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Comparative Study on the Chemical Composition of Cows, Goat and She Camels Colostrum during the First Three days after Parturition.

دراسة مقارنة المكونات الكيميائية لسرسوب البقر و الماعز والإبل خلال الثلاثة أيام الأولى بعد الولادة

A thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Masters of Science in Animal Production

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الآيـــــــــــة

بِسْمِ اللهِ الرَّحْمنِ الرَّحِيمِ

قال تعالى:

﴿ وَإِنَّ لَكُمْ فِي الأَنْعَامِ لَعِبْرَةً نُّسْقِيكُم مِّمَّا فِي بُطُونِهِ مِن بَيْنِ فَرْثٍ وَدَمٍ لَّبَناً خَالِصاً سَآئِغاً لِلشَّارِبِينَ ﴾

صدق الله العظيم

النحل الآية (٦٦)

DEDICATION

I dedicate this work to the candle that lights the way in my life.

My mother

To the angle who spent all his life to make me happy.

My father

To those persons who taught us the meaning of life

My brothers and sisters

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First of all thanks go to ALLAH for his mercy and for sending the sun light every day and giving us the reasons for Research and knowledge. I would like to express my sincere appreciation to professor: ***Dr. Abd Aziz Makkawi Abdel Rahman*** *for his support, guidance and professional supervision may ALLAH blesses him.*

Thank for the all animal production department staff, and a very grateful thanks extended to Animal production department labors.

Also my deep thanks are to camel research center staff, and Special thanks appreciation are to food research center laboratory staff, for their help during the chemical analysis of the samples.

Abstract

The present study was undertaken to compare the chemical composition of the colostrums of cows, goat and she camel's species during the first three days after parturition. Camel colostrums was collected from camel research center University of Khartoum (Shambat), cows and goat colostrums collected from the department of animal production dairy farm college of agriculture studies, Sudan University of science and Technology (Shambat). The total of the samples was 45 samples from 15 animals (3 samples from each animal in 3 days) .The parity order of the species was similar (one animal from each species in the2nd parity, one animal from each species in the 3rd parity, two animal from each species in the 4th parity and one animal from each species in the 5th parity). Fresh colostrum were analysed to test its chemical composition. The result showed significant differences between species in fat, lactose, SNF and acidity. Lactose and SNF were higher in camel colostrums than that found in goats and cows colostrums; while fat is highest in goat's colostrums and cow's colostrums have higher acidity .There were no significant differences between the colostrums of the three species in the rest of the colostrums components. Also the result showed high significant differences between the three days in all species of the

experiment , the first day was the highest in protein ,fat , ash , TS,SNF and acidity ,while the third day was higher in moisture and pH, and there was no significant difference between the three days in lactose . The study showed no significant differences between parity order, within the different species.

الخلاصة

أجريت هذه الدراسة لمقارنة المكونات الكيميائية لسرسوب الابقار و الماعز و الإبل في الثلاثة ايام الاولي بعد الولادة . تم جمع عينات سرسوب الإبل من مزرعة مركز ابحاث الإبل جامعة الخرطوم (شمبات) ، و عينات السرسوب للابقار و الماعز من مزرعة الانتاج الحيواني ' كلية الدراسات الزراعة جامعة السودان للعلوم والتكنولوجيا (شمبات) . حيث تم جمع ٤٥ عينة سرسوب من ١٥ حيوان بواقع ٣ عينات من كل حيوان موزعة علي الايام الثلاثة الاولي بعد الولادة ، كانت عدد الولدات في ترتيب متشابه لكل الفصائل (عدد واحد حيوان من كل فصيلة في الولدة الثانية و عدد واحد حيوان من كل فصيلة في الولدة الثالثة و عدد اثنين حيوان من كل فصيلة في الولدة الرابعة و عدد واحد حيوان من كل فصيلة في الولدة الخامسة).تم تحليل عينات السرسوب لاختبار الصفات الكيميائية . أظهرت النتائج وجود فروقات معنوية بين الفصائل في الدهن واللاكتوز و الجوامد الصلبة اللادهنية و الحموضة، حيث كان سرسوب الابل الاعلي في اللاكتوز و الجوامد الصلبة اللادهنية بينما كان سرسوب الماعز الاعلي في الدهن وسرسوب البقر الاعلي في الحموضة ولا توجد فروقات معنوية بين سرسوب الفصائل الثلاثة في باقي مكونات السرسوب، و كذلك اظهرت النتائج فروقات معنوية بين الايام الثلاثة حيث كان سرسوب اليوم الاول الاعلي في البروتين و الدهن و الجوامد الصلبة الكلية و الجوامد الصلبة اللادهنية و الرماد و الحموضة بينما كان سرسوب اليوم الثالث الاعلي في الما ء وال pH

ولاتوجد فروقات معنوية في اللاكتوز ، اما عدد الولادات لم تظهر فروقات معنوية بين الانواع المختلفة من الحيوانات.

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CHAPTER ONE

INTRODUCTION

Sudan ranks first among the Arab countries and second in Africa with respect to animal population. According to Federal Ministry for Animal Resources Fishery and Range (2012) numbers of livestock in Sudan are 29,618,000 cows, 39,296,000 sheep,30,649,000 goats and 4,715,000 camels, will a total 104,278,000 head.

Generally defined, milk is the fluid secretion of the female mammary gland; through species-specific adaptations it largely meets the unique nutritional requirements of the neonate of the species. The composition of the secretion is quite dynamic over the period of lactation, reflecting the changing metabolic needs of the offspring from birth through to weaning. Colostrums is somewhat variously defined, as the secretion of the mammary gland produced immediately after parturition (Levieux and Ollier, 1999) or through the first few days after birth (Tsioulpas et al., 2007).

The Nubian goat is the only specialized milk breed (Gubartallah et al ,2005). The majority of Nubian goats are reared in the northern part of the country north of latitude 12º .This breed plays an important role in the life of many families as a favorite animal kept for milk production (Abdelatif et al, 2009). Ismail et al,(2011) stated that Sudanese desert goats are mainly found in the western region of the Sudan which includes Dar-fur and Kordofan states.

The most important factor in calves management is colostrum feeding , which is a key factor for their survival ,since it provides

immunity, Boyd (1972). Kids are agammaglobulinemic at birth (Constant et al.,1994;Argiiello et al.,2004),therefore need to be fed colostrum during the first hours after birth. Indeed, the percentage of newborn kids that survive is correlated with the colostrum fed in the first 2 days postpartum (Morand –Fehr,1989).

Feeding kids the correct amount of high-quality colostrum immediately after birth is one of the most important management practices in kid management. Colostrum is so important that sometimes it is called “gold liquid”. Colostrum is very rich in proteins, vitamin A, and sodium chloride, but contains lower amounts of carbohydrates, lipids, and potassium than mature milk. The most pertinent bioactive components in colostrum are growth factors and antimicrobial factors. The antibodies in colostrum provide passive immunity, while growth factors stimulate the development of the gut. They are passed to the neonate and provide the first protection against pathogens. Jenn Bentley et al., (2014)

All mammals produce colostrum. It is the thick, yellowish, first milk produced by the female after she gives birth. Colostrum is rich in energy, protein, vitamins, and minerals. Most importantly, it contains maternal antibodies that help protect the newborn from disease pathogens during the early part of its life. Immediately after birth, kids are exposed to a variety of infectious agents present in the environment, the doe, and other goats. Without any protection from these infectious organisms, the kids may become diseased and die. Larry Tranel et al., (2 014)

At birth, the kid does not carry any antibodies against these organisms because antibodies in the doe’s bloodstream do not cross the placenta. However, these antibodies are concentrated in the colostrum and provide a natural and efficient source of protection against many intestinal, respiratory, and other diseases.

Vaccinating for diseases such as enterotoxemia and tetanus prior to kidding is important, since antibodies against these diseases will then be contained in the colostrum. Additionally, colostrum provides the energy needed to stay warm and acts as a laxative to ensure excretion of meconium.(Argiiello et al ,.2006).

The objective of the present study is to assess and compare the chemical composition colostrum between the cow, goat and she camel.

