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Comparison of Some Blood Constituents between Cyclic and Acyclic Friesian Cows

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ABSTRACT. The present study was conducted to investigate the blood biochemical profile in cyclic and acyclic Friesian Cows under northern Egyptian conditions. Twenty Friesian lacting cows, 5-7 years in age, were divided into two equal groups, the first included cycling cows while the second included acycling or anoestrous cows. Blood samples were withdrawn from all experimental animals. Plasma was separated and kept at –20ºC until biochemical analysis. Plasma creatinine, cholesterol, total proteins, albumin, globulin, glucose, calcium, phosphorus, sodium, potassium, chloride, GOT, GPT, and alkaline phosphatase were analyzed.

Results revealed that in cyclic cows the levels of cholesterol, total proteins, albumin, globulin, glucose, calcium, sodium, potassium, chloride, GOT, GPT and alkaline phosphatase were significantly higher than those in acyclic cows. There was no significant differences in the levels of creatinine and phosphorus between the two groups. These changes could be attributed to ovarian activity.

KEY WORDS: Friesian cows, blood constituents, cyclic cows, acylic cows.

Introduction

The reproductive failure in farm animals could be attributed to many environmental factors such as herd management, nutrition and diseases (Tandle *et al*., (1998). Many attemps have been made to detect reproductive problems before their appearance in the farm, one of which is the measurement of blood biochemical components. Blood metabolites and mineral levels of grazing animals

may indicate their nutritional status (Tandle *et al*., 1998). Nutrients play an important role in dairy cattle reproduction, since they are necessary for the different reproductive tissues and fertility. Nutrient deficiency may impair the enzymatic function and cellular metabolism of the reproductive organs and induces concomitant reproductive disorders such as anoestrus and suboestrus (Shemesh *et al.,* 1984, Dutta *et al*., 1988 and Vohra *et al*., 1995).

Field studies in which correlations have been made between the fertility of dairy cattle and their blood biochemical components have principally been concerned with the effects of specific nutritional deficiencies. Fertility in dairy cattle was studied in relation to blood levels of glucose (McCultre, 1970), albumin (Ashton, 1972), transaminases and other blood constituents (Rowlands, 1977). Rowlands (1977) indicated that changes in certain plasma constituents during different reproductive stages alter the proper function of the reproductive organs. The present study was conducted to investigate the possible relations between different blood constituents, enzymes and ovarian activity in lactating Friesian cows.

Materials and Methods

Twenty Friesian lactating cows, 5-7 years in age, were taken from a private herd located at 20 km north of Cairo. Cows were fed according to their live body weight and reproductive status. The ration consisted of wheat or rice straw and a concentrate (each kg of concentrate mixture contained 380 g undecorticated cotton seed meal, 220 g yellow maize, 300 g wheat bran, 30 g molasses, 20 g limestone and 10 g common salt). The ration was offered twice a day. Drinking water was available all time of the day. Mobile milking machine was used to milk the cows individually in their barn. Cows were divided into two equal groups, the first group included cycling cows while the second group included acycling or anoestrous cows. The reproductive status of each animal was determined according to the visual observations of the oestrous behaviour beside rectal palpation. Blood samples were withdrawn from the jugular vein by a venepuncture technique from all experimental animals. Plasma was separated and kept at –20ºC until biochemical analysis. Total proteins and albumim were determined according to Doumas and Biggs, 1972. Globulins were calculated by the difference between total proteins and albumin. Creatinine (Husdan 1968), cholesterol (Zoppi and Fellini, 1976), plasma GOT, GPT (Reitman and Frankel, 1957), alkaline phosphatase (Ratliff and Hall, 1973), calcium (Kepner and Hercules, 1963), inorganic phosphorus (Chen *et al*., 1956), glucose (Hyvarinen and Nikkila, 1962) were determined. Sodium and potassium were determined using the photometric technique. Data were statistically analyzed using a computer statistical program) SAS, 1992).

Results and Discussion

1 – Total Proteins, Albumin, Globulins and Creatinine

The mean values and ranges of blood plasma concentrations of total proteins, albumin, globulins and creatinine, are presented in Table (1).

TABLE 1. Concentrations of some blood plasma constituents in cyclic and acyclic Friesian cows.

