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METABOLIC PROFILE TEST FOR MONITORING THE CLINICAL, HAEMATOLOGICAL AND BIOCHEMICAL ALTERATIONS IN CATTLE DURING PERI-PARTURIENT PERIOD

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A B S T R A C T

The aim of this work was to utilize the metabolic profile test (MPT) for evaluation of the changes in Friesian cows (n=25) during the peri-parturient period in association with body condition score (BCS) using multiparous postpartum cow (n=20) and heifers (n=5). The clinical signs included anemia during the pre-parturient period, and hypocalcaemia and ketosis during the post-parturient period. RBCs count, hemoglobin concentration, packed cell volume, mean corpuscular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration significantly ($P<0.05$) decreased during peri-parturient period as compared to heifers. WBCs count considerably ($P<0.05$) decreased during pre-parturient period while lymphocytes count showed a significant increase ($P<0.05$) during peri-parturient period. On the other hand, neutrophils count showed a significant decrease ($P<0.05$) during peri-parturient period. Glucose significantly ($P<0.05$) increased during 2-3 weeks pre-partum, non-esterified fatty acids, beta hydroxyl butyric acid, triglycerides, cholesterol, low density lipoprotein, very low density lipoprotein, alanine amino transferase, gamma glutamyl transferase, urea and creatinine clearly ($P<0.05$) increased during peri-parturient period, insulin. Total protein and lecithin cholesterol acyltransferase significantly decreased during 2-3 weeks pre-partum, whereas serum cortisol, aspartate amino transferase enzyme obviously ($P<0.05$) increased as parturition approach. High density lipoprotein and globulin significantly ($P<0.05$) decrease during peri-parturient period. Besides, There was a significant ($P<0.05$) decrease in Ca, P, Mg, K and Na concentrations during the peri-parturient period. BCS of Friesian cows showed a significant decrease ($P<0.05$) during postpartum period. It was concluded that MPT is a reliable method for recording the hematological and biochemical changes as well as determination of liver and kidney function status during the peri-partureint period in cattle. Under field condition, BCS is considered a supplementary aid for MPT for determination of the susceptibility of peri-parturient cows for subclinical or clinical metabolic or nutritional deficiency disorders.

KEY WORDS: Body condition score, metabolic diseases, metabolic profile test, LCAT.

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1. INTRODUCTION

Transition period of a dairy cow's productive cycle is the change from the pregnant, non-lactating state to the non-pregnant, lactating state during the interval from three weeks pre-partum until three weeks postpartum [19]. Production disease includes those diseases previously known as metabolic diseases, which are attributable to an imbalance between the rates of input of dietary nutrients and output of production. When the imbalance is continued, it may lead to change in the amount of body reserves of certain metabolites [44]. Since 1970, the metabolic profile has emerged as a tool for assessing metabolic status and helping in

the diagnosis of metabolic diseases [40]. The metabolic profile is based on the concept that the laboratory measurement of certain components of the blood will reflect the nutritional status of the animal, with or without presence of clinical abnormalities MPT is considered a reliable tool for veterinarian for assessment the input-output (nutrient-productivity) relationships. MPT is also a reliable test for the early diagnosis of nutritional deficiency or metabolic disease that would be a major forward step in attempting to optimize flock production and obtain maximum yields at minimum costs [44]. Therefore, MPT is considered as a useful diagnostic aid in difficult herd situations whose other, more direct, diagnostic techniques have failed to uncover the problem [16]. The aims of this study were: 1) to determine the hematological, biochemical and hormonal changes related to metabolic disorders in pregnant Friesian cows during the peri-parturient period. 2) To monitor the clinical signs of metabolic disorders appearing in pregnant cows with relation to abnormal findings of MPT. 3) To record the changes in BCS and its relation to metabolic diseases.

2. MATERIALS AND METHODS

2.1. *Animals and design*

The present study was carried out in a private farm in El-kanater El-kheiria, Kalubia, on two groups of animals during the period from Aprils to September 2010. Group 1 included twenty apparently healthy Friesian cows during peri-parturient period (from 8-6 weeks pre-partum to 5-6 weeks postpartum) with an age ranged from 4-7 years old. Group 2 included five apparently healthy Friesian heifers with age ranged from 1.5 year to 2 years.