CHAPTER TWO

Literature Review

2.1 Colostrums definition:

All mammals produce colostrum. It is the thick, yellowish "first milk" that is produced by the female after she gives birth (parturition). Colostrum is rich in energy, protein, vitamins and minerals. Most importantly, it contains maternal antibodies that help protect the newborn from disease pathogens during the early part of its life. Ewes and does only produce colostrum for about 24 hours (plus or minus a few hours) after delivering their offspring. Colostrums is a viscous mammary secretion during the first three days of lactation. It provides all the essential components of nutrition and passive immunity required by the newborn calf. Colostrum is somewhat variously defined, as the secretion of the mammary gland produced immediately after parturition (Levieux and Ollier 1999).

Or through the first few days after birth. It is characterized by a lemon – yellow colour and contains high quality protein fat, essential minerals, vitamins and electrolytes . The unique character of colostrums is the high concentration of secretary Ig A antibodies which confer local gastrointestinal immunity to the new natal calves (Tsioulpas et al., 2007).

Colostrums 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 per partum dry period and are collected via milking at parturition (Folet and Otterby, 1978).

2.2 **Colostrogenesis**:

This is the process of colostrums synthesis by the lactating udder, in contrast to lactogensis which described the synthesis of milk. Colostrogenesis is initiated during the last days perpartum during the dry period .The triggering mechanism of colostrogensis is the increase receptor sites for prolactin and growth hormone which synergize to stimulate the production of suitable enzymes for the formation of triglycerides , lactose and casein Moreover formation of protein and epithelia cell division will be enhanced (Brandon,. et al 1971) .

The composition of colostrum differs markedly from the mature milk produced later, reflecting a difference in the biological function of the two materials. Bovine colostrum has a much higher total solids content than mature bovine milk, manifested largely in a significantly higher protein content and a slightly higher fat content, but it has lower contents of ash and lactose (Kehoe et al., 2007)

2.3 **Physical properties of colostrums:**

Attention was paid to the colostrums physical properties.The properties include pH ,taste, odour ,acidity and other comparative physical characteristics of colostrums and milk .

2.4 chemical composition of colostrum:

Chemical composition and physical properties depend on various factors including the age of animal ,number of lactation cycles, breed , and disease (Horne et.al .,1986, Rodriguez et.al., 2001)..The gestational nutrition affects colostrums and milk yield and nutrient content, even when lactation nutrient requirements are met. Meyer et.al. (2011). Studies indicated the presence of different factors affecting milk composition , of these is parity, primiparous cows produced less colostrums (Robinson et.al 2009) . Factors such as number of parity and genotype do seem to influence colostrums yield and composition (Farmer and Quesnel,2009).

2.5 Colostrum composition of cows :

Colostrums 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, vitaminB_{12} and iron (Szulc and Zachwieja,.1998).

2.5.1 Water in colostrum:

Water is the main constituent of colostrums and it forms the major part of it . water secreted in association with water soluble consiituene such as sodium , potassium and chlorine . found that bovine colostrums contain 77.5 % water ewe colostrum contain 58.8% water (Long 1961) .

2.5.2 Fat in colostrum :

Fat is the most variable constituent of milk that depended widely on several factors including breed, individuality of animal, stage of lactation, season, nutritional, stage type of feed, health and age of animal,interval between milking and point during when sample is taken (Fox and Mc Sweanl 1998). A high yield of milk usually is associated with low fat content and a low yield favors a high fat content (King , 1980 ,)Roy (1980) reported that colostrums contains 3.5% while Naylor et al , (1991) reported a higher value of 6.7%. In another study conducted by (Kehoe et al 2007) they found that the fat ranged from 0.3% to 18% . In constrast (Tsioulaps et al ,.2007) postulated fat content of bovine colostrum as 3.6 %other found the content of fat in bovine colostrums about 7% (Szulc and Zachwieja 1998).

Foley and Otterby (1978) claimed that fat percentage in colostrums was 6.7% compared to 4% in mature milk . Huber (1974) reported that bovine colostrums has fat content in the range of to4 - 5%. Bovine mature milk contain (. Walstra,2006).

Colostrums also is rich in fatty acids . Santschi(2009) demonstrated a fatty acids profile of bovine colostrums as 65.5% ,25.5% ,3.6% are saturated, mono – saturated and poly unsaturated fatty acids respectively . Hassbao (2001)studied the milk composition of dairy cattle of kenana sugar company and reported that fat values were 5.3 %and 4.7% , 4.55% and 3.45% for the kenana type 50% ,62.5% and 75% cross pedigreds friesion x kenana respectively. Reported that local Sudanese cattle produce fat ranging between 3.4 -5.9 % with a mean of 4.5 % . sheep colostrums in early posportum period has higher fat content 13% (Anifantakis 1986).

Camel colostrum contain about 0.27 % fat this result was postulated by Zhang et al ,(2005) Musa (2001) found that camel colostrums content 30.1±19.5 g/l . The content of mono-unsaturated ,poly unsaturated and straight –chain saturated fatty acid were 14-16 in colostrums ewes. The colostrums of individual ewes kept under indentical living and feeding conditions displays high variability mainly in the content of individual branch – chain saturated fatty acids (Gorova et al,2011) . cows kept on control diet had higher milk butter fat content than those on baobab (Adansonia digitata L) and seed cake based diets (Madzimure et al,2011).

2.5.3 Protein in colostrum:

The protein component varies considerably , but not as much as the fat . The protein content varies among species from 1% to 14% Fox et al. ,(1998) . In general protein plays crucial role in animal metabolism acting as enzymes , hormones transport protein , structural protein and protective structures . Additionally they contribute to the nutrition of mammals by supplying easily digestible and readily absorbable energy , as well as high level of essential amino acids .

Milk can be classified as major (98%) of total milk protein and minor (2%) of total milk proteins. Major milk proteins comprise casein and whey protein ,while minor milk protein include the actual minor protein (lactoferrin), milk fat globule membrane protein , and all of milk enzymes (Topel, 2004) .Roy (1980) found that colostrums contain about 14.3% protein in first 24 hours after calving . The protein of milk is one of the most constituent which affected by heat Fox and McS Weeney (1998).

Kehoe et al ,(2007) found that bovine colostrums contain about 14.9 %protein while Tisioulaps et al, (2007) postulated percentage of protein in bovine colostrums is in the range of 16.2% . colostrum content of casein is lower than casein content in milk (Ontsouka et al ,2003) .

Musa (2001) reported that camel colostrums has a protein content about 58.0± 14g/l whereas Zhang et al, (2005) reported that the camel colostrums contain a value of 14.23 % protein . In Sows , the protein composition in colostrums and milk varied markedly with the anatomical location of mammary glands (Wu et al, 2010) .

The total nitrogen content average 1.13% , with 74% in the non- protein nitrogen fraction . producing an apparent protein content of 1.9% (Christiansen et al, 2010) . The protein content differ across

all treatment groups with cows on 15% BSC producing the highest protein content 3.43% while the control had the least 2.6% (Madzimure et al, 2011).

2.5.4 Lactose in colostrum:

Lactose is the main carbohydrate found and is essentially unique to milk (Yagil and Etozin , 1980,Abu – Iehia 1989) . Approximately 26% of the energy , in cow's milk is represented by lactose (Jackson 2003) . The content of lactose in colostrums is lower than those in milk (Ontsouka et al , 2003) . Kehoe et al ,(2007) reported that cows colostrums has 2.5% lactose content, whereas Tsiouloas et al.,(2007) found that lactose in cows colostrums accounted about 2.7%. Bovine colostrums has lower lactose content 2.5% versus 4% in mature milk (Kehoe et al , 2007) . The Holstein cows colostrums contains lower lactose 2.3% compared with mature milk (Nylor et al, 1991). The mean percentage of lactose in colostrums is 2.7% ,whereas in mature milk 5% (Foley and Otterby ,1978) . Stated that cow colostrums has 3% lactose content in the first 24 hours after calving.

Ali (1973) found that mature cow milk contains about 3% to 6.5 % with mean value of 4.97 % Anifantakis (1986) compared in his study between ewe colostrums and cow colostrums . he found that ewe colostrums has higher concentration in basic nutrients including lactose with a value of 3.3%.

2.5.5 Total solids of colostrum:

Roy (1980) reported that colostrums contain 22.5% total solid during the first 24 hours while mature milk contain 12.5 % total solid .Kehoe et al , (2007) found that bovine colostrums contain about

27.6% total solids . A percentage of 14 to 18 % total solids in colostrums was reported (Daniels et al ,1977) .

