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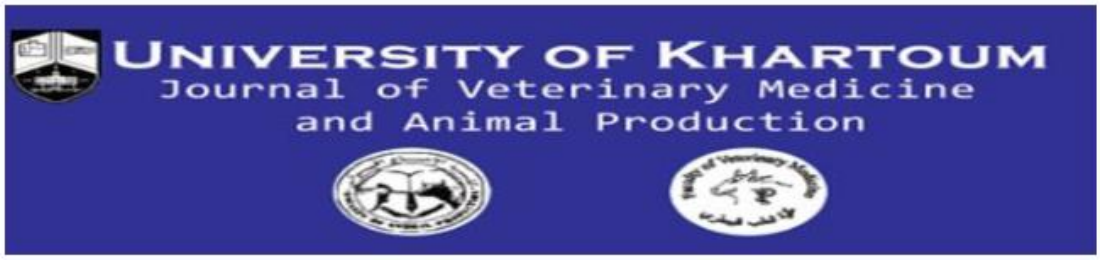

Effect of Colostral Period on Cows and She-Camels Colostrum Composition and Immunoglobulin Concentration

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Abstract

The present study was undertaken to investigate the impact of colostral period on colostrum composition and immunoglobulin (Ig) concentration of cows and she-camels. The study was conducted at two sites, the U. of K. Dairy farm and Tamboul Camel Research Centre (TCRC). Six cows and two she camel, immediately post-partum were selected from the U. of K. Dairy farm, and three post calving she-camels, were chosen from the TCRC.. A total of 66 colostrum samples representing two samples from each animal for the first three colostral days were collected and subjected to chemical analysis, by colostremeter apparatus. The results revealed significant ($P<0.01$) differences in the composition of the two species. The bovine colostrum significantly ($P<0.05$) exceeded camel colostrum in fat and ash while CP, TS, lactose and Ig were significantly ($P<0.05$)higher in camel colostrum. The Ig concentration in camel colostrum was twice that of cow colostrum. In both species, the first day colostrum samples significantly ($P<0.05$) secured the highest CP, fat, TS and Ig compared to the 2nd and 3rd day samples, while the lactose concentration was lowest in the first day samples and increased gradually in the successive days. The concentration of Ig in the first day samples was twice its concentration in the 2nd and three times greater in the 3rd day samples indicating the importance of feeding colostrum to the new born during the first 24 hours postpartum.

المستخلص

أجريت هذه الدراسة لمقارنة نوعية السرسوب في البقر والأبل ولدراسة تأثير فترة السرسوب في تركيب السرسوب المنتج .أجريت الدراسة في موقعين هما مزرعة جامعة الخرطوم ومحطة ابحاث الابل في تمبول . أختيرت ست أبقار حلوب مختلفة في عدد ولاداتها وناقتين كلاهما في الولدة الثالثة من قطيع مزرعة جامعة الخرطوم. كما أختيرت ثلاث نوق من محطة ابحاث الابل بتمبول. جمعت 66 عينة من السرسوب تمثل نوعية السرسوب فى البقر والابل وفترة السرسوب في الثلاثة ايام الاولي بعد الولادة . اوضحت النتائج فروقات معنوية في المكونات الكيميائية للسرسوب في الأبقار والجمال. تميز سرسوب الابقار باحتوائه علي كميات اكثر معنويا في الدهن والاملاح فيما تميز سرسوب النوق في البروتين الخام والجوامد الكلية واللاكتوز وقلوبيولينات المناعة. وبلغ تركيز قلوبيولينات المناعة في سرسوب النوق ضعف تركيزها في سرسوب الأبقار. دلت النتائج ايضا على أن سرسوب اليوم بعد الولادة في النوعين أحتوى على تركيز أعلى معنويا فى البروتين والدهن والجوامد الكلية وقلوبيولينات المناعة مقارنة باليوم الثاني والثالث، بينما كان تركيز اللاكتوز أدني معنويا في اليوم الاول وزاد تركيزه في الأيام التالية. بلغ تركيز قلوبيولينات المناعة في سرسوب اليوم الأول بعد الولادة ضعف تركيزه في اليوم الثاني وثلاثة اضعافه في اليوم الثالث بعد الولادة مؤكدا أهمية التغذية علي السرسوب خلال اليوم الاول بعد الولادة.