1.2. *Rectal examination.*

Periodical rectal examination was applied to detect the expected parturition date.

1.3. *Clinical examination.*

Determination of body temperature, respiratory and pulse rates and ruminal movement as well as examination of mucous membranes was conducted [28].

1.4. *Blood sampling.*

The blood samples were collected during the early morning [28]. The blood samples were collected from jugular vein of all cows during the periods 8-6, 5-4, 3-2 weeks pre-partum and 1-2, 5-6 weeks postpartum (peri-parturient period). Two blood samples were collected from each cow as follows: Three cm of blood were collected on EDTA for hematological examination. Another five cm of blood were collected without anticoagulant for obtaining clear non–hemolyzed sera. Only clear non–hemolyzed serum was used for the quantitative determination of glucose, total lipid, cholesterol, triglycerides, HDL, NEFA, BHBA, albumin, total protein, urea, creatinine, Na, K, Ca, P, Mg, AST, ALT, GGT, LCAT, cortisol and insulin.

1.5. *Hematological examination.*

The total erythrocytic count, MCV, MCH, MCHC, Hb, PCV, total leukocytic count, lymphocytes count and neutrophils count were measured by using Hematology Analyzer Perlong Medical Machine Co., Ltd Model XF9080 [25].

1.6. *Biochemical analysis of serum.*

Serum biochemical analysis included the spectrophotometric determination of the cortisol [56], glucose [55], NEFA and BHBA [9], total cholesterol[13], LCAT [30], triglycerides [4], HDL [13], total protein and albumin [22], ALT [53], GGT [46], AST[3], urea [39], creatinine [58], Ca [54], P [57], Mg [3], Na and K [21]. Insulin was measured by using of radioimmunoassay [RIA] [56]. Globulin was determined by the difference between total protein and albumin [7]. LDL-C and VLDL -C was estimated according to [15] according Formula: LDL=total

cholesterol-HDL-TG/5.0 (mg/dL). VLDL-cholesterol was estimated as one-fifth of the concentration of triglycerides [15].

1.7. *The body condition score.*

The determination of BCS followed the methodology previously proposed by [10]. BCS is assigned by visual observation of the cow's rump area-primarily the region delimited by the hip bones (tuber coxae), a assigned a score of head. The amount of "covering" over the 1 and extremely fat cows, a score of 5.The eight areas of the cow's body were examined the pin bones (tuber ischii) and the tail vertebrae of the back is also used in giving score. Cows are usually ranked on a scale from 1 to 5. Extremely thin cows are and criteria within each area were used to indicate the body condition. The eight locations (B1 to B8) examined were in three major regions:

1) Loin - B1: spinous processes, (the vertical prominances of the lumbar vertebrae); B2: depression between the spinout and transverse processes; B3: transverse processes (the transverse prominances of the lumbar vertebrae); B4: overhanging shelf formed by the transverse processes above the flank.

2) Pelvis - B5: tuber coxae (hooks) and tuber ischii (pin bones) bony prominances; B6: depression between the hook and pin bones; B7: depression between the hooks.

3) Tail head - B8: spinous and transverse processes of the coccygeal vertebrae and ischio rectal fossa (depression beneath the tail).

1.8. *Statistical analysis.*

Data were analyzed by using one–way analysis of variance (ANOVA) [14]. The means in different periods of peripartum stage were compared to that of the heifers using Whitney Man parametric test. Means were considered statistically significant from heifers when $P<0.05$.

3. RESULTS

3.1. *Clinical examination.*

Clinical examination of the examined cows (Table 1) showed a non significant increase ($P \leq 0.05$) in temperature during the period form 3-2 weeks pre-partum to 1-2 weeks postpartum. The respiratory rate showed a significant increase than heifers during 3-2 weeks pre-partum. The pulse rate showed a significant increase than heifers during the periods 5-4, 3-2 weeks pre-partum. The ruminal movements showed a significant decrease than heifers during 3-2 weeks pre-partum. Clinical sign of anemia such as pale mm and emaciation were observed during pre-parturient period (Fig. 1), whereas clinical signs of ketosis such as emaciation (Fig. 2) and clinical signs of milk fever such as sternal recumbency (Fig. 3) were observed in some cows during postparturient period.

