [10] and they had to be confirmed pregnant with a known breeding date and by rectal palpation described by [11].

Sampling:

blood samples was drawn from the jugular vein from all animals 5 ml blood without anticoagulant for analysis. The following parameters were measured: Calcium, magnesium , phosphorus, glucose, aspartate aminotransferase (AST), alanine transaminase (ALT), and cortisol.

Biochemical analysis:

Determination of serum concentrations of calcium , phosphorus , magnesium, glucose, aspartate aminotransferase (AST), alanine transaminase (ALT), and cortisol were carried out by using commercial test kits according to the method described by [12-18], respectively .

Statistical Analysis:

The data were analyzed by using the packaged SPSS program (SPSS, 2000 Inc .,Chicago, IL). The mean standard error (SE) was used to represent the data. The differences between groups were determined by the one-way analysis of variance (ANOVA). $P \leq 0.05$ was chosen as the significance level [19].

RESULTS:

Biochemical parameters*:*

Serum calcium concentration in the lactating cows were significantly decreased ($p<0.05$) compared by pregnant cows and non-pregnant cows, while there were no significant differences in pregnant cows compared by non-pregnant cows Table (1), serum magnesium concentration, showed a significant increase ($P < 0.05$) in the pregnant cows compared with lactating cows and non-pregnant cows, while there were no significant differences between lactating cows and non-pregnant cows Table (1), phosphorous serum concentrations, showed a significant decrease in lactating cows and pregnant cows($p<0.05$) compared to non-pregnant cows while there were no significant differences between pregnant and lactating cows. Table (1), serum glucose concentrations, showed a significant decrease in lactating cows and pregnant cows compared to non-pregnant cows but showed no significant difference between pregnant cows and lactating cows Table (1).

Enzymes and hormonal parameters*:*

AST levels significantly increased ($P< 0.05$) in pregnant cows compared to non-pregnant ones, and they significantly increased ($P< 0.05$) in lactating cows compared to non-pregnant cows and show no significant difference between pregnant cows and lactating cows Table (2), Pregnant cows had significantly ($P< 0.05$) greater blood levels of ALT than non-pregnant and lactating cows. The level of ALT in lactation cows dramatically rose in comparison to non-pregnant cows (P 0.05) Table (2),level of cortisol in lactating cows significantly ($P< 0.05$) increased in comparing with that of the non-pregnant cows and compared by pregnant cows while there were no significant differences between pregnant and non-pregnant cows Table (2).

Table:(1). Some biochemical parameters calcium, magnesium, phosphorus, glucose (Mean ± SEM) in non-pregnant, pregnant and lactating cows (N= 100).

Parameters	Non-pregnant cows (N=20)	pregnant cows (N=40)	Lactating cows (N=40)
Calcium (mg/dl)	8.87 ± 0.07[a]	9.01±0.04[a]	7.95±0.08[b]
Magnesium (mg/dl)	1.95 ±0.07 [b]	2.23±0.03.[a]	1.99±0.04[b]
Phosphorus (mg/dl)	7.10±0.10.[a]	5.87±0.12[b]	5.66±0.20 [b]
Glucose (mg/dl))	78.50±0.37[a]	65.28±1.52[b]	69.20±1.80[b]

Means having the different letters are significantly different at ($p<0.05$).

Table 2 : Cortisol and liver function tests (Mean ± SEM) in non-pregnant, pregnant and lactating cows (N= 100).

Parameters	Non-pregnant ewes (N=20)	pregnant ewes (N=40)	Lactating ewes (N= 40)
AST(IU/L)	80.42±2.54[a]	75.95±1.60[a]	55.65±1.81[b]
ALT (IU/l)	17.65 ±0.55 [b]	35.13±2.27[a]	25.1±1.39[b]
Cortisol(IU/L)	26.90±1.77.[a]	18.43±2.14[b]	20.13±1.25 [b]

Means having the different letters are significantly different at ($p<0.05$).

