IMMUNOGLOBULIN CONCENTRATIONS IN THE SERA OF CAMEL CALVES BEFORE AND AFTER INGESTION OF COLOSTRUM AND DURING THE FIRST 8 MONTHS OF AGE

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Abstract

This study is a trial to focus light on the immunological status of the new born camel calves before and after ingestion of colostrum and during the first 8 months of life (weaning age). This was done through estimation of serum total protein levels and their fractions, mainly δ globulin fractions of 14 apparently healthy camel calves. Blood samples were collected just after birth before suckling and after suckling colostrum at different times till 8 months of age.

Serum total protein was found low att birth, then, it markedly increased postcolostral ingestion to reach its maximum level after 24 hours. This elevation might be due to concomitant rise in gamma globulins and albumin levels. Total protein level gradually decreased after 48 hours post-colostral ingestion and reached its normal level after one week. Albumin level was significantly elevated postcolostral ingestion and reached its maximum level after 24 hours, then, it significantly decreased till age of 2 weeks.

Alpha globulin showed higher levels at time of birth and 24 hours after ingestion of colostrum, then, it gradually decreased till the age of 3 weeks.

Beta globulin level was found low at birth, and progressively increased postcolostral ingestion for 2 days followed by gradual decrease till the age of one month.

Camel calves are born with low levels of gamma globulins in their sera, but their levels markedly rise 24 hours post-colostral ingestion. This makes its importance for the new born calves to secure the colostrum from their dams as soon as possible as they represent the principal mechanism by which young calves aquire maternal immunity. From the first to 8th months of age (weaning age) no significant differences were detected between protein levels and their fractions.

INTRODUCTION

Camel has been exploited by man for centuries in aird regions in Africa and Asia. They provide milk, meat, hair, hides, skin and manure. The one-humped Bedouin camel, either alone or together with sheep and goat husbandry, offers one possibility to combat malnutrition in perennial drought areas. Camels survive and produce milk for prolonged periods and under unfavourable conditions as they have the ability to survive to severe drought conditions. Milk production of camels in drought areas can be valuable source of food for human population. Despite their importance as milk producing animals, the lactation period varies from 8 to 18 months (Yagil, 1982). Milk secretion in the camel is stimulated by the calf by which it is suckled for about a year. There is sometimes an acute competition of milk between the calf and human, especially during the drier months of the year (Abdurahman, 1996). Calf mortality is reported to be high up to 35% in the camel, and it has been suggested that this is due to the competition for milk between calf and man (Schwartz and Walsh, 1992).

At birth, immunoglobulins (Ig) are either absent in the serum of domestic species or found at only low levels (Kaneko, 1989). Within few hours after ingestion of colostrum, the serum Ig levels rise, this represents the principal mechanism by which the young of most domestic animal species acquire maternal immunity (Webb *et al.*, 1983). Under normal environmental conditions, ingestion of colostrum is an absolute requirement for health during neonatal period (Kaneko, 1989). The Ig fraction is the essential factor in colostrum that protects against systemic infections (Penhal *et al.*, 1971). The time elapsing from birth to ingestion of colostrum, the method of ingestion (natural suckling, versus bucket feeding), season and familial factors, may have an important influence on serum gamma globulins (Kaneko *et al.*, 1989).

The mortality of hypogammaglobulinemic calves is higher than that of calves with normal serum δ globulins (McEwa *et al.*, 1970). In camel, the denial of colostrum to the calf by some pastoralists, mastitis and other diseases which reduce milk production might be contributing factors to high levels of calf mortality (Abdurahman, 1996).

Data about haematological and biochemical parameters of camel in the early phase of life were lcked. This study was conducted to determine the immune status of camel calves at birth, before and after ingestion with colostrum, and during the first 8 months of life. This was done through estimation of total protein levels and their fractions, mainly gamma globulin fractions durig the early phase of life for these calves.

MATERIALS AND METHODS

To perform this study, blood samples were collected from Bani-adi Village, Assiut Governorate from 14 apparentaly healthy camel calves. Samples were collected from new born calves before suckling colostrum and after 24 hours; 2,3,4 days; 1,2,3 weeks after suckling colostrum. These samples were also taken monthly from calves till the 8th month. These calves were kept with their dams and allowed to suckle at will. The animals (dams and calves) grazed daily and were supplemented, with green fooder and hay. Clean drinking water was available *ad. libitum*.

Sera were separated and used to determine total protein using the method of Peters (1968). Also, serum protein fractions were separated and measured by electrophoresis technique using cellulose acetate strips (Henry *et al.*, 1974).

Statistical analysis of data was performed by using the methods of Milton and Tsokos (1983) to assess the significance of difference between means using "t test" at each time point.