Blood plasma constituents	Cyclic animals		Acyclic animals		Significance
	X ± SE	Range	X ± SE	Range	
Creatinine (mg/dl)	0.64 ± 0.06	0.54-0.72	0.60 ± 0.05	0.52-0.71	n.s.
Cholesterol (mg/100 m)	255.67 ± 8.32	145.43-317.00	187.76 ± 8.96	170.45-198.24	P < 0.01
Total proteins (g/100 ml)	7.27 ± 0.32	6.80-7.80	6.45 ± 0.49	5.20-6.80	P < 0.01
Albumin (g/100 ml)	3.81 ± 0.14	3.50-4.00	3.41 ± 0.26	2.80-3.70	P < 0.01
Globulins (g/100 ml)	3.46 ± 0.23	3.10-3.80	3.04 ± 0.31	2.40-3.40	P < 0.01
Glocose (mg/dl)	69.22 ± 4.37	60.42-74.60	52.11 ± 5.19	45.34-60.25	P < 0.01
GOT (IU/dl)	107.76 ± 4.77	98.25-114.23	88.28 ± 10.67	66.12-102.24	P < 0.01
GPT (IU/dl)	35.89 ± 2.67	33.12-42.11	31.48 ± 1.41	29.28-33.21	P < 0.01
Alk. Ph. (IU/dl)	12.2 ± 1.39	10.28-14.23	9.66 ± 0.51	8.90-10.40	P < 0.01
Calcium (mg/dl)	10.84 ± 1.01	9.80-12.60	8.49 ± 0.58	7.50-9.50	P < 0.01
Phosphorus (mg/dl)	6.12 ± 0.21	5.80-6.30	6.00 ± 0.19	5.70-6.20	n.s.
Sodium (meq/I)	90.37 ± 4.39	82.15-96.22	79.09 ± 3.81	70.11-84.24	P < 0.01
Potassium (meq/I)	2.75 ± 0.58	2.18-3.60	1.94 ± 0.20	1.70-2.30	P < 0.01
Chloride (meq/I)	93.26 ± 3.78	88.21-98.23	80.27 ± 3.07	76.14-85.22	P < 0.01

The normal cyclic and Friesian cows had significantly ($P < 0.01$) higher blood plasma levels of total proteins, albumin and globulins than those of acyclic cows, while creatinine was not significantly different. Chetty and Roa (1986), Dutta *et al.*, (1988), Vohra *et al.,* (1995), Arosh *et al.,* (1998) and Tandle *et al.*, (1998) also found similar results. Patil and Despande (1979) reported that certain amounts of proteins, albumin and globulins are necessary for the expression of oestrus in cows. In addition Breacten and Fuquary (1992), reported that deficiency in blood total proteins induced weak expression of oestrus. Vohra *et al.* (1995), suggested that the low levels of total proteins may cause a deficiency of certain amino acids required for gonadotropins synthesis. In the present study deficiency of total proteins, albumin and globulins may affect the boisynthesis of gonadotropins and gonadal hormones in acyclic Friesian cows.

2 – Cholesterol

The mean value of blood cholesterol in cyclic and acyclic Friesian cows were found to be 255.76 and 187.76 mg/dl, respectively, and the difference between both was significant ($P < 0.01$). These results agree with those of Dutta *et al.*,

(1988), Pual *et al.* (1991) Vohra *et al.* (1995) and Arosh *et al.* (1998). Cholesterol is the precursor for synthesis of steroid hormones, including male and female sex hormones. Pereek and Deen (1985) stated that subnormal energy of steroids hypocholesterolemia which in turn leads to improper output of steroids. The high level of cholesterol in cyclic animals is indicative of more secretion of steroids during oestrus due to increased ovarian activity (Dutta *et al.*, 1988). The declined level of cholesterol in the present study may be responsible for the reduced ovarian activity in acyclic cows.

3 – Glucose

The mean values of plasma glucose in cyclic and acyclic Friesian cows were 69.22 and 52.11 mg/dl, respectively, and the difference between both was significant ($P < 0.01$). The present results agree with those of Dutta *et al.* (1998). The plasma glucose concentration may effect the productive efficiency of the animal. The high plasma glucose level was reported to increase progesterone production directly by increasing pulses and mean concentration of LH (Richards *et al.*, 1989), and indirectly by increasing blood insulin levels which stimulate progesterone secretion from the luteal cells (McArdle and Holtfort, 1989), Howland *et al.* (1966) reported that hypoglycemia caused loss of ovarian activity by affecting the hypothalamus and the release of gonadotropins from the pituitary gland. The low plasma glucose level detected in anoestrus cows in the present study may indicate a hypophyseal ovarian axis resulting in acyclicity.

4 – GOT, GPT and Alkaline Phosphatase

The mean values and ranges of plasma GOT, GPT and alkaline phosphatase are presented in Table (1).