DISCUSSION:

The roots of the term "periparturient" are the word "parturition" and the prefix "peri," which literally but ambiguously means "around." The periparturient period usually includes the dry period and the first three to four weeks after calving[20]. A dairy cow's life is at risk during the transition from late gestation to early lactation if the negative energy balance (NEB) brought on by the abrupt rise in energy requirements associated with lactation and the lagged dry matter intake is not adequately managed [21]. Without adequate care, females who enter this period of significant metabolic problems are more likely to have metabolic or nutritional disorders [22]. The most crucial measurements used to determine the energy, protein, enzymatic, hormonal, and mineral profiles, as well as to evaluate nutritional status, milk production, and animal health, are blood biochemical markers[23]. Our study's findings showed that calcium concentrations in the lactating cows were significantly decreased ($p<0.05$) compared to pregnant cows and non-pregnant cows, while there were no significant differences in pregnant cows compared to non-pregnant cows. These results may be explained by[24]. The fact that early lactation drains calcium at a rate that is substantially higher than the late fetal development requirement of 10 to 15 grams per day was also mentioned by [25]. mentioned that early lactating dairy cows usually secrete colostrum (which contains 1.7–2.3 g of calcium per kilogram) or milk (which contains 1.2 g of calcium per kg).typically secrete 30 to 40 grams of calcium daily. Estimates place the total amount of calcium in plasma and extracellular fluids at 12 g. As a result, when dairy cows begin to produce milk, the body has a negative calcium balance. Serum magnesium concentration showed significant increase(P

< 0.05) in the pregnant cows compared by lactating cows and compared by non-pregnant cows while there were no significant differences between lactating cows and non-pregnant cows this result was accept with [26]. Hypomagnesaemia typically does not manifest clinically in dairy cows, but instead affects them sub-clinically and chronically, especially after delivery, also [27]. reported that 11 cows were examined during the transitional period, and it was discovered that five of them had subclinical hypomagnesaemia (blood levels below 1.8 mg.dL-1) during both pre- and post-partum episodes. Of particular note were two of these cows, whose Mg concentrations were below normal serum levels for 60% of the experiment. Other research [28,29] have also observed a reduction in plasma magnesium levels following calving. Phosphorous serum concentrations showed a significant decrease in lactating cows and pregnant cows (p p<0.05) compared to non-pregnant cows while there were no significant differences between pregnant and lactating cows This result was agreed with [30]. The rate of phosphorus migration from the mother's blood stream into the fetus increased during late pregnancy as well, and this increase was not countered by a rise in the rate of phosphorous absorption from the mother's bones or intestine. Cows that are still in the early stages of lactation may suffer hypophosphatemia as a result of a sudden and increasing loss of phosphorus in the milk [31]. Serum glucose concentration were significant decrease in lactating cows and in pregnant cows compared by non-pregnant cows and show no significant difference between pregnant cows and lactating cows, the decrease in glucose level in pregnant and lactating period may attribute to drop in glucose levels in puerperal dairy cows may be due to the increased lactose synthesis and rapid mammary gland activity[32], decrease levels of glucose in late period of gestation are linked to rapid growth of fetus and mobilization of maternal glucose into fetal blood circulation [33]. AST levels significantly increased (P< 0.05) in pregnant cows compared to non-pregnant ones, and they significantly increased (P< 0.05) in lactating cows compared to non-pregnant cows and show no significant difference between pregnant cows and lactating cows this result was agreed with[34], the serum AST activity is considered as the most sensitive indicator for diagnosing fatty liver in this species ,the serum AST activities measured in late pregnant and in early lactating cows were significantly higher. Pregnant cows had significantly (P< 0.05) greater blood levels of ALT than non-pregnant and lactating cows, AST activity is a marker of periparturient animals' liver function and is associated with impaired liver function in cows with fatty liver disease [35]. The level of ALT in lactation cows dramatically rose in comparison to non-pregnant cows (P 0.05) this result agreed with[36] stated that the ALT and AST levels are higher in pregnant period than non-pregnant animals. level of cortisol in lactating cows significantly (P<0.05) increased in comparing with that of the non-pregnant cows and compared by pregnant cows while there were no significant differences between pregnant and non-pregnant cows. These results comply with those of other researchers [37,38] and suggest that dairy cows undergo severe stress immediately before and during calving ,which leads to hormonal changes manifested as significant increases in glucocorticosteroid and catecholamine levels in the circulation, Maternal glucocorticoids' concentration rises throughout parturition, a sign that persistent stress is present [39].

CONCLUSION:

Cows showed biochemical and hormonal adaptation in the transitional period (late stage of pregnancy and early lactation), including changes in calcium, phosphorous, magnesium, glucose, AST, ALT, and cortisol. During the transitional period, these alterations might be used as indications of the health status of cows (late pregnancy and early lactation). The level of some biochemical parameters is impacted by late pregnancy and early lactation (the transition period), so cows should get mineral supplements including calcium, magnesium, and phosphorous. Monitoring both main and minor components can be thought of as true health indicators for cows during this transitional period, which aids in the prevention of many diseases during this time.