Introduction

Colostrum is considered as the most important food for the newly born during the first three days. The importance of colostrum stems from the fact its provide all needed nutrients and is very rich in carbohydrate, protein, lipid, vitamins and minerals. Moreover colostrum provides newborn by immunoglobulins and help in dispose meconium because of its laxative effect.

Colostrum is not only a source of nutrients such as protein, carbohydrate, fat, vitamins and minerals but it also contains several biologically active molecules which are essential for specific functions (Kukarni and Pimpale, 1989; and Playford, 2001).

Colostrum produced by cows during the first few days after calving differs significantly from milk with respect to composition. It is yellow alkaline thick and sticky. Colostrum contains more protein and has a higher concentration of lipids than milk. Other distinguishing features include a very high content of fat soluble vitamins, vitamin B12 and iron (Szulc and Zachwieja 1998)

The colostral period of the she camel colostrum is controversial. While some authors describe it as 5 days post partum, others postulated longer colostral periods (Musa, 2001).

Colostrum is a viscous mammary secretion during the first 3 days of lactation. It provides all the essential components of nutrition and passive immunity required by the newborn calf. It is characterized by a lemon –yellow colour and contains high quality protein, fat, essential minerals, vitamins and electrolytes. The unique character of colostrum is the high concentration of secretary Ig A antibodies which confer local gastrointestinal immunity to the new natal calves (Smith, 2002).

Colostrum is a mixture of lacteal secretions and constituents of blood serum such as immunoglobulin (Ig) and other serum proteins that accumulate in the mammary gland during the pre partum dry period and are collected via milking at parturition (Foley and Otterby, 1978).

The objective of the present study was to assess and compare the chemical and immunological quality of bovine and cameldiae colostrum at different parities and management system.

Material and Methods

Study site

The present work was carried out at two locations. The first experimental site is The Camel Research Center (CRC) afflicted to the University of Khartoum Dairy Farm. The second experimental site is Tamboul Camel Research Center (TCRC).

Experimental animals

Six lactating cows were selected, Immediately postpartum colostrum samples of 500ml each were collected from each cow on day one, day 2 and day 3 to cover the colostral period. The samples collected were deep freezed on collection day and transferred to the Milk Chemistry Laboratory (Faculity of Animal Production, U.of K.) for determination of chemical components. Concerning the camel colostrum, five she camels, three of which belong to Tamboul Camel Research Center (TCRC) and the other two from the CRC of University of Khartoum dairy farm were selected. The same procedure of colosrtoum sampling described for cows was adopted.

Chemical analysis of samples

Duplicate samples of colostrum for each day were subjected to analysis using the conventional methods.

Standardized colostrum samples were analyzed for fat content was determined using Gerber method (Marshall, 1993), protein content using Kjeldahl methods (Marshall, 1993)**,** total solids was determined by forced draft oven method (Bradley *et al.,* 1992) and Lactose content was determined by anthrone method (Richard, 1959)**.** However immunoglobulin analysis was carried out according to the manual instructions. (Fleenor and Stott, 1980).

Statistical analysis

The collected data was subjected to analysis of variance using General Liner Model (G.L.M) of statistical Package of social science (SPSS) Program.

Results and Discussion

The data pertaining to the mean chemical composition of colostrum obtained from cows and she-camel is portrayed in Table1.

The result indicated highly significant (P<0.01) differences between the two species, in fat, C.P, lactose, ash and Ig contents. The she camel colostrum contained a higher level of C.P, Lactose and Ig while, the cow colostrum was superior in fat and ash content. The she camel colostrum was also significantly,(P<0.05) higher in TS with concentration of 16.93±6.3% and 14.82±4.6% For the two species, respectively.