Anifantkis (1986) reported that sheep colostrums contain about 28.9 % total solids . Zhang et al , (2005) reported that camel colostrums contain about 20.16 % total solids.

Cows on the control diet had higher milk butterfat content than those on the BSC –based diets . Protein content differed across all treatment groups with cows on 15% BSC , producing the highest protein content (3.43%) while the control had the least 2.6% . The concentration of milk total solids for cows fed on 15% body conditions score BSC was higher than that from cows on other diets . Lactose content was not affected by the diets (Madzimure et al , 2011).

2.5.6 Minerals content:

Kume and Tanade (1993) indicated that the colostrums concentration of calcium , phosphorus ,magnesium ,sodium , copper ,and manganese are highest at parturition and decrease rapidly by 24 hours postpartum .

Kehoe et al ,(2007) reported that concentrations of macro elements in colostrums were 1.1g /kg sodium , 2.8g/kg potassium , 4.7 g/kg calcium , and 0.79g/kg magnesium , while in mature milk the respective values were 0.5g/kg sodium ,1.5g/kg potassium ,1.2g/kg calcium , and .1g/kg magnesium.

In camel ´s colostrums minerals showed high variations with lower values the first day after parturition and variable changes up to the end of week where the values were stabilized .

2.5.7 vitamins:

Milk in addition to protein , carbohydrate , lipids and minerals also contain vitamins . These include the fat soluble vitamins (A,D,E,K). In addition to vitaminA(Sawaya et al, 1984).

2.6 Effect of Parity order on chemical composition of cows colostrums:

The chemical composition of colostrums of first parity cows contains higher components than second and subsequent parities. Both fat and protein decreases with succeeding parities while lactose content increases. lactose in colostrums is lower than in milk because lactose has osmotic effects. It causes water influx in milk. Lower values of lactose in colostrums ensure high viscosity of colostrums and prevents diarrhea in newborn, Day one colostrums is characterized by a high content of total protein (15.14-1568% (Zarcula et al. , 2010).

Mohammed (2011) reported that colostrums chemical composition obtained from parity order of cow, in first parity found fat ,protein , T.S ,and lactose ,4.21%,6.52%,15.56% and 2.49% respectively. And 3th parity found fat ,protein ,T.S, and lactose ,3.56%,6.77%,16.77% and 2.75% respectively. And 4th parity found fat , protein , T.S and lactose ,3.57%, 7.40%, 15.70% and 2.49% respectively. And > 5th parity found fat , protein , T.S and lactose , 3.09% ,5.96%, 13.78% , 1.99% respectively.

Mustafa(2014) reported that colostrums chemical composition obtained from parity order of cow, in second parity found fat ,protein , T.S , lactose and ash 6.33%,2.25%, 13.55%, 0.84% and 3.87 respectively. And 4th parity found fat ,protein , T.S , lactose and ash 8.89%, 1.39%, 15.39%, 0.92% and 3.83% respectively. And 5th parity found fat ,protein , T.S , lactose and ash,8.60%, 1.22%, 14.44%, 0.85%, and 3.72% respectively.

Foley and Otterby (1978) reported that colostrums obtained from Holstein contained 6.7% fat , 14% protein 2.7% lactose . In their study on colostrums from Rommanian black and white cows stated 11.56 % for fat, 17.73% for protein 1.89% lactose. Tsioulpas (2007) on the other hand indicated that the total protein colostrums declined rapidly from 16.1% in day one to 5.43% on two and then continued to decreases on the third day and maintain a constant value of 3.08% afterwards . Both foley et a (1978) and Sordillo et al (1997) observed the high protein content of colostrums during the early postpartum period. Lactos content on the other hand was very low on day -one postpartum and tends to increase progressively up to the both postpartum to maintain a constant normal level .

Foley et al., (1978) noted that lactose contributes to one -third of the osmotic equilibrium in milk. furthermore they reported that during the first day postpartum, lactose content is inversely proportional to the concentration to maintain the osmotic pressure in equilibrium , cows parity, feed intake ,breed and milk yield influenced the chemical composition of colostrums .

The concentration of total protein, fat ,lactose , in all colostrums samples during the first 80h after calving. The protein content decreased with time while the concentration of lactose increased, No effect on the fat content was observed. This observation of general composition of colostrums are in line with previous reports (Foley and Atterby , 1978). The composition of colostrums in the cow is similar to that of blood and differs significantly from milk (Blum ,2006).

2 .7 Camel colostrums:

The data pertaining the chemical composition of camel colostrum and milk witnessed variable citations. The variations in composition can be referred to several factors including breed parity order , age and type of nutrition, water availability , general management, season and reproductive status (Wilson,1990).

The camel colostrum is generally opaque – white of slight yellow, with sweet and sharp taste caused by the type of fodder and availability of drinking water. Differences in camel colostrum composition may be due to physiological, behavior, type of feed and age of animal (Yagil et.,al 1994).

The main components of camel colostrum are proteins , fats ,density ,lactose , and total solids ;it also contains minor components such as vitamins and trace elements (Ramet,2001).

Zhang et al.,(2005) reported that camel colostrum taken two hours postpartum is composed of the following components 14.23%protein,4.44%lactose ,0.27%fat,0.77Ash , and 20.16 % total solids. In another study conducted by Abu-Lehia et al ,.(1989),the authors found that at parturition the colostrum comprised 0.20 %fat ,13%protein ,2.6%,0.99%ash ,20.49%total solids. Zhang et al ,(2005) reported that camel colostrums has lactose content of about 4.44% . Musa (2001) compared in has study the composition of camel colostrums and normal milk . The a other stated that colostrums contain 27.5±5.5 g/l ,as compared with normal milk 25.6 ±1.09g/l . carbohydrate analysis of bovine colostrums showed an average of 58.2% lactose mono hydrate with no monosaccharide s , other disaccharides ,triodes , or tetroses detected Christiansen et al,(2010) Gorban et al .,(1997) reported that the fat content in camel colostrum (1-

7days postpartum) amounted to 30.1± 19.5g/l and which increased in milk (10-240days postpartum) to 32.8±14g/l .

Khalid et al., (2007) reported a range of 35.7-35.5g/l for protein ,34.10-31.20g/l for fat and 29.2-23.10g/l for lactose ,the wide variation in lactose content was evident.

2.7.1 Effect of Parity order on chemical composition of camel colostrums:

Variations in colostrum composition of camel have been well documented in the literature . These variations arise from a variety factors including ; breed differences , parity order, age of the animal, type of nutrition water availability, season of the year and general management (Yagil et al .,1994).

Mustafa(2014) reported that colostrums obtained from parity order chemical composition of camel, in 3rd parity found fat, protein, T.S, lactose and ash 1.98%, 10.48%, 16.70%, 6.44%, and 1.10% respectively.And 4th parity found fat, protein, T.S, lactose and ash 1.60%, 5.68%, 18.37%, 6.10% and 0.71% respectively. And 5th parity found fat, protein, T.S, lactose and ash0.56%, 10.75%, 16.16%, 4.78% and 0.68% respectively.

2. 8 Goat colostrums:

Colostrum feeding in small ruminants is crucial during the first hours after birth due to the lack of Ig transfer during pregnancy via the placenta. In addition the immature immune system of the neonate is slow to produce its own Ig during the first weeks of life.

Colostrogenesis, i.e. the transfer of Ig from blood into mammary secretions, starts several weeks prepartum. In goat plasma, immunoglobulin G (IgG) concentration decreases by around 38% from

the third month of gestation until partum, which coincides with the dry period. Thus, management during the dry period is crucial for the course of colostrogenesis. The colostrum synthesis is determined by the nutrition during the prepartum period, but the transfer of Ig is obviously independent of nutritional influences (Argiiello., et al 2004)

The levels of protein and total IgG contents dropped quickly from the time of birth to 132 h postpartum, whereas fat content increased from birth to 24 h postpartum and subsequently decreased until 132 h postpartum. The lactose content increased slightly from birth to 132 h postpartum and pH and electric conductivity increased slightly, whilst density values dropped quickly after partum, also the levels of protein and total Ig contents dropped quickly from the time of birth to 132h postpartum, The concentrations of dry matter, fat, ash, lactose, protein and IgG at 3 h of lactation were 21.23%, 7.73%, 1.57%, 1.93%, 10.24% and 72.01 mg/mL respectively (Argiiello., et al 2006).

