

A study of some biochemical variables for different stages of pregnancy and lactation in cows

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Abstract

The present study was undertaken to evaluate the effects of change in stage of pregnancy and lactation on blood metabolites and ions in cows. The animals (n = 38) were divided into three groups: the first group included lactating cows (n=12); the second group included pregnant cows (n =11); the third group included control cows (not pregnant and not lactating) (n=15). Serum samples were obtained and analyzed for glucose, urea, triglyceride and cholesterol and measured electrolytes were sodium, potassium, calcium and magnesium. Serum Ca⁺⁺ and Mg⁺⁺ concentration were determined by using commercial kits with spectrophotometer. Sodium (Na⁺) and potassium (K⁺) values were obtained with the use of a flame photometer. The results presented showed the least of glucose level in lactating and pregnant cows compared with control cows. Cholesterol level recorded higher level in pregnant and intermediary in lactating cows, while triglyceride level has Suffered a decline lower than control stage. The urea concentration did not differ significantly between the three stages. Serum calcium was lower in lactating and pregnant cows compared with control cow. The magnesium level did not differ significantly between the three stages. Sodium level recorded a highly level in lactating and intermediary in pregnant, the level of Na⁺ higher than the normal value. In contrast Na⁺, potassium level was least than normal value in lactating and pregnant stages. The results which confirmed in this paper show that the blood serum biochemical parameters considered in this paper were affected by the different stages of cows.

Key words: biochemical variables, pregnancy, lactation, cows.

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دراسة بعض المتغيرات الكيموحيوية لمراحل مختلفة من الحمل والرضاعة في الأبقار

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الخلاصة

أجريت الدراسة الحالية لتقييم تأثير التغير في مجاميع مختلفة من الأبقار الحوامل والحلابة على العمليات الأيضية للدم وأيونات المختلفة في الدم. تم تقسيم الحيوانات (ن = 38) إلى ثلاث مجاميع: المجموعة الأولى تضمنت الأبقار الحلابة (ن = 12)، واشتملت المجموعة الثانية الأبقار الحوامل (ن = 11) والثالثة مجموعة السيطرة (غير الحوامل وغير حلابة) (ن = 15). تم الحصول على عينات من مصل الدم وتحليلها لقياس سكر الدم والكوليسترول ودهن ثلاثي واليوريا، كما تم حساب تركيز الالكتروليتات المختلفة (الصوديوم والبوتاسيوم والكالسيوم والمغنسيوم). بينت النتائج انخفاض مستوى السكر في الأبقار الحلاب والحوامل مقارنة مع مجموعة السيطرة. سجلت مستويات الكوليستيرول ارتفاع في الأبقار الحوامل ومستوى متوسط في الحلابات، بينما سجل مستوى الدهون الثلاثية انخفاض في المجاميع المدروسة مقارنة مع مجموعة السيطرة. لم يظهر تركيز اليوريا أي اختلاف واضح في المراحل المختلفة. انخفض مستوى الكالسيوم في مجموعتي الحوامل والحلابة مقارنة مع مجموعة السيطرة، لم تظهر مستويات المغنسيوم أي اختلاف في المجاميع الثلاثة المختلفة. سجلت مستويات

الصوديوم أعلى تركيز في الأبقار الحلابة وتركيز متوسط في الحوامل، كان مستوى الصوديوم في هذه المجاميع أعلى من المستوى الطبيعي. على عكس الصوديوم انخفض تركيز البوتاسيوم اقل من القيم الطبيعية في مجموعتي الحوامل والحلابة. بينت نتائج البحث أن المتغيرات الكيموحيوية للدم قد تغيرت في اغلب المجاميع المدروسة.

الكلمات المفتاحية: المتغيرات الكيموحيوية، الحمل، الرضاعة، الأبقار.