RESULTS AND DISCUSSION

The present investigation showed that, serum total protein of new born camel calves before ingestion of colostrum was significantly low (4.98 ± 0.11 g/dl) as compared with its mean value 24 hours after ingestion of colostrum (9.67 ± 0.10 gm/dl). The increase of total protein was accompanied by simultaneous increase in gamma globulin levels. The rise of serum δ globulin after 24 hours coincides with the high level of immunoglobulines in colostrum (Yagil, 1982). The rise of serum total protein is due to the concomitant rise in serum δ globulins, as in the albumin level 24 hours post-colostral ingestion (Table 1). Eckles *et al.* (1951) reported that the most striking difference between normal milk and colostrum is that globulin often reaches 12-13 times in the colostrum.

The serum total protein in camel calves reached its maximum level 24 hours post-colostrum ingestion, and then, it gradually decreased after 48 hours till it reached its normal level (7±0.15 g/dl). This result was confirmed by Abd El-Samee (1987) after 1 week (Table 1). This could be attributed to the high percentage of total solids in colostrum as its average reached 30.4 percent 3 hours post-partum, then, it decreased to 18.4 percent during the first 2 days after lactation due to decline in total protein and mineral levels (Ohris and Joshi, 1961). This property makes its importance for the new born calf to secure the colostrum milk from its mother as soon as possible after birth, as it contains antibodies which serve to protect the new-born calf against

the invasion of bacteria until the animal itself develops a resistance (Yagil, 1982). In buffaloand cow calves, serum total protein reached its maximum level 3 days after birth and after ingestion of colostrum (El Mulla, 1972), but not after 24 hours as shown in camel calves.

The level of albumin was relatively low in sera of newborn precolostral camel calves (3.11±0.14 gm/dl) as compared with its level 24 hours postcolostral ingestion (4.24±0.15 gm/dl). This is opposite to that reported for other animals. Albumin was gradually decrreased 48 hours postnatal life till age of 2 weeks. The significant elevation in the albumin level postcolostral ingestion ($P<0.001$) seems to be either due to increase in milk ingestion by the calf, and or the ability of the liver to synthesize albumin at considerable rate to meet the necessary requirements (Afzal and Khan, 1995).

Alpha globulin level was highest at time of birth and 24 hours after ingestion of colostrum. It was 1.114±0.015 gm/dl just at birth and 1.167±0.01 gm/dl after 24 hours from suckling colostrum, then, it gradually decreased 48 hours post suckling colostrum till the age of 3 weeks (Table 1). The decrease in alpha globulin may be due to the fact that it is particularly eliminated in the urine (Pedersen, 1947).

Regarding the beta globulin level, camel calves born are with low level of beta globulin (0.618 ± 0.03 gm/dl), then, it progressively increased for 2 daya after ingestion of colostrum, followed by gradual decrease till the age of 1 month.

The new born camel calves showed low levels of gamma globulins in their sera just after birth, then, the gamma globulin progresively increased to reach its maximum level 24 hours after they ingested colostrum. Its level was 2.89 ± 0.2 gm/dl after ingestion of colostrum followed by gradual decease (Table 1). The increase of gamma globulin is mainly due to the increase in the permeability of intestinal mucosa of camel calves to colostral globulins during the early 24 hours postnatal (Deutsch and Smith, 1957).

The results of this study indicate that the camel calf in its first days of life depends on its immunoglobulin largely, if not completely, on what is taken through the ingested colostrum. This is concurred with Webb *et al.* (1983) and Kaneko (1989) as they mentioned that the immunoglobulin fractions are essential factors in colostrum that protects against systemic infections. Also, the results of this work confirm the view of other workers who recorded that calves are born with scanty or without

Table 1. Serum total protein and its factions before and after ingestion of colostrum and during the first 8 months of age.

Time of Sampling	Total protein g/dl	Albumin g/dl	α globulin g/dl	β globulin g/dl	δ globulin g/dl	Total globulin g/dl	A/G ratio
Before suckling	4.892±0.11	3.11±0.14	1.114±0.015	0.618±0.03	0.05±0.01	1.782±0.06	1.745±0.119
After suckling 1 day	9.675±0.1 ***	4.242±0.15 ***	1.67±0.01 **	1.376±0.02 ***	2.89±0.2 ***	5.433±0.15 ***	0.781±0.11 ***
2 days	8.5±0.134 ***	3.863±0.09 ***	1.06±0.011 **	1.584±0.016 ***	1.933±0.13 ***	4.637±0.124 ***	0.833±0.12 ***
3 days	8±0.14 ***	3.65±0.04 ***	1.05±0.013 **	1.493±0.012 ***	1.807±0.11 ***	4.35±0.14 ***	0.839±0.04 ***
4 days	7.5±0.11 ***	3.45±0.04 *	0.898±0.02 ***	1.397±0.02 ***	1.755±0.08 ***	4.05±0.15 ***	0.852±0.06 ***
1st week	7±0.15 ***	3.43±0.03 *	0.856±0.015 ***	1.285±0.015 ***	1.429±0.04 ***	3.57±0.07 ***	0.961±0.05 ***
After 2 weeks	6.8±0.12 ***	3.34±0.09	0.851±0.013 ***	1.109±0.013 ***	1.54±0.03 ***	3.46±0.08 ***	0.965±0.04 ***
After 3 weeks	6.23±0.11 ***	3.121±0.1	0.694±0.15 **	1.082±0.018 ***	1.34±0.041 ***	3.11±0.05 ***	0.004±0.05 ***
After 1 month	5.5±0.57	3.11±0.162	0.764±0.5	0.868±0.36	0.758±0.33	2.39±0.6	1.301±0.6
At 2 month	5.48±0.5	3.00±0.2	0.860±0.4	0.742±0.59	0.878±0.4	2.48±0.7	1.2±0.5
At 3 month	5.45±0.7	3.11±0.35	0.861±0.34	0.741±0.4	0.738±0.5	2.34±0.5	1.33±0.8
At 4 month	5.47±0.55	3.12±0.2	0.860±0.36	0.736±0.5	0.754±0.36	2.35±0.67	1.33±0.5
At 5 month	5.5±0.68	3.11±0.35	0.796±0.4	0.740±0.35	0.854±0.4	2.39±0.6	1.3±0.7
At 6 month	5.51±0.4	3.15±0.22	0.861±0.3	0.730±0.46	0.769±0.3	2.4±0.8	1.3±0.5
At 7 month	5.7±0.5	3.15±0.5	0.858±0.55	0.742±0.3	0.95±0.4	2.55±0.7	1.24±0.6
At 8 month	5.79±0.4	3.3±0.45	0.864±0.4	0.740±0.25	1.066±0.5	2.67±0.6	1.24±0.4