The normal oestrus Friesian cows had significantly ($P < 0.01$) higher levels of GOT, GPT and alkaline phosphatase than those of anoestrous cows. The present results are in agreement with the findings of Stallcupp *et al.* (1967), and Pual *et al.* (1991). Hormonal imbalance and deranged enzymatic action affect the normal reproductive behaviour of the animal and cause physiological alteration (Pual *et al.*, 1991). The plasma concentrations of GOT, GPT, and alkaline phosphatase are indicative for the physiological activity of the tissues. Rowlands (1977) showed that alkaline phosphatase activity was associated with pregnancy in Egyptian buffalo, being higher in the pregnant animals than in non pregnant ones. In the present study, the diminished concentration of GOT, GPT, and alkaline phosphatase may be associated with a reduced ovarian activity in the anoestrus cows.

5 – Some Plasma Elements

The mean values of plasma sodium (Na), potassium (K, chloride (Cl), calcium (Ca) and phosphorus (P), are presented in Table (1). Oestrus cows had significantly ($P < 0.01$) higher concentrations of Na, K, and Cl. These elements play an important role in the action of hormones and enzymes at subcellullar levels (Arosh *et al.*, 1998). These elements may act in an integrated fashion in the synthesis of reproductive hormones and on the action of such hormones on the reproductive organs and initiation of oestrus in cows.

The concentration of plasma calcium was significantly ($P < 0.01$) lower in acycling than in cycling cows, while the phosphorus level was not significantly different .The present results agree with those of Dutta *et al.* (1988) and Arosh *et al.* (1998). Pugh *et al. (*1985) reported that the altered dietary Ca/P ratio affects the reproductive performance of cattle. Moreover, calcium is involved in steroid biosynthesis (Shemesh *et al.*, 1984). Hurley and Doane (1989) showed that GnRH stimulation of LH release from hypophysis may occur in a calcium dependent manner and the LH is not released in the absence of calcium. On the other hand, phosphorus is often associated with reproductive abnormalities in cattle and its deficiency induces anoestrus and reduces ovarian activity (Pugh *et al*., 1985). Hurley and Doane (1989) reported that the hypophosphatemia affects most of the cell functions, as phosphorus is an integral component of nucleic acids, nucleotides, phospholipids and some proteins. Phosphorus is essential for transfer and utilization of energy, normal phospholipid metabolism and large number of coenzymes activation (Hurley and Doane, 1989). The role of calcium and phosphorus may be regarded as to their influence on the level of coenzyme system in the synthesis of hormones involved in reproduction (Arosh *et al.,* 1988).

It could be concluded from the present study that ovarian activity during estrous cycle or cyclicity in cattle may be dependent on different blood constituents, minerals and enzymes which are necessary for the synthesis and action of hormones involved in the follicular growth, ovulation and corpus luteum function.

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مقارنة بعض مكونات الدم بين أبقار الفريزيان المنتظمة وغير منتظمة الشبق

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المستخلص . تهدف هذه الدراسة إلى توضيح العلاقة بين الصورة الكيميائية للدم في كل من الأبقار الفريزيان المنتظمة وغير المنتظمة الشبق تحت ظروف شمال مصر . استخدمت في هذه الدراسة ٢٠ بقرة فريزيان يتراوح عمرها بين ٥–٧ سنوات وتم تقسيمهم إلى مجموعتين متساويتين حسب انتظام الشبق. وتم سحب عينات الدم من جميع الحيوانات الداخلة في التجربة وتم فصل البلازما والتي حفظت عند درجة –٢٠°م حتى التقدير الكيماوي. وتم تقدير كل من الكرياتينين ، الكوليسترول ، البروتين الكلي ، الألبومين ، الجلوبيولين ، الكالسيوم ، الفوسفور ، الصوديوم ، البوتاسيوم ، الكلوريد والانزيمات الكبدية. ولقد أوضحت النتائج أن الأبقار منتظمة الشبق ارتفع فيها مستوى كل من الكوليسترول ، البروتين الكلي ، الألبومين ، الجلوبيولين ، الجلوكوز ، الكالسيوم ، الصوديوم ، البوتاسيوم ، الكلوريد والانزيمات الكبدية عن الحيوانات غير المنتظمة الشبق ارتفاعا معنويا بينما هذه الزيادة كانت غير معنوية في كل من الكرياتينين والفوسفور.

وعلى ضوء هذه النتائج فإنه يمكن القول بأن هناك علاقة بين مكونات الدم ونواتج عملية التمثيل ونشاط المبيض في الحيوانات الموجودة في حالة شبق.