Introduction

Hematological and biochemical variables are most widely used medical decision making tool. Hematological and biochemical analyses of blood are very useful to get an insight in metabolic and health status of animal (1). There are numerous studies on the effects of different phases of the reproduction cycle on biochemical parameters in domestic animal species. In sheep and cow they were carried out, among others, in relation to oestrus cycle, pregnancy and lactation (2, 3). Pregnancy is one of the physiological conditions leading to remarkable and dramatic change in biochemical variables in all animal species. Preparation dairy cows are at high risk of metabolic and reproductive disorders and oxidative stress is considered to be involved in these events(4). Pregnancy and lactation are physiological statuses considered to modify metabolism in animals (5), during pregnancy the concentration of number of blood constituent are significantly altered in cattle (6). Blood biochemical parameters including glucose, triglycerides, cholesterol, urea and electrolytes are important indicators of the metabolic activity in pregnant and lactating animals (7). Early lactation in dairy cows resulted in negative energy balance, high mobilization of lipids from bodily fat reserves as well as hypoglycemia (8). During lactation, electrolytes Na^+ , K^+ , Cl^- and Ca^{++} are lost in milk, which puts an extra burden upon mechanisms regulating electrolyte balance. From data available on goats, it can be calculated that the amount of Na^+ secreted via milk is equal to that lost in urine (9). The sodium is the most important cation in extracellular fluid, where it is responsible for maintenance of osmotic pressure. Together with chlorine (Cl) collaborates in metabolism of water and regulation of acid-base balance in the organism (10). In ruminants the potassium is absorbed from rumen and small intestine and excreted over the kidney and with feces. The majority of calcium (99%) in organism is stored in bones and teeth. Calcium is important for activation of numerous enzymes and hormones (11), therefore; this study was aimed at examine biochemical parameters in healthy cows during different period of pregnancy and lactation.

Materials and Methods

The study was carried out In total 38 cows, they belong to different physiological stages of which (12 cows) were lactating, (11 cows) were pregnant and (15 cows) were control (not pregnant and not lactating). The cows varied in age from 3 to 7 years. Collection of Samples: Blood samples (10 ml) were collected aseptically by jugular vein puncture using plastic disposable syringes. 2 ml of blood was kept in a tube containing EDTA (Ethylene Diamine Tetra Acetic acid) as an anticoagulant and after centrifugation, using for biochemical parameter. The rest of the blood sample was left without anticoagulant then centrifuged and used in biochemical test (electrolytes), samples were harvested and immediately frozen at -20°C for subsequent analysis. Biochemical parameter: The plasma glucose concentration was determined by the enzymatic method using a kit (Randox Laboratories-London). Serum urea concentration was determined using a kit (SPINREACT, S.A. Spain). Serum cholesterol level was determined using a kit (SPINREACT, S.A. Spain). Serum triglyceride concentration was determined using the enzymatic method (Liner Chemical). Serum Ca and Mg concentration were determined by using commercial kits with spectrophotometer (12). Sodium (Na^+) and potassium (K^+) values were obtained with the use of a flame photometer (13).