More over the camel colostrum is characterized by high Ig concentration that was approximately twice the Ig in bovine colostrum as the respective value were 61.80±28.29mg/ml and 38.08±29.91mg/ml for the she camel and cow, respectively. In the present study, the chemical composition of colostrum from the experimental animals showed wide variability with inconsistent pattern for almost all the studied components. This great disparity in composition had exerted their effect on the mean composition of colostrum for each individual animal.

Colostrum of cows maintained significantly (P<0.05) the higher content in, fat and ash compared to the colostrum of the-camel. The she camel colostrum was also significantly (P<0.05) higher in T.S, protein, lactose and Ig concentration.

The overall mean of colostrum samples from the experimental animals revealed that the lowest content was the fat (1.63±1.76%). This value was very much higher than normal fat content reported for colostrum in the camel. Zhang ***et al.*** (2005) reported a value of 0.27% for fat in colostrum, however the overall of colostrum in the cow recorded 7.88±4.487% for the fat. This value however was higher than what was found by Naylor *et al*. (1991) who reported 6.7% fat in bovine colostrum it was also higher than the result found by Szulc and Zachwieja (1998**)** who reported that bovine colostrum contain 7% fat. The different breeds used might have contributed to this disparity.

The overall mean of colostrum protein in cows in the third colostral days amounted to 2.40±1.86%.Polzin *et al*. (1977), Huber (1974), reported a higher mean of protein colostrum in the range of 4% to 5%. The overall mean of colostrum protein in the she camel during third colostrum days amounted to 9.58±5.02%. As reported by Abu-Lehia et al., (1989).The lower mean of protein colostrum was 4.02% in she-camels.

The lactose content of colostrum is minimum compared to lactose content of milk. This finding complies smoothly with previous finding authenticated by Czister and Dirijarea (2003), that lower lactose content in first day colostrum ensure high viscosity and prevent diarrhea. The concentration quality of colostrums. The density of colostrum is closely related to its protein. In first day colostrum indicates the immunological composition and provides information on its quality. Concentration of immunoglobulin are highest immediately following parturition and decrease rapidly with each subsequent milking Rauprich *et al.* (2000); Blum and Hammon (2000); Playford *et al.* (2000) and Blum (2006). The immunoglobulin concentration in this study was within the range reported by several previous authors. The present data indicated Ig concentration of 38.08±29.91 in cows which coincide well with the range (50-150mg/L) reported by Larson *et al*. (1980**);** and (40-90mg/L) as reported by Quigley *et al.* (2001; Kehoe *et al.* (2007) and Mehra *et al*. (2006).

The immunoglobulin in bovine colostrum varies widely based on number of pregnancies, the rate of transfried of compound to colostrum by mammary glands and the actual volume of colostrum produced.

The particulars of colostral day on the chemical composition of colostrum are stated in Table 2.

The data revealed a significant role of colostral days on fat, T.S, ash and Ig components. While C.P and lactose were not affected by colostral days, the first day samples secured significantly higher values in fat, T.S and Ig contents, while the 2nd colostral day excelled the 3rd day in T.S (13.04±2.19% and 10.87±0.58%), respectively.

The results also authenticated that first colostral day samples secured the highest immunological activity compared to the 2nd and 3rd days.

The Ig concentration in first day samples was approximately twice of that of the 2nd day and three times and greater than the 3rd day.

In the first colostral day the fat is high and then decrease on subsequent postpartum days with a non-consistent pattern. There was no particular trend observed for the fat content, which varied throughout sampling periods. The fat is the most variable constituent of milk depending widely on several factors such as breed, individuality of animal, stage of lactation, season of calving, nutritional status, type of feed, health, age of animal, interval between milking and the point during when sampling taken Fox and McSweany (1998).

The highest protein content in the first day of the colostral period secured a value of 2.76±1.68%. However lower than the value reported by folly and Otterby (1978). Other workers reported comparable values (14.9%) of first day colostrum protein Kehoe *et al*. (2007); and (16.2%) obtained Tsioulpas *et al*. (2007).