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REFERENCES:

1. Drackley, J. K. (1999). Biology of dairy cows during the transition period: The final frontier? *Journal of dairy science*, *82*(11), 2259-2273.
2. Grummer, R. R. (1995). Impact of changes in organic nutrient metabolism on feeding the transition dairy cow. *Journal of animal science*, *73*(9), 2820-2833.
3. Van Saun, R. J., & Sniffen, C. J. (2014). Transition cow nutrition and feeding management for disease prevention. *Veterinary Clinics: Food Animal Practice*, *30*(3), 689-719.

4. Bauman, D. E., & Currie, W. B. (1980). Partitioning of nutrients during pregnancy and lactation: a review of mechanisms involving homeostasis and homeorhesis. *Journal of dairy science, 63*(9), 1514-1529.
5. Baumgard, L., Collier, R. J., & Bauman, D. (2017). A 100-Year Review: Regulation of nutrient partitioning to support lactation. *Journal of dairy science, 100*(12), 10353-10366.
6. Bell, A. W. (1995). Regulation of organic nutrient metabolism during transition from late pregnancy to early lactation. *Journal of animal science, 73*(9), 2804-2819.
7. Goff, J. P. (2008). *Transition cow immune function and interaction with metabolic diseases.* Paper presented at the Tri-state dairy nutrition conference.
8. Akraeim, A. M., Abdelghany, A. H., & Saad, S. E. S.(2021) Evaluation the impact of the transition period on some hematobiochemical parameters in native sheep in Algabal Alakhdar governorate in Libya Benha Veterinary Medical Journal.
9. Kenéz, Á., Dänicke, S., Rolle-Kampczyk, U., von Bergen, M., & Huber, K. (2016). A metabolomics approach to characterize phenotypes of metabolic transition from late pregnancy to early lactation in dairy cows. *Metabolomics, 12*(11), 1-11.
10. Constable, P., Hinchcliff, K., Done, S., & Grünberg, W. (2017). Clinical examination and making a diagnosis. *Veterinary medicine: a textbook of the diseases of cattle, horses, sheep, pigs, and goats*, 1-28.
11. Karen, A. M., Darwish, S., Ramoun, A., Tawfeek, K., Van Hanh, N., de Sousa, N. M., . . . Beckers, J.-F. (2011). Accuracy of transrectal palpation for early pregnancy diagnosis in Egyptian buffaloes. *Tropical Animal Health and Production, 43*(1), 5-7.
12. Andresen, B. D., & Bhagavan, N. (1986). *Textbook of clinical chemistry*: WB Saunders company.
13. Young, D. S., Pestaner, L., & Gibberman, V. (1975). Effects of drugs on clinical laboratory tests. *Clinical chemistry, 21*(5), 1D-432D.
14. Bohuon, C. (1962). Mircodetermination of magnesium in various biological media. *Clinica chimica acta; international journal of clinical chemistry, 7*, 811-817.
15. Trinder, P. (1969). Enzymatic methods for glucose determination. *Ann Clin Biochem, 6*, 24-26.
16. Reitman, S., & Frankel, S. (1957). A colorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminases. *American journal of clinical pathology, 28*(1), 56-63.
17. Thefeld, W., Hoffmeister, H., Busch, E.-W., Koller, P., & Vollmar, J. (1974). Referenzwerte für die Bestimmungen der Transaminasen GOT und GPT sowie der alkalischen Phosphatase im Serum mit optimierten Standardmethoden. *DMW-Deutsche Medizinische Wochenschrift, 99*(08), 343-351.
18. Wilson, M., & Miles, L. (1977). Radioimmunoassay of insulin. In hand book of Radioimmunoassay, GE Abraham (ed.), M. *Inc. New York, p275*.
19. Bailey, N. T. (1995). *Statistical methods in biology*: Cambridge university press.
20. Stevenson, J. S., & Call, E. P. (1988). Reproductive disorders in the periparturient dairy cow. *Journal of dairy science, 71*(9), 2572-2583.
21. Drackley, J. K., Overton, T. R., & Douglas, G. N. (2001). Adaptations of glucose and long-chain fatty acid metabolism in liver of dairy cows during the periparturient period. *Journal of dairy science, 84*, E100-E112.
22. Souto, R. J., Afonso, J. A. B., Mendonça, C. L., Carvalho, C. C., Silva Filho, A. P., Cajueiro, J. F., . . . Soares, P. C. (2013). Biochemical, electrolytic and hormonal findings in goats affected with pregnancy toxemia. *Pesquisa Veterinária Brasileira, 33*, 1174-1182.
23. Soares, G., Souto, R., Cajueiro, J., Afonso, J., Rego, R., Macêdo, A., . . . Mendonça, C. (2018). Adaptive changes in blood biochemical profile of dairy goats during the period of transition. *Revue Méd. Vét, 169*(1-3), 65-75.
24. Seifi, H. A., & Kia, S. (2017). Subclinical hypocalcemia in dairy cows: Pathophysiology, consequences and monitoring. *Iranian Journal of Veterinary Science and Technology, 9*(2), 1-15.