Results and Discussion

The knowledge about normal values of biochemical variables in blood serum and other physiological variables is important for assessment of damage of organs and tissues in different diseases and for assessment of development from the welfare aspect (14). The biochemical and hematological parameter of the experimental cows had a profound influence on their blood profile as seen from table (1). The lactating cows recorded the least glucose level of (43.6±2.5 mg/ dl), pregnant cows recorded (53.2±1.7 mg/ dl) compared with control cows recorded the level of glucose as (76.6±3.4 mg/dl) of blood. These results similar with study in (15) that declare adaptation of glucose metabolism in early lactation leads to increased gluconeogenesis in the liver to direct glucose into the mammary gland for lactose synthesis. Other study showed the hypoglycemia are more common obvious biochemical features of pregnancy because during pregnancy, fetuses have a large glucose demand that is satisfied by the mother. If the fetal demand and the mother supply become imbalanced due to fasting of the mother or the increased nutritional demands of the rapidly developing fetal placental unit, females suffer from negative energy balance and resulting in severe hypoglycemia (16). The physiological state of the animal such as parturition, pregnancy and lactation had a profound influence on total plasma cholesterol levels (17). Such was the case with the experimental cows with highly significant difference between the stages such as control, lactating and pregnant. The cholesterol level was highest as (222.7 ± 8.46 mg/dl) in pregnant stage and in lactating intermediary as (179.17 ± 3.66 mg/ dl), while in the cows were control the cholesterol level was least as (167.91 ± 6.46 mg/dl). Triglyceride levels were lower during the lactating stage as (25.2±4.3 mg/dl) and intermediary in pregnant cows as (31.4±6.3 mg/dl) compared with control cows as (39.4±5.7 mg/dl). It was in close agreement with study declare that lipid mobilisation characterized by highly concentrated free fatty acids in blood starts in a high degree of pregnancy, reaching its maximum in early lactation. Free fatty acids are reesterified and accumulated in the form of triacylglycerols in the liver. As a result, lipid mobilisation intense ketogenesis and lipogenesis in the liver and consequently lower concentrations of glucose (18). The urea concentration did not differ significantly between the three stages, it recorded level as (38.5±7.2 mg/dl), the concentration of urea in blood depends from nutrition, diagnostically is important also at diseases of kidneys (19). The results presented in tables (1) show that the blood serum biochemical parameters considered in this report were affected by the different stages of cows.

Table (1) the parameter in different stages (groups)

Blood constituents	Physiological stages		
	Lactating (12)	pregnant (11)	Control (15)
Glucose mg/dl	43.6±2.5	53.2± 1.7	76.6±3.4
cholesterol mg/dl	179.17± 3.66	222.7± 8.48	167.9±6.46
Triglyseried mg/dl	25.2± 4.3	31.4± 6.3	39.4±5.7
Urea mg/dl	38.4±7.1	38.6±6.9	38.5±7.2
Ca ⁺⁺ mg/dl	7.33± 0.73	7.6± 0.83	8.28±0.59
Mg ⁺⁺ mg/dl	1.99±0.02	1.91±0.03	1.98±0.02
Na ⁺ mmol/l	189±9.9	148.5±8.4	136± 0.04
K ⁺ mmol/l	3.28±0.17	3.55±0.52	3.75± 0.15

The result of the analysis of Ca⁺⁺, Mg⁺⁺, Na⁺ and K⁺ are shown in table (1). Serum calcium was lower in lactating cows than in pregnant cows, in both stages the level of calcium is less from control group. This result was similar with study (17) that declare Serum calcium was higher in late pregnant cows than in early lactating cows. The decrease in Ca⁺⁺ level in pregnant may also be associated with aemodilution which has been reported in cows (20). However, the study (21) reported increased Ca⁺⁺ level

during late pregnancy in cows and attributed this to increase of intestinal absorption of Ca^{++} and bone resorption because of hormonal changes. The magnesium level did not differ significantly between the three stages. This result was similar with observation in (22) that observed the same level of Mg^{++} in different stages in cow. Sodium and potassium concentrations in serum also differed between control, lactating and pregnant cows at a highly level in lactating and intermediary in pregnant, this level of Na^+ higher than the normal value. In contrast Sodium and potassium level was least than normal value in lactating and pregnant stages. Hypokalemia may result from depletion of body K^+ store or from loss of K^+ in large quantities to milk (23).

Conclusions:

1. Serum calcium was lower in lactating cows than in pregnant cows, in both stages the level of calcium is less from control group.
2. Sodium and potassium concentrations in serum differed between control, lactating and pregnant cows at a highly level in lactating and intermediary in pregnant, this level of Na^+ higher than the normal value.
3. Hypokalemia may result from depletion of body K^+ store or from loss of K^+ in large quantities to milk.
4. The physiological state of the animal such as parturition, pregnancy and lactation had a profound influence on total plasma cholesterol levels.

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