Table 1: Effect of species on chemical composition of colostrum from cows and she-camels

Variable	Cow	Camel	SL
Fat (%)	7.88±4.480[a]	1.63±1.764[b]	***
CP (%)	2.40±1.867[b]	9.58±5.027[a]	***
T.S (%)	14.82±4.672 [b]	16.93±6.324[a]	*
Lactose (%)	0.86±0.226 [b]	13.04±2.664[a]	***
Ash (%)	3.95±0.898 [a]	0.94±0.852[b]	***
Ig mg/mL	38.08±29.913 [b]	61.80±28.292[a]	***

In this table and subsequent ones a, b, c. different superscript along the column differ sig.
*> p0.05
***p>0.01

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Table 2: Effect of colostral days on colostrum quality of the cows

Colostral days				
Variable	**Day =1**	**Day =2**	**Day =3**	**SL**
CP%	2.76±1.689[a]	2.74±2.531[a]	1.70±1.009[a]	NS
Fat%	13.40±3.004[a]	5.58±1.919[b]	4.65±0.846[b]	***
Ash%	3.26±0.652[b]	4.03±0.714[a]	4.55±0.842[a]	***
TS%	20.56±2.813[a]	13.04±2.190[b]	10.87±0.585[c]	***
Lactose%	0.79±0.107[a]	0.88±0.339[a]	0.92±0.167[a]	NS
Ig mg/mL	60.66±32.850[a]	34.33±26.830[b]	19.25±9.459[b]	***

Table 3 portrayed the data on the effect of colostral days on colostrum quality of she-camel.

The results indicated that C.P, fat, T.S and Ig concentration were significant ($p<0.05$) affected by the trait, on the other hand the colostral days exerted a non-significant effect on lactose and ash component.

The first day colostrum was characterized by the highest values in C.P, T.S and Ig components. Also it was noticeable that the C.P, T.S and Ig tend to decrease progressively with advancing colostral days.

14.9%, 8.3%, 5.4% for C.P in first, 2nd, 3rd days. 22.2%, 14.5%, 13.9% for T.S .and 81, 63, 40 mg/ml for Ig for the respective colostral days.

The highest fat content was evident in the 3rd colostral day samples compared to the first and 2nd colostral days. The respective values were 2.78%, 1.84% and 0.27% for 3rd, 2nd and first colostral days, respectively.

. **Table 3: Effect of colostral days on colostrum quality of the she -camel**

Colostral days				
Variable	**Day =1**	**Day =2**	**Day =3**	**SL**
CP%	14.91±4.426[a]	8.35±2.933[b]	5.46±1.062[c]	***
Fat%	0.27±0.279[b]	1.84±1.567[a]	2.78±1.976[a]	***
Ash%	0.87±0.097[a]	1.21±1.482[a]	0.74±0510[a]	NS
TS%	22.24±8.648[a]	14.58±2.044[b]	13.95±1.597[b]	***
Lactose%	5.55±1.735[a]	5.63±3.258[a]	6.93±2.814[a]	NS
Ig mg/Ml	81.50±27.060[a]	63.00±26.381[a]	40.90±15.256[b]	***

Conclusion

The chemical characteristics of colostrum were greatly affected by colostral days and slighty by lactation number.

The method applied to assess colostral immunoglobulin have variable drawback, suggesting that testing colostrum with acolostrometer is not the most accurate method for testing colostrum for neonates, since it is not affected only by human error but environmental effects as well. The colostrometer apparatus is however easy,

simple and quick device to give a reasonable indication of the quality of colostrum. The study recommended that estimation of colostrum yield would have strengthened the study.

More studies are needed to investigate the immunological characteristic of colostrum and factors affecting it.

Colostrometer is useful and easy apparatus to use. Despite it is drawbacks it must be introduced widely in farms to insure and promote calves health.

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