The consumption of colostrum by the progeny of ruminant species (cow, sheep, and goat) has a fundamental role in passive immune transfer and in the survival rate of newborns (Lascelles 1979) as they are born hypo-gammaglobulinemic. For this reason, animals growing under an artificial rearing system need to be fed, by bottle, an adequate amount of colostrum during their first days of life, to obtain adequate passive immune transfer and increase future productivity, Nevertheless the amount of colostrum produced by the dam and its composition can be affected by several factors such as nutrition or litter size (Banchero et al., 2004). In addition, lambs fed an inadequate amount of colostrum in the first hours of life are more susceptible to disease and mortality (Ahmad et al., 2000).Therefore, it is crucial to provide an optimal colostrum source, and consequently, several studies have investigated the use of bovine colostrum as an alternative source to feed lambs in early life (Quigley et

al., 2002; Moretti et al., 2010). However, studies report that lambs fed with cow colostrum run the risk of developing anemia (Winter and Clarkson, 1992; Winter, 2011; Ruby et al., 2012). For this reason, it is necessary to study another colostrum source from a phylogenetically closer species, such as goat, which may provide similar passive immune transfer to sheep colostrum and therefore would not affect the future performance of the offspring.

Timing of the first colostrum feeding (**TFCF**) is another important factor that affects immune status and, therefore, the future productivity of adult animals (Hernández-Castellano et al., 2011). For ruminants, the period between 12 and 36 h after birth is critical for absorption of colostrum IgG (Chen et al., 1999). t

One of the most important immune variables is the immunoglobulin concentration (mainly IgG and IgM). However, other immune variables directly affect lamb immune status, such as chitotriosidase (**ChT**) activity and complement system activity, and play an important role in the final animal productivity. As described by Argüello et al. (2008), ChT is an important component of innate immunity against chitin-containing pathogens. Chitotriosidase is a functional chitinase with a high homology to chitinases that belong to family 18 of glycosyl hydrolasesComplement system activity—comprising the total (**TCA**) and alternative (**ACA**) pathways—plays an important role in host defense mechanisms against infectious microbes, because it is involved in specific and nonspecific immunity (Rodríguez et al., 2008).

The study on performance of Toggenburg dairy goats under smallholder production systems reported lactation length (LL) was significantly affected by parity,(LL) was longest for dose in their 3th parity (296days) and shortest for first parity (201days) (Ahuya et al ,.

2009). Parity influenced lactation length of Maltese goats, and days in milking ranging between (244days) for goats in their first parity to (257days) for goats in their 4th parity (Carnicella et al 2008).

Dry period is which extended from the end of lactation to the following parturition. This period should be at least 6-8 weeks to allow the doe to build up enough reserves for coming lactation and to provide nutrients for the fetus (Kudouda,1985).

Min et al .,(2005) found the milk production and composition were affected by feeding treatment. Increased levels of concentrate supplementation led to 22% greater milk yield compared to other diets . He also stated that better nutrition lead to an increase in daily milk yield and persistency.

2.9 Colostrum quality :

Colostrums quality is an important factor in calves survival . Acquisition of high colostrums is an important factor influencing neonatal calf health .It is measured by the amount of immunoglobulin found in colostrums. Generally values less than 20mg/l indicates poor quality ,20to 50mg/l moderate and greater than 50mg/l excellent quality (Shearer et al, 1992).

The first step to ensuring adequate levels of serum Ig in calves is to provide them with high quality colostrum. However colostrum quality is influenced by a variety of factors breed and lactation number, The breed of animal from which colostrum is harvested plays in important role in quality of colostrum, (Muller and Ellinger 1981).

In addition to breed differences, the parity (or lactation number) of a cow will also influence colostrum quality .The concentration of Ig is lower in the colostrum of first calf heifers than older cows .This because

first calf heifers have probably not exposed to as many herd specific pathogens as older cows,(Hunt,1990)

2.10 Colostrum preservation :

Regular supply of high quality colostrums is an essenyial part of all new born calves production system . In some situation , colostrums may be unavailable from the dam ,or it is of poor quality . One strategy to prevent bacterial proliferation in the storage of colostrums include freezing , refrigeration, and the use of preservative agents such as potassium sorbate for refrigerated fresh colostrums (Stewart et al , 2005).

CHAPTER THREE

Material and Methods

3.1 The site of the study:

This study was conducted at the farm of the animal production department college of Agricultural studies (Shambat),Sudan University of science and Technology, and the camel research center University of Khartoum (Shambat), during the period (9 October2014 -20 February 2015).

3.2 Experimental Animal:

Fifteen experimental animals of different spp.(cow, goat and she camel), divided as following five cows, five goats and five she camels, each breed at second, 3rd, 4th (2 animals) and 5^{th} parity. 500ml colostrums sample were collected from each breed. In one day, two days and three days after calving, collected sample colostrum in the morning.

3.3 Feeding program:

The dairy animals (cows, goats and she camels) are managed in a semi intensive system .the animals were allowed grazing during the morning hours and concentrate mixed was offered at the milking time for cows in addition to Abo70 green forage, also concentrate mixed was offered at the morning in addition to the forage for the camels, but there no concentrate for goats only green forage for them. The cows concentrate ingredients were sorghum grain, ground nuts cake ,wheat bran ,molasses salt and lime stone, in percentage, 40%, 20%, 17%, 20%, 1%, 2% respectively,

and the camels concentrate ingredients were sorghum grain, ground nuts cake, wheat bran ,sorghum straw, salt and lime stone, in percentage, 38%,20%,40%,10%,1% and1% respectively and the total equal,110%.

3.4 **Colostrums Collection:**

A total of 45 colostrums samples were collected from the 15 individuals (5 cows, 5 goat and she camels).The collection of colostrums samples were obtained from each doe in plastic samples bottles (500ml) sanitizer. The collected samples were daily transferred immediately to the food research center laboratory for chemical analysis.

3.5 chemical composition of colostrums analysis:

3.5.1 Fat content:

The fat content was determined by Gerber method as described by AOAC (1995) .10 ml, of sulphuric acid (specific gravity 1.820 at 155℃) were measured into Gerber butyrometer . And mixed well, 10.94ml,of colostrums was gently added into the butyrmeter tube. 1ml of amyl alcohol was added and alock stopper was inserted securely with the stopper´s end up .The Gerber tube was grasped and shacked with precaution until the sample of colostrum completely digested. The Gerber tubes were centrifuged at 1100 revolution per minute (rpm) for 4 minutes. The butyrometer was then placed in a water bath at 65℃ for 3 minutes .The fat percent was finally read out directly from the column .

3.5.2 Protein content:

The protein content of samples was determined by kjeldahl method according to AOAC (1995) as follows:

Digestion:

10ml of colostrum were weighed and poured in a clean dry kjeldahl flask and 2 gm of cuso4 were added. Concentrated sulphuric acid [25ml] was added to the flask.The flasks were heated until a clear solution was obtained [2-3 hrs] and left for another 30 min. the flasks were removed and allowed to cool.

Distillation:

The digested sample was poured in a volumetric ,flask[100ML] and diluted with distilled water ,then 15ml of 40 presentage Naoh was added to each flasks and the content of the flask was distillated .The distillate was received in a conical flask [100ml] containing 10 ml of 2 presentage poric acid plus 3 drops of indicator [bromocresol green plus phenolphthalein red].the distillation was continued until the volume in the flask was 75ml,then the flask was removed from the distillatory.

Titration:

The distillate was titrated with 0.1N Hcl until the end point [red color] was obtained .the protein content was calculated from the following equation .

$$N\% = \frac{T \times 0.1 \times 0.014 \times 100}{W}$$

T= Reading of titration

W= weight of the original sample

Protein (%)=%NX×6.38

3.5.3 Lactose determination:

Preparation of solution:

The standard solution was prepared by dissolving 5mg lactose in to 95ml of distilled water to give 5% (w/v) solution of monohydrate. One ml of this solution was diluted with 500ml volumetric flask to give 75mg

lactose /ml standard solution. The Anthrone reagent was prepared by dissolving 150mg of Anthrone into 100ml of 70 %(w/v) sulfuric acid. The solution was then cooled and stored overnight.