Mean S.E *Significant at P < 0.05 **Significant at P < 0.01 ***Significant at P < 0.001

gamma globuulins in their sera which are passively acquired from the colostrum (Fay and Margadant, 1961). There is a relationship between the immunoglobulin levels measured in the first week of life and the susceptibility of calves to diseases (McEwan *et al.*, 1970).

No significant changes were detected in the levels of serum proteins, albumin and globulin from the first to the 8th months of age. These coincide with Afzal and Khan (1995). The total protein in camel calves sera was lower than that seen in adult camels (Sarwar *et al.*, 1991 and Afzal abd Khan, 1995). This was primarily due to lower globulin levels, since albumin levels were similar to those seen in adult camels. Albumin, besides maintaining osmotic pressure, also, acts as primary source of reserve amino acids for tissue proteins which are in high demand in young ones.

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تركيز جلوبيولينات المناعة في مصل صغار الجمل قبل وبعد تناول السرسوب وحتي الفطام

روضات علي مطاوع

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هذه الدراسة محاولة لإلقاء بعض الضوء علي الحالة المناعية لصغار الجمل حديثي الولادة قبل أخذ السرسوب وبعده وحتي سن الفطام (٨ شهور). حيث تم تقدير البروتين الكلي ففي المصل ثم تحليله كهربيا اثناء هذه الفترات في ١٤ من صغار الجمل حيث تم تجميع عينات دم من من هذه الجمال بعد الولادة وقبل رضاعة السرسوب ثم بعد أخذ السرسوب ثم علي فترات مختلفة وحتي عمر ٨ شهور. وقد وجد ان كمية البروتين الكلي في المصل منخفضة عند الولادة ثم زادت زيادة ملحوظة بعد اخذ السرسوب لتصل الي اعلي مستوي لها بعد ٢٤ ساعة وهذه الزيادة تعزي الي زيادة مستوي جلوبيولينات المناعة وزيادة كمية الألبيومين في المصل.

وقد قل مستوي البروتين الكلي في المصل تدريجيا بعد ٤٨ ساعة من أخذ السرسوب حتي وصل الي مستواه الطبيعي بعد أسبوع وقد أرتفع مستوي الألبيومين بعد رضاعة السرسوب ووصل الي اعلي مستوي له بعد ٢٤ ساعة ثم انخفض بالتدريج حتي وصل الي مستواه الطبيعي بعد أسبوعين.

وقد كانت الألفاجلوبيولين مرتفعة وقت الولادة وحتي بعد رضاعة السوسوب بأربعة وعشرين ساعة ثم أخذت في الإنخفاض تدريجيا حتي عمز شهر.

وكان مستوي البيتاجلوبيولين منخفضا عند الولادة ثم إزداد تدريجيا بعد رضاعة السوسوب ولمدة يومين ثم أخذ في الإنخفاض بالتدريج حتي وصل الي مستواه الطبيعي عند عمر شهر.

وصغار الجمل تولد وبها كمية ضئيلة من جلوبيولينات المناعة في مصلها ثم يزداد تركيز جلوبيولينات المناعة في مصلها زيادة ملحوظة بعد رضاعة السوسوب بـ ٢٤ ساعة مما يجعل من الأهمية تناول صغار الجمل لبن السوسوب من أمهاتها. بسرعة بقدر المستطاع حيث أنه الوسيلة الأساسية للغار للإكتساب المناعة المستمدة من الأم. هذا ولم توجد إختلافات معنوية في مستوي البروتين الكلي أو أجزائه من الشهر الأول وحتي الشهر الثامن (الفطام).