1.9. *Hematological examination*

RBCs count showed a significant decrease ($P<0.05$) during postpartum period. Hb and PCV showed a significant decrease during the period from 5-4 weeks pre-partum to 5-6 weeks postpartum period. MCV, MCH and MCHC showed a significant decrease during the peri-parturient period. MCH showed a significant decrease during the period from 3-2 weeks pre-partum to 5-6 weeks postpartum parturition. Regarding the total and some differential leucocytic count, WBCs count showed a significant decrease during pre-parturient period, lymphocytes count showed a significant increase during the peri-parturient period. On the other hand, neutrophils count showed a significant decrease during peri-parturient period (Table 1).

1.10. *Biochemical analysis of serum*

Serum glucose showed a significant increase during 3-2 weeks pre-partum. Serum NEFA showed a significant increase during the period from 8-6 weeks pre-partum to 5-6 weeks postpartum.

Serum BHBA showed a significant increase during the period from 3-2 weeks pre-partum to 5-6 weeks postpartum. Serum insulin showed a significant decrease during 3-2 weeks pre-partum. Serum cortisol showed a significant increase during 5-4 and 3-2 weeks pre-partum. Serum cholesterol showed a significant increase during the peri-parturient period. Serum LCAT showed a significant decrease during 3-2 weeks pre-partum.

Table 1. Changes in clinical examination, hematological and biochemical parameters and BCS during the peri-parturient period in Friesian cows and heifers (Means ± S.E.).