Procedure:

One ml of milk was pipetted into a 500ml flask with distilled water. The solution was then mixed thoroughly and 0.5ml was transferred to boiling tube (sample) standard stock solution (0.5ml) was transferred to a second boiling(blank).To each tube 10ml ice cooled Anthrone reagent was added. The tube were then transferred to boling water bath for 6 min then transferred to an ice bath and held for 30min . The optical density (O.D)was read at 625nm Lactose content (in mg/100ml) was calculated as follows:

$$\textbf{Lactose}=\frac{\boldsymbol{O.D(S)-O.D(B)\times 4.75}}{\boldsymbol{O.D(SD)-O.D(B)}}$$

Where: O.D (S)=Optical density of sample. O.D(SD)=Optical density of standard. O.D(B)= Optical density of blank

3.5.4 Titratable Acidity :

The acidity of colostrums was determined according to AOAC(1990).Ten milliliters of sample were placed in a white porcelain,and five drops of phenolphthalein indicator were added .Titration was carried out using 0.1 N NaOH until a faint pink color with lasts for 30 seconds was obtained. The titration figure was divided by 10 to get the percentage of lactic acid.

$$\text{T .A \%} \ \frac{9\times 0.1 ml\ of NaOH}{Milk\ weight}$$

3.5.5 Total solids content:

Total solids (T.S) content was determined according to AOAC (1995). A clean aluminum moisture dishes were dried at 105℃ for 3hrs.

Five grams of the sample were weighed in dry clean flat bottomed aluminum dish and heated on a steam bath for 15 minutes . The deshes were placed into a forced draft oven at 100℃ for 3hrs. Then cooled in a desicator and weighed quickly. Weighing was repeated until the difference between the two readings was <0.1mg. The total solids (T.S) content were calculated as follows:

$$\text{T.S. \%} = \frac{W1}{W2} \text{X100}$$

Where:

W1=Weight of sample after drying

W2=Weight of sample before drying

3.5.6 Solid-non fat content:

Solids –non-fat (NSF) content was determined from the following equation : SNF (%) = % T.S%-Fat%

3.5.7 **Ash content:**

The ash content was determined by gravimetric method AOAC (1995). Five grams of the sample were weighed in a crucibles ,then placed in a muffle furnace at 550-600℃ for 3 hours until ashes were carbon free. The crucibles were then cooled in desiccators and weighed. The ash content was calculated using the following equation:

$$\text{Ash \%} = \frac{w1}{w2} \text{ x100}$$

Where: w1 = weight of ash, w2 = weight of sample

3.5.8 pH:

pH was determined by electric pH meter (Hanna instrument pH , 209). 10 ml of colostrum were pipette into the tube ,then the pH

meter was adjusted with buffer pH 4 , the pH meter was placed into the sample, and the pH was directly read .

3.5.9 Moisture content:

Moisture was determined according to AOAC (1995). Five grams of colostrum were weighed. The samples were dried in oven over night at 105℃. After cooling in adesiccator they were weighed. The different in weight before and after divided as following:

$$\textbf{Moisture \%} = \frac{\textbf{different in weight}}{\textbf{sample weight}} \times 100$$

3.6 statistical analyses:

Data generated was subjected to statistical analysis system (SPSS) program. Statistical package of social science and separate means by Duncan's test (DMRT).

CHAPTER FOUR

Results and Discussion

The data pertaining to the mean chemical composition colostrum obtained from cows, goats and she camels is portrayed in table (4-1) Fig1. The result indicated highly significant difference ($P<0.05$) between the three species , in lactose ,The she camel colostrum contained the higher level of lactose ,and also significant ($P<0.05$) between species in fat , S.N.F, and acidity. While there were no significant ($P > 0.05$) difference in moisture, protein, ash, total solid and ph value.

The highest moisture percentage was obtained in cow's colostrums (80.20±1.84) followed by goat (79.41±2.4), then camel (75.81±1.56). Protein was numerically higher in cow, in comparison to camel and goat with their corresponding values of (11.33±1.75), (9.72±0.95) and (9.72±0.95) respectively. The highest percentage for fat contend recorded in goats (6.25±0.52) followed by cows (5.17±0.40) then camels (4.30±0.19). Lactose, SNF, was appeared high in camel compared to that observed in cow and goat respectively. While acidity value was higher in cow followed by goat then camel with their corresponding values of (0.35±0.023), (0.34±0.024) and (0.27±0.013) respectively.(table.1. figure.1.)

In the present study moisture content for cows average was 80.20%. Its higher than that reported by Long (1961) 77.5%. The average of fat content for cows in this study is 5.17% which is lower than that reported by Naylor et al.,(1991) 6.7% ,the average of fat in bovine colostrum also lower than the result found by (Szulc and Zach wieja, 1998) 7%,and the average of fat content for she camels in this study is4.30% its higher than that reported by Zhang et al.,(2005). The average

of fat content for goats in this study is 6.25%,its lower than that reported by(Argiiello., et al 2006) 7.3%.The overall mean of colostrum protein in cows in this study is 11.33% its lower than that reported by Kehoe et al ,(2007) 14.9%, and also lower than the result found by Tisioulaps et al, (2007) 16.2%, and higher than that reported by (Madzimure et al, 2011) 3.43%.And the average of protein content for she camels in this study is 9.72% its lower than that reported by Zhang et al.,(2005) 14.23%, and higher than that reported by Abu-Lehia et al ., (1989) 4.20%. The average of protein content for goats in this study is 9.51%,its lower than that reported by (Argiiello., et al 2006) 10.24%. The overall mean of colostrum lactose in cows in this study is 3.56% its higher than that reported by Kehoe et al., 2007) 2.5%,and also higher than that reported by Foley and Otterby ,1978) 2.7%. And the average of lactose content for she camels in this study is 9.14% its higher than that reported by Zhang et al.,(2005) 4.44%. The average of lactose content for goats in this study is 3.52% its higher than that reported by (Argiiello., et al 2006) 1.93%.The difference can be due to seasonal variations and type of feed and availability of drinking water.

Table (4-1). effect of species on chemical and physical composition of colostrums .

PARMETERS	SPECIES(means ±SE)			Level of sig
	COW	GOAT	CAMEL	
Moisture	80.20^{ab}±1.84	79.41^{a}±2.47	75.81^{c}±1.56	NS
Protein	11.33^{a}±1.75	9.51^{a}±1.43	9.72^{a}±0.95	NS
Fat	5.17^{a}±0.40	6.25^{a}±0.52	4.30^{a}±0.19	*
Ash	1.21^{a}±.112	1.25^{a}±.136	1.16^{a}.112	NS
Lactose	3.56^{b}±.298	3.52^{b}±.2425	9.14^{a}±.399	**
TS	21.21^{a}±1.987	20.59^{a}±1.782	24.14^{a}±1.554	NS
SNF	16.22^{ab}±1.577	14.26^{b}±1.312	19.97^{a}±1.372	*
pH	5.90^{a}±0.097	6.03^{a}±0.160	6.03^{a}±0.091	NS
Acidity	0.35^{a}±0.023	0.34^{a}±0.024	0.27^{b}±0.013	*

Different superscript letters (a to c) within the same raw showed significant differences among the groups (P<0.05). Level of.sig= Level of significant