25. Goff, J. P. (2004). Macromineral disorders of the transition cow. *Veterinary Clinics: Food Animal Practice, 20*(3), 471-494.

26. Mulligan, F., & Doherty, M. (2008). Production diseases of the transition cow. *The Veterinary Journal, 176*(1), 3-9.

27. Schimitt, E., Pereira, R. A., Hoffmann, D. A. C., Vendramin, L., Lima, M. E., dos Santos Farofa, T., . . . Corrêa, M. N. (2016). Hipomagnesemia subclínica em vacas leiteiras durante o período de transição: ocorrências hormonais e metabólicas. *Revista Brasileira de Ciência Veterinária, 23*(1-2).

28. Rérat, M., Philipp, A., Hess, H., & Liesegang, A. (2009). Effect of different potassium levels in hay on acid–base status and mineral balance in periparturient dairy cows. *Journal of dairy science, 92*(12), 6123-6133.

29. Verdaris, J. N., & Evans, J. L. (1976). Diet calcium and pH versus mineral balance in Holstein cows 84 days pre-to 2 days postpartum. *Journal of dairy science, 59*(7), 1271-1277.

30. Braithwaite, G. (1983). Calcium and phosphorus requirements of the ewe during pregnancy and lactation: 2. Phosphorus. *British journal of nutrition, 50*(3), 723-736.

31. Grünberg, W., Constable, P., Schröder, U., Staufenbiel, R., Morin, D., & Rohn, M. (2005). Phosphorus homeostasis in dairy cows with abomasal displacement or abomasal volvulus. *Journal of veterinary internal medicine, 19*(6), 894-898.

32. Djoković, R., Šamanc, H., Jovanović, M., Fratrić, N., Dosković, V., & Stanimirović, Z. (2013). Relationship among blood indicators of hepatic function and lipid content in the liver during transitional period in high-yielding dairy cows. *Acta Scientiae Veterinariae, 41*(1), 1-6.

33. Jacob, N., & Vadodaria, V. (2001). Levels of glucose and cortisol in blood of Patanwadi ewes around parturition. *Indian Veterinary Journal, 78*(10), 890-892.

34. Kupczynski, R., & Chudoba-Drozdowska, B. (2002). Values of selected biochemical parameters of cows' blood during their drying-off and the beginning of lactation. *Electronic Journal of Polish Agricultural Universities. Series Veterinary Medicine, 5*(1).

35. Herdt, T. H. (1988). Fatty liver in dairy cows. *The Veterinary Clinics of North America. Food Animal Practice, 4*(2), 269-287.

36. Van Saun, R. J. (2004). *Metabolic profiling and health risk in transition cows.* Paper presented at the American Association of Bovine Practitioners Proceedings of the Annual Conference.

37. Bertoni, G., Trevisi, E., Lombardelli, R., & Bionaz, M. (2005). Plasma cortisol variations in dairy cows after some usual or unusual manipulations. *Italian Journal of Animal Science, 4*(sup2), 200-202.

38. Forslund, K. B., Ljungvall, Ö. A., & Jones, B. V. (2010). Low cortisol levels in blood from dairy cows with ketosis: a field study. *Acta Veterinaria Scandinavica, 52*(1), 1-6.

39. Vermorel, M., Dardillat, C., Vernet, J., Renseigné, N., & Demigne, C. (1983). *Energy metabolism and thermoregulation in the newborn calf.* Paper presented at the Annales de Recherches Veterinaires.