	Heifers	---------- Pre-partum stage (weeks) ----------			-- Post-partum stage (weeks) --	
		8-6	5-4	3-2	1-2	5-6
Body temp. (ºC)	38.3±0.3	38.1±0.4	38. 3±0.2	38.9±0.4	39.1±0.5	38.2±0.1
Respiratory rate/minute	19.3±1.1	17.5±0.5	19.5±0.5	22.5±1	21.2±1.04	18.5±0.5
Pulse rate/minute	55.6±2.2	54±2	60.5±2.5	65.2±3.2	58.2±1.8	56±2
Ruminal movement/2min	3	3	3	2	2	3.
RBCs (10^6/UL)	4.2 ±0.2	6.12±0.3	4.2±0.4	4.7±0.26	3.7±0.2	3.2±0.1
PCV%	36.6±4.3	33±1	27±2	29±1.5	26.4±4.5	26±2
Hb (g/dl)	9.6±0.5	10.4±0.4	7.9±0.4	8±1	8.16± .8	7.4±0.9
MCV(fl)	86.2 ±4.4	55.6±2.3	63.8±1.3	61.4±2.1	61±1.8	81.1±2.9
MCH(pg)	25.4 ±1.3	17.5±.8	19±2.8	16.9 ±1.2	19.6±1.2	23.4 ±0.1
MCHC (%)	29.4 ±0.1	31.5±0.3	29.7±3.8	27.4± 1.9	29.1±.1	28.5 ±0.6
WBCs (10^9/L)	7.8±0.6	4.3±0.8	4.6±0.1	7.2±1.2	6.6±2.4	8.5±2.5
Lymphocytes (10^9/L)	2.8±0.3	2.4±0.2	2.5±0.1	4.3±0.2	3.8±0.1	5.5±0.5
Neutrophils (10^9/L)	3.9±0.4	1.7±0.3	1.6±0.5	2.4±0.2	2.2±0.2	2.2±0.3
Glucose (mg/dl)	73.6±8.8	79.6±2.1	57.9 ±9.2	94.1 ±4.1	87.9±7.5	87.9±10.4
NEFA (mg/dl)	30.1±2.5	36.3±2.4	37.9±5.7	39.4 ±4	40.8±4.8	47.3±5.7
BHBA (mg/dl)	8.2 ±2.2	9.3±1.7	11.3±2.5	14.9± 3.5	13.6±2.2	39.9±1.8
Insulin (uIU/ml)	34.6±1.1	32.7±1.9	33.4±2.6	26.8±5.5	30.1±4.6	38.8±4.8
Cortisol(ug/dl)	11.7±0.3	11.16±0.6	15±0.31	26.2±2.3	11.6±1.1	11.3±0.5
Cholesterol (mg/dl)	134 ±10	161.7±12	179±8.7	145.5±7.2	159.2±6.1	159.9±1.2
LCAT (U/L)	29.2±2.5	32.7±1.1	27.2±1.5	23.3±4.2	26.9±3.2	28.63±1.5
Triglycerides (mg/dl)	44.3±5.5	116.±4.7	117±4.	132±9.8	118 ±14	101.6±8.4
HDL(mg/dl)	92.6±4.9	35.0±.16	33.8±4.2	32.1±4.4	34.7±5.5	30.2±0.1
LDL (mg/dl)	33.3±11	103±19	105±20	85.8±22	100.2±16	106.5±3.5
VLDL (mg/dl)	5.1±0.2	23.3±0.9	23.4±0.8	26.9±2.6	23.7±2.2	22.1±2.1
Total protein (g/dl)	7.7±0.5	7.85±0.04	7.4±0.37	6.96±0.1	7.14±0.36	7.86±0.11
Albumin (g/dl)	3.13±0.1	3.47±0.3	3.1±0.04	3 ±0.04	3.11±0.2	3.8±0.02
Globulin (g/dl)	4.6±0.4	4.38±0.2	4.37±0.27	3.9±0.26	3.7±0.31	4.01±0.2
AST(U/L)	63.3±4.2	60.8±1	62.1±1.2	84.3±4.6	65.6±4.2	58.9 ±1.8
ALT(U/L)	24±2.6	24±2.66	46.9±5.1	65.2±5.20	67.9±8.9	48.2±3.5
GGT (U/L)	15.3 ±2.4	36.2±2.5	37.9±5.8	61.8±4.9	60.8±8.07	41.2±2.5
Urea (mg/dl)	30. 3±1.5	31.4±1.6	41.1±0.5	53.3 ±8.4	48.1±7.1	34.2±0.6
Creatinine (mg/dl)	1.2±0.1	1.14±0.1	1. 2±0.3	2.5 ±0.3	2.3±0.3	1.7±0.3
Ca (mg/dl)	8.9±.37	9.4±1.3	7.3±.0.4	5.6±0.4	7.73±0.7	8.5±0.05
P (mg/dl)	6.2±1.4	4.9±0.1	4.4±0.3	3.09±0.1	3.9±0.3	5.07±0.1
Mg (mg/dl)	2.3±0.3	1.9±0.2	1.5±0.2	1.4±0.3	1.6±0.3	1.9±0.2
Na (mmol/l)	141±01.4	126.9±4.6	115.7±4	99.9±6.2	128.2±6.7	145.2±6.5
K (mmol/l)	4.6±0.2	4.3±0.51	2.9±0.1	2.5±0.23	3.2±0.3	4.4±0.3
BCS	3.4±0.3	3.3±0.2	3.1±0.3	2.9±0.3	2.4±0.2	2.2±0.4

Serum triglycerides, LDL and VLDL showed a significant increase during the period from 8-6 weeks pre-partum to 5-6 weeks postpartum, while serum HDL showed significant decrease during the period from 8-6 weeks pre-partum to 5-6 weeks postpartum. Serum total protein showed a significant decrease during the period 3-2 weeks pre-partum. Serum globulin showed a significant decrease during the period from 3-2 weeks pre-partum to 1-2 weeks postpartum. While the mean Serum albumin showed a non-significant decrease during the peri-parturient period. Serum AST showed a significant increase during period 3-2 weeks pre-partum. Serum ALT enzymes showed a significant increase during the period from 5-4 weeks pre-partum to 5-6 weeks postpartum. Serum GGT enzymes showed a significant increase during the period from 8-6 weeks pre-partum to 5-6 weeks postpartum. Serum urea showed a significant increase during the period from5-4 weeks pre-partum to 5-6 weeks postpartum and nearly similar was creatinine. Serum Ca showed a significant decrease than heifers during the period from 5-4 weeks pre-partum to 5-6 weeks postpartum. Serum P, Mg and K showed a significant decrease than heifers during the period from 5-4weeks pre-partum to 1-2 weeks postpartum. Serum Na showed a significant decrease than heifers during the period from 8-6 weeks pre-partum to 1-2 weeks postpartum (Table 1).