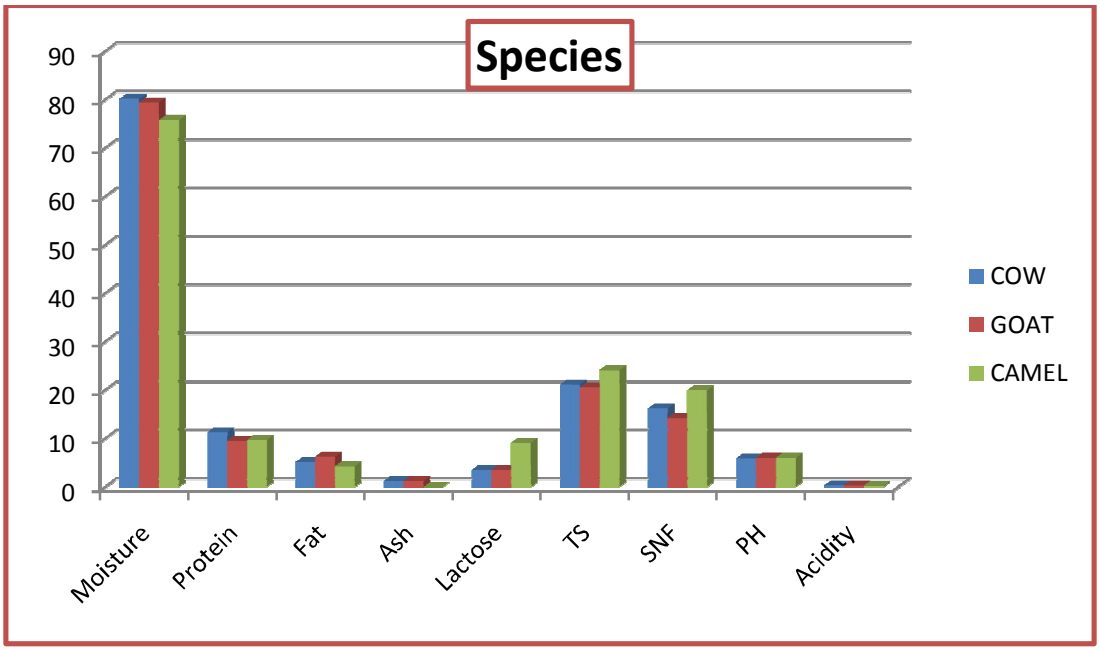

Fig. (1) effect of species on chemical and physical composition of colostrums.

The data in table (4.2) Fig (2) describes the impact of parity order on colostrums quality in the studied cows, goat and she camels.

The results indicated Parity number had showed no significant ($P > 0.05$) difference on physical and chemical characteristics of colostrum. But parity5 showed higher percentages of moisture, protein, fat, ash, total solid and SNF, except pH was higher in parity4, while acidity is high in parity3.

The highest moisture percentage was obtained parity 5 (81.008±3.070) followed by parity 2 (78.74±1.986), parity 4 (78.030^{a}±2.108) then parity 3(76.104±2.079). Protein was numerically higher in parity5 in comparison to each parity. The highest percentage for T.S contend recorded in parity 5 (22.991±2.309) followed by parity 4 (21.973^{a}±2.111) then parity 3 and parity 2 (21.772±2.141) (21.18±2.028) .also the highest percentage for pH contend recorded in parity 2 (6.189^{a}±0.201) and lower in acidity ($0 .31^{a}$±0.012) for each parity (3 ,4,5).

Variation in colostrum composition of cows, goats and she camels have been well documented in the literature.These variations arise from variety factors including ; breed differences , parity order , age of the animal type of nutrition water availability , season of the year and general management.(Yagil et al ., 1994). The difference can be due to seasonal variations and type of feed and availability of drinking water.

Table (4 .2) : Effect of parity order on colostrum chemical and physical composition of (cows, goat, and she camels).

PARMETERS		Parity treatments (means ±SE)			Level of sig
	parity2	**Parity3**	**Parity4**	**Parity5**	
Moisture	78.74[a]±1.986	76.104[a]±2.079	78.030[a]±2.108	81.008[a]±3.070	NS
Protein	9.90[a]±1.513	10.072[a]±1.701	10.287[a]±1.707	10.486[a]±1.784	NS
Fat	5.150[a]±0.524	5.126[a]±0.526	5.095[a]±0.444	5.585[a]±0.637	NS
Ash	1.15[a]±0.132	1.181[a]±0.117	1.215[a]±0.144	1.304[a]±0.163	NS
Lactose	5.01[a]±.858	5.435[a]±1.004	5.456[a]±1.013	5.725[a]±1.113	NS
TS	21.18[a]±2.028	21.772[a]±2.141	21.973[a]±2.111	22.991[a]±2.309	NS
SNF	16.03[a]±1.699	16.622[a]±1.846	17.116[a]±1.846	17.496[a]±2.027	NS
pH	6.189[a]±0.201	5.777[a]±0.105	5.983[a]±0.090	5.988[a]±0.106	NS
Acidity	0 .31[a]±0.012	0 .326[a]±0.029	0 .324[a]±0.023	0 .321[a]±0.029	NS

Different superscript letters (a) within the same raw showed significant differences among the groups (P<0.05).

Level of.sig= Level of significant.

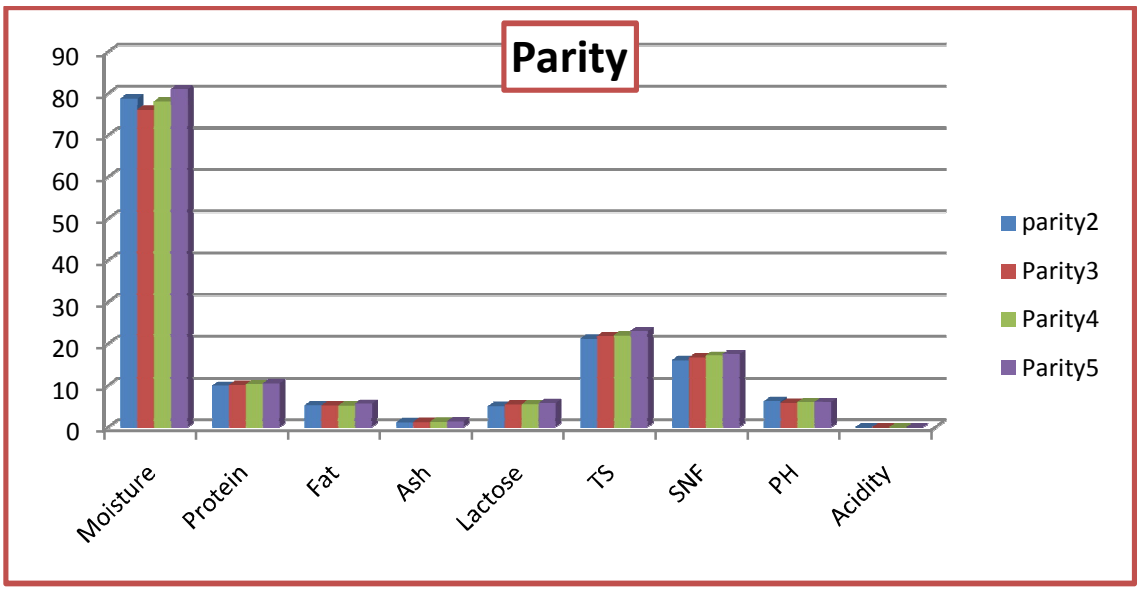

Fig. (2) Effect of parity order on colostrum chemiccomposition of (cows, goat, and she camels).

The data in table (4.3) Fig (3) describes the impact of parity order on colostrums quality in the studied cows. The results indicated no significance effects of parity order on the investigated component . The highest protein ,lactose ,ash, T.S, S.N.F, and acidity was obtained in samples of the 5th parity. The highest moisture percentage was obtained parity 5 (82.81±2.904) followed by parity 2 (80.13±4.362), parity 3 (79.43±4.449) then parity 4(78.4±4.664). Protein was numerically higher in parity5 in comparison to each parity. The highest percentage for T.S contend recorded in parity 5 (23.19±4.456) followed by parity 4 (21.59±4.675) then parity 3 and parity 2 (20.42±2.4.563) (19.63±4.551) respectively.

In this study the average of protein in parity 2 was 10.67% it's higher than that reported by (Mustafa 2014) 2.25%. and the average of protein in parity 4 was 11.43% its higher than that reported by (Mustafa 2014) 1.39%. and everage of fat in the 5^{th} parity 5.49% its lower than that reported by (Mustafa 2014) 8.60% and higher than that reported by (Mohammed 2011) 3.57%. the average of lactose in the 3^{rd} parity 3.67%its higher than that reported by (Mohammed 2011) 2.75%. The difference can be due to seasonal variations and type of feed

Table (4.3) Effect of parity order on colostrums chemical and physical of the cows.

Parameters	Parity 2	Parity3	Parity4	Parity5	L.of sig
Moisture%	80.13±4.362	79.43±4.449	78.4±4.664	82.81±2.904	Ns
Protein%	10.67±3.0929	10.7±4.067	11.43±4.067	12.54±4.071	Ns
Fat%	4.9±0.929	5±0.0939	5.28±0.981	5.49±0.8834	Ns
Ash%	1.06±0.206	1.17±0.254	1.22±0.257	1.39±0.274	Ns
Lactose%	3.23±0.612	3.67±0.694	3.58±0.707	3.77±0.722	Ns
T.S%	19.63±4.551	20.42±4.563	21.59±4.675	23.19±4.456	Ns
SNF%	14.97±3.523	15.54±3.647	16.69±3.702	17.703.613	Ns
pH	5.8±0.209	5.70.208	6.050.132	6.03±0.240	Ns
Acidity%	0.35±0.061	0.34±0.061	0.35±0.038	0.36±0.052	Ns

L of.sig= Level of significant.