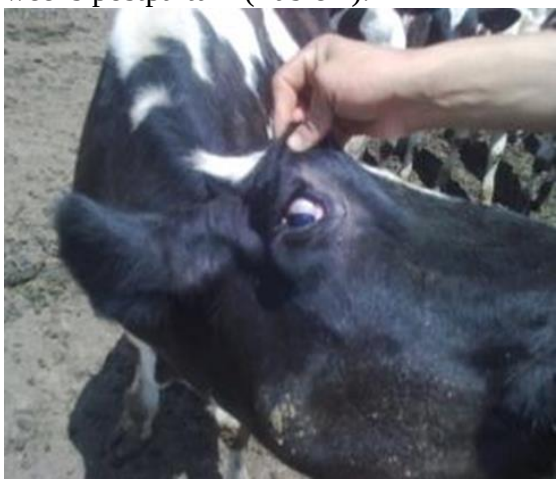

Fig.1 Cow during pre-partum period showed pale mm due to anemia.

1.2. *Body condition score:*

BCS of peri-parturient cows showed a significant decrease than heifers during postpartum period (Fig. 4-5 and Table 1).

Fig. 2 A Cow during the 5th week postpartum showed loss of body weight due to ketosis.

Fig. 3 A recumbent cow during the 1st week Postpartum showed sternal recumbency due to milk fever.

Fig. 4 A Cow during pre-partum period with good body condition score (Hooks and pins are rounded).

Fig. 5. A cow during postparturm period showed loss in body condition score (V-angle area formed between hooks, thurl and pins.

4. DISCUSSION

The clinical examination of cows in the peri-parturient periods showed different deviation from heifers. The increase in respiratory and pulse rate in cows during peri-parturient period may be related to stress [28]. The decrease in ruminal movements near parturition could be attributed to hypocalcaemia which reduces rumen motility [17].

In addition to changes recorded by the clinical examination, the hematological parameters were also significantly altered in cows during the peri-parturient periods compared to heifers**.** RBCs count showed a significant decrease than heifers during postpartum period. MCH and MCHC showed a significant decrease than heifers during peri-parturient period. This result is similar to what observed by [16] who attributed the reduction in RBCS count, MCH and MCHC to deficiency of iron during this period. PCV% and Hb showed a significant decrease during peri-parturient period , that was attributed to anemia due to stress of pregnancy [8].The reduction of MCV during peri-parturient period was attributed to iron deficiency that results in a decreased MCV (microcytosis) because cells undergo an extra division as a result of inadequate hemoglobin concentration [47]. Fetal growth that occurs in last period of pregnancy produces a greater oxygen demand; this greater need for oxygen is compensated by activation of the endocrine system that stimulates the release of erythropoietin by the renal tissue [41]. The secretion of this circulating glycoprotein stimulates increased production of erythrocytes in the bone marrow [33]. WBCs count showed a significant decrease than heifers during peri-parturient period. However, there was an increase in WBCs near parturition (3-2 weeks pre-partum) as compared with other pre-partum periods. The increase of WBCs near parturition might be attributed to the antepartum rise in cortisol [29].There was an increase in number of neutrophils near parturition this is similar to what observed by [29]. The increase in number of neutrophils near parturition is mediated by antepartum rise in cortisol [43].

Variations in serum biochemical parameters were observed in cows during the peri-parturient period compared to heifers. Serum glucose showed a significant increase during 3-2 weeks pre-partum. The increase in pre-partum glucose might be attributed to increase of several hormones as cortisol and estrogen [23]. Serum insulin showed a significant decrease than heifers during 3-2 weeks pre-partum. The decrease in insulin in pre-parturient period could be related to insulin taken-up from blood to the mammary [34]. Hypoinsulinemia in the dairy cow during peri-parturient period is a part of an adaptation process from gestation to lactation [38]. Low plasma insulin concentration reduces glucose uptake by non-mammary extra-hepatic tissue and makes glucose available for uptake by the mammary gland which is not responsive to insulin [1].Serum cortisol showed significant increase. The increased cortisol near parturition could be attributed to the placental transfer from fetus to the mother [20].

The lipid profile was significantly changed in cows during the peri-parturient period

compared to heifers leading to negative energy balance. Serum NEFA showed a significant increase than heifers during peri-parturient period. The increase in NEFA near parturition could be attributed to increase in lipolysis as a result of stimulation of hormone-sensitive lipase in adipose tissue related to hypoinsulinemia [32]. Serum BHBA concentration showed a significant increase than heifers during the peri-parturient period. Elevated plasma of BHBA is indicative of a negative energy balance as a result of drop in feed intake combined with exceedingly large energy demands [45]. Serum cholesterol showed a significant increase during peri-parturient period. The increase of cholesterol during pregnancy occurs as a result of decreased activity of LPL and hepatic lipase which responsible for catabolism of lipoproteins [36]. The depression of lipoprotein lipase activity may be due to hypoinsulinemia [49]. LCAT showed a significant decrease than heifers during 3-2 weeks pre-partum [42]. The reduced LCAT activity could be attributed to decreased apolipoprotein (Apo) B-100 and Apo A-I that play a role in the activation of LCAT as a result of fatty liver [37]. LCAT is synthesized in the liver and therefore, its synthesis and/or excretion is impaired in hepatocellular diseases such as fatty liver [52]. Serum HDL showed a significant decrease than heifers during the period from 8-6 weeks pre-partum to 5-6 weeks postpartum. The decrease in HDL may be attributed to depressed lipoprotein lipase as there is a positive association between LPL and HDL [5]. Serum LDL and VLDL showed a significant increase than heifers during peri-parturient that could be due to depression of LPL and hepatic lipase which responsible of catabolism of lipoproteins [36].

Regarding the serum protein profile, Serum total protein showed a significant decrease than heifers during period 3-2 weeks pre-partum. The decrease in serum total protein as parturition approach may be attributed to the fact that the fetus synthesizes all its proteins from the amino acids derived from the dam, and growth of the fetus increases exponentially reaching a maximum level, especially in muscles, during late pregnancy [26]. Serum globulin s showed a significant decrease during peri-parturient period. The reduction of globulin in peri-parturient period associated mainly with the production of colostrum and other immunological changes typical for the peri-parturient period [27].The change of total protein, albumin and globulin to the transfer of albumin and γ-globulins and total protein from blood to the mammary glands [31].

With regard to liver function tests, AST and ALT showed significant increase during 3-2 weeks pre-partum. The higher concentrations of AST in dairy cattle are associated with fatty liver syndrome and ketosis signs [24] and [51]. Serum GGT showed significant increase than heifers during peri-parturient period. This result was attributed that to fatty liver infiltration [11].In a similar pattern, the kidney function was significantly altered as serum urea showed significant increase than heifers during the peri-parturient period and nearly similar showed creatinine. The increase in urea s in late pregnancy and early lactation could be attributed to the increased cortisol that increases the catabolism of protein in the body [48].Elevated creatinine near parturition due to the fetal maternal circulation and the load of organic waste of the newborn [12].

The serum mineral were significantly altered in cows in the peri-parturient period compared to heifers. Serum Ca and P showed a significant decrease during peri-parturient period. Hypocalcaemia was attributed to the impaired absorption of food metabolites from the gastrointestinal precursor, excessive losses of Ca through urine, colostrum as it was much more drained in the colostrum during excessive milking and due to insufficient

mobilization from the skeleton [19]. The decrease of serum P could be attributed to the large demand of colostrum and milk [19]. Serum Mg showed a significant decrease than heifers during peri-parturient period that decrease was attributed to the insufficient intake or poor bioavailability of Mg in the digestive tract [7]. Serum Na and K showed a significant decrease than heifers during the peri-parturient period. The decrease of Na and K during late pregnancy and early lactation could be attributed to loss of these ions through colostrum and milk [8]. The body condition score of Friesian cows showed a non-significant decrease than heifers during pre-partum weeks, whereas BCS showed significant decrease during postpartum weeks (1-2, 5-6 postpartum weeks). The decrease in pre and postpartum BCS was similar to [35]. Decreased post-calving body condition score demonstrated that cows experienced negative energy balance [50].

5. CONCLUSION

Based upon the results of this work, it can be concluded that MPT is a useful tool for recording the hematological changes, the serum biochemical parameters, the changes in livers and kidney functions and determination of some hormonal changes especially those related to metabolic disorders. Under field condition, body condition score is considered a supplementary aid for MPT.