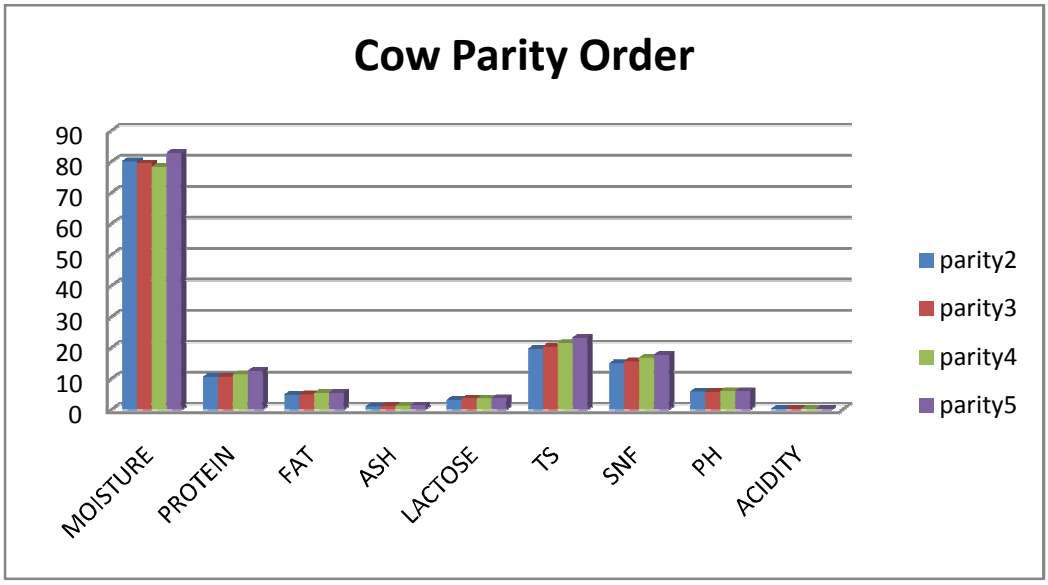

Fig (3) : Effect of Parity Order on Colostrums chemical and physical of the cows.

The data in table (4.4) Fig (4) describes the impact of parity order on colostrums quality in the studied goats. The results indicated no significance effects of parity order on the investigated component. The average highest protein, lactose, ash, T.S, S.N.F, and acidity was obtained in samples of the 5th parity. The highest moisture percentage was obtained in the 5^{th} parity (84.55±7.874) followed by parity 2 (80±3.84), parity 4^{th} (79.87±4.024) then parity 3^{rd}(73.3±3.001). Protein was numerically higher in the4^{th} parity (9.80±3.390) followed by parity 3^{rd} (9.70±5.686), and parity 5^{th} (9.6±3.406) then second parity (8.94±2.941), fat, ash, lactose, TS and SNF was numerically higher in parity5 in comparison to each parity. The average of the pH higher in the parity second and acidity higher in the parity 3^{rd}.

In this study the average of protein in parity 2 was 10.67% it's lower than that reported by Csapo et al.(1994) found a 16.2% and Chen et al.(1998) discovered 16.5% in Nubian goats. Thus differences between breed are more pronounced in milk production , when the milk or colostrum production is high the total protein content falls (Pritchett et al.,1991;Quigley et al.,1994).

Table (4.4) Effect of parity order on colostrums chemical and physical of the goats.

Parameters	Parity 2	Parity3	Parity4	Parity5	L.of sig
Moisture%	80.84±3.2308	73.3±3.001	79.78±4.025	84.55±7.874	Ns
Protein%	8.94±2.941	9.70±3.568	9.80±3.390	9.6±3.406	Ns
Fat%	6.01±1.294	6.33±0.952	5.7±0.917	6.97±1.442	Ns
Ash%	1.25±0.327	1.22±0.214	1.26±0.348	1.27±0.364	Ns
Lactose%	3.57±0.504	3.41±0.626	3.47±0.597	3.61±0.527	Ns
T.S%	203.8423	20.67±4.105	20.2±24.025	21.45±4.642	Ns
SNF%	13.77±2.743	14.343.178	15.52±3.115	14.43±3.216	Ns
pH	6.47±0.555	5.8±0.208	5.9±0.160	5097±0.233	Ns
Acidity%	0.31±0.046	0.38±0.0523	0.34±0.052	0.33±0.0592	Ns

L of.sig= Level of significant.

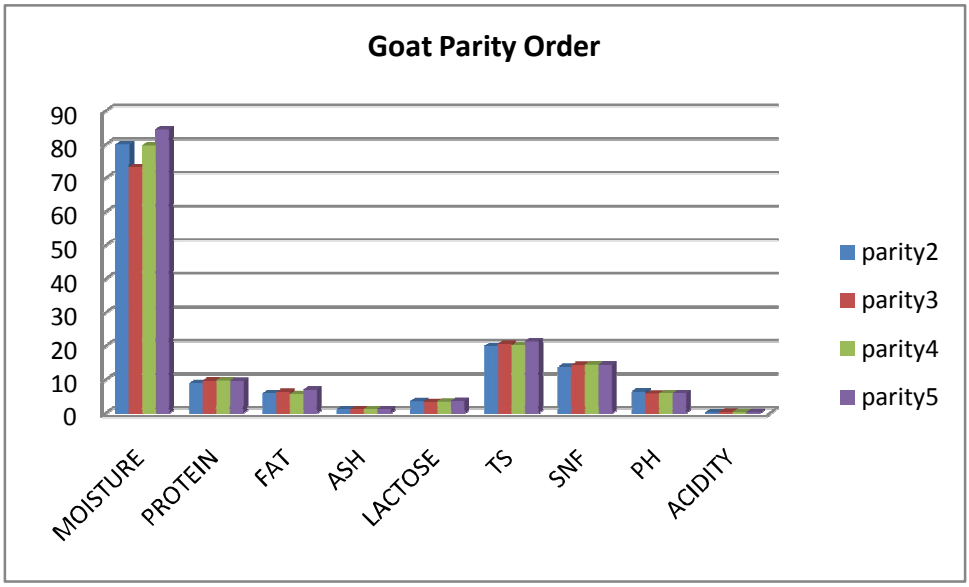

Fig (4): **Effect of Parity Order on Colostrums chemical and physical of the goats**.

The data in table (4.5) Fig(5) describes the impact of parity order on colostrums quality in the studied camels. The results indicated no significance effects of parity order on the investigated component.

The highest protein, lactose, ash, T.S, S.N.F, and acidity were obtained in samples of the 5th par. The highest moisture percentage was obtained in the second parity (76.10±2.878) followed in the parity4th (75.91±3.394) and in the parity 5th (75.67±4.523) then parity 3rd (75.58±3.671). Protein fat was numerically higher in the second parity (10.09±1.584) (4.54±0.429) respectively. Ash, lactose, TS and SNF was numerically higher in parity5th in comparison to each parity. The pH is higher in second parity and acidity higher in parity 4th.

In this study the average of the protein in the 3rd parity was 9.82% its lower than that reported by (Mustafa 2014) found 10.48% and higher than that reported by (Mohammed 2011) found 6.77%, in this study the average of the protein in the 5th parity was 9.32% its lower than that reported by (Mustafa 2014) found 10.75%, and higher than that reported by (Mohammed 2011) found 5.96%. In this study the average of the lactose in the 3rd parity was 9.23% its higher than that reported by(Mustafa 2014) and (Mohammed 2011) 6.44% - 2.75% respectively. The difference can be due to seasonal variations and type of feed and availability of drinking water.

Table (4.5) Effect of parity order on colostrums chemical and physical of the camels.