6. REFERENCES

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مجلة بنها للعلوم الطبية البيطرية
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إستخدام إختبار البرفيل الأيضى فى رصد التغيرات الإكلينيكية والدموية والبيوكيميائية فى الأبقار فى الفترة حول الولادة

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الملخص العربي

الغرض من هذا البحث هو استخدام إختبار البروفيل الأيضى لتقييم التغيرات الاكلينيكية و البيوكيمائية بالاضافة الى التغيرات التى تحدث فى صورة الدم خلال فترة ماقبل وبعد الولادة فى الابقار الفريزيان. اجريت هذة الدراسة على 25 بقرة اشتملت على 20 بقرات سليمة ظاهريا خلال الفترة من 8-6 اسابيع قبل الولادة حتى 5-6 اسابيع بعد الولادة وخمس عجلات سليمة ظاهريا. تم تحليل عينات الدم لقياس التغيرات فى صورة الدم وعينات مصل الدم لقياس التغيرات البيوكيمائية. أظهر الفحص الاكلينيكى اعراض انيميا فى فترة ماقبل الولادة واظهر اعراض مرض نقص الكالسيوم ومرض تخلون الدم خلال فترة مابعد الولادة فى بعض الابقار. أظهرت صورة الدم انخفاضا معنويا فى عدد خلايا الدم الحمراء، الهيموجلوبين ،الهيماتوكريت، متوسط وزن هيموجلوبين كرية الدم الحمراء ومتوسط تركيز الهيموجلوبين في كريات الدم الحمراء خلال فترة ماقبل وبعد الولادة بينما انخفض عدد كرات الدم البيضاء انخفاضا معنويا خلال فترة ماقبل الولادة واظهر عدد للخلايا اليمفاوية زيادة معنوية خلال فترة ماقبل وبعد الولادة بينما عددلخلايا الدم المحببة اظهرت انخفاضا معنويا خلال فترة ماقبل وبعد الولادة. بالنسبة للتحليل البيوكيميائى لعينات مصل الدم فقد تبين وجود زيادة معنوية فى الجلوكوز خلال الاسبوع 2-3 قبل الولادة . وكذلك وجدت زيادة معنوية فى الأحماض الدهنية الغير مأسترة، حمض البيتا هيدروكسى بيتريك، الدهون الثلاثية ، الكوليسترول، البروتينات الدهنية منخفضة الكثافة وشديدة الانخفاض فى الكثافة، آلانين أمينو ترانسفيراز ، الجاما جلوتاميل ترانسفيراز، اليوريا والكرياتينين خلال فترة ماقبل وبعد الولادة و اظهر كل من الإنسولين واليثيثين كوليسترول إسيل ترانسفيراز واظهرت نسبة البروتين الكلى إنخفاضاً معنوياً خلال أخر 2-3 أسابيع قبل الولادة .بينما اظهر كل من الكورتيزول و أسبرتات أمينوترانسفيراز زيادة معنوية باقتراب موعد الولادة بينما اظهرت كل من البروتينات الدهنية عالية الكثافةو الجلوبيولين أنخفاضا معنوياً خلال فترة ماقبل وبعد الولادة واظهر الالبيومين انخفاضاًغير معنوى خلال فترة ماقبل وبعد الولادة. أما عن مستوى الكالسيوم، الفوسفور، المغناسيوم، البوتاسيوم و الصوديوم فقد أظهروا إنخفاضاً معنوياً خلال فترة ماقبل وبعد الولادة. حالة الجسد اظهر انخفاضا معنويا خلال فترة مابعد الولادة. يتضح ان إختبار البروفيل الأيضى وسيلة يمكن الوثوق بها لتقيم التغيرات الاكلينيكية و البيوكيمائية بالاضافة الى التغيرات التى تحدث فى صورة الدم، وظائف الكبد والكلى خلال فترة ماقبل وبعد الولادة فى الابقار الفريزيان كما يعتبر حالة الجسد وسيلة مساعدة لتحديد مدى استعداد الأبقار للأصابة بامراض الايض والتمثيل الغذائى خلال فترة ما قبل وبعد الولادة.

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