Parameters	Parity 2	Parity3	Parity4	Parity5	L.of sig
Moisture%	76.10±2.878	75.58±3.671	75.91±3.394	75.67±4.523	Ns
Protein%	10.09±1.584	9.82±2.264	9.65±2.307	9.32±2.613	Ns
Fat%	4.54±0.425	4.047±0.497	4.30±0.2239	4.30±0.474	Ns
Ash%	1.06±0.219	1.15±0.227	1.17±0.242	1.25±0.326	Ns
Lactose%	8.21±0.692`	9.23±0.661	9.31±0.536	9.80±1.279	Ns
T.S%	23.90±2.878	24.23±3.579	24.11±0.393	24.33±4.522	Ns
SNF%	19.36±2.453	19.99±2.937	20.15±3.071	20.37±4.130	Ns
pH	6.3±0.115	5.83±0.202	6±0.217	5.97±0.145	Ns
Acidity%	0.28±0.023	0.26±0.023	0.29±0.031	0.27±0.035	Ns

L of.sig= Level of significant.

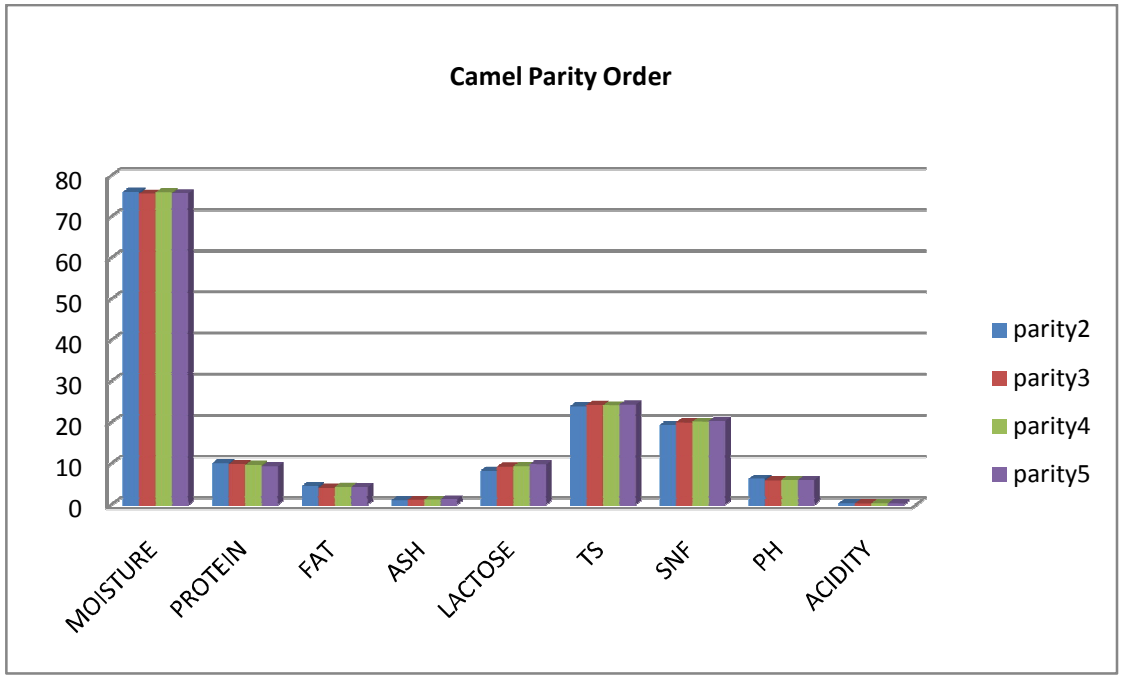

Fig (5): **Effect of Parity Order on Colostrums chemical and physical of the camels**.

The data in table (4.6) Fig (6) describes the impact of chemical and physical composition of cows, goat and she camels colostrum during the first three days after postpartum. On the other hand, the physical and chemical characteristics of colostrum had high significant ($P < 0.05$) difference as affected by days after parturition except lactose was not affected. Moisture increased with increasing days after parturition and vice versa with protein, fat, ash, total solid, SNF, and acidity. While pH value was higher in day 3 after parturition (6.262±0.0457), followed by day 2 after parturition (6.075±0.1353) then day 1 after parturition (5.616±0.0622) respectively.

The highest moisture percentage was obtained in day 3 (83.3±1.47) followed by day 2 (79.92±1.68) and day 1 (72.19±1.41). the protein, fat, ash, TS and acidity its higher in day 1 , while pH higher in day 3.

In the first colostral day the fat is high and then decrease on subsequent postpartum days with anon consistent pattern. The fat is the most variable constituent of milk depend widely on several factors such as breed , individuality of animal, stage of lactation season of calving , type of feed health age of animal (Fox and MCS Wean 1998).

Table (4.6): Effect of colostral days on chemical and physical composition of cows, goats and she camels colostrums during the three days after postpartum.

PARMETERS	Days after parturition (means ±SE)			Level of sig
	Day 1	**Day2**	**Day3**	
Moisture	72.195^{b}±1.4136	79.928^{a}±1.6894	83.291^{a}±1.4741	**
Protein	15.904^{a}±.7273	9.703^{b}±.2220	4.950^{c}±.3161	**
Fat	6.545^{a}±.4458	5.357^{b}±.2733	3.815^{c}±.1640	**
Ash	1.712^{a}±.0554	1.082^{b}±.0507	0.825^{c}±.0188	**
Lactose	5.099^{a}±1.1461	5.481^{a}±.8100	5.636^{a}±.4708	NS
TS	29.279^{a}±1.0336	21.545^{b}±.6022	15.111^{c}±.6778	**
SNF	22.685^{a}±0.7765	16.349^{b}±0.8332	11.415^{c}±0.7182	**
pH	5.616^{b}±0.0622	6.075^{a}±0.1353	6.262^{a}±0.0457	**
Acidity	0.394^{a}±0.0170	0.328^{b}±0.0118	0.240^{c}±0.0128	**

Different superscript letters (a to c) within the same raw showed significant differences among the groups (P<0.05). L of.sig= Level of significan

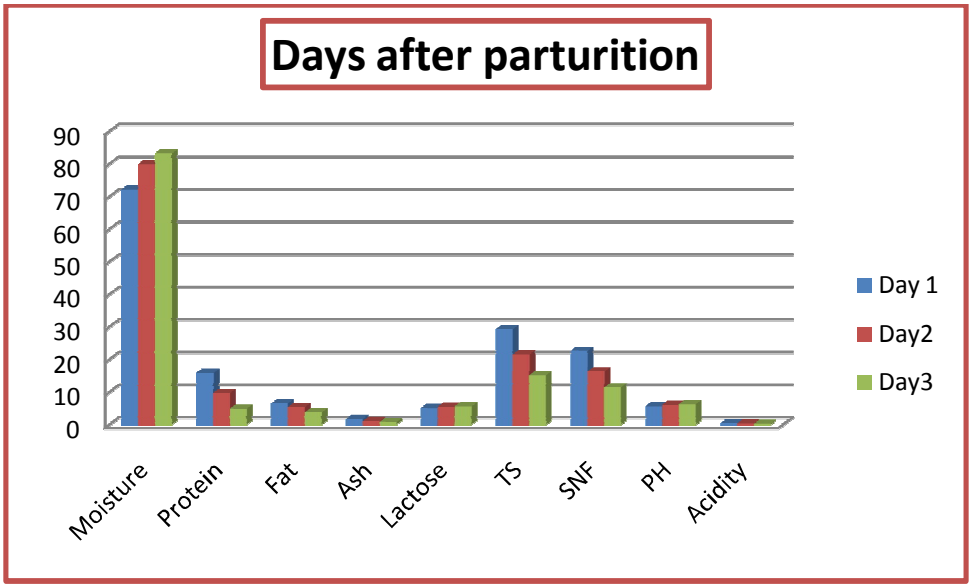

Fig (6): Effect of colostral days on chemical and physical composition of cows, goats and she camels colostrums during the three days after postpartum.

The data pertaining to the mean physical and chemical composition of colostrums obtained from cows in three days after postpartum is portrayed in table (4.7) Fig (7).

The result indicated highly significant difference ($P<0.05$) between three days, in protein ,fat ,ash ,lactose T.S,NSF, and acidity . Also had highly significant ($P < 0.05$) effect on moisture and pH.

The highest protein ,fat ,ash T.S ,SNF and acidity was obtained in colostrums samples of the day one , while the highest moisture, lactose and Ph was obtained colostrums sample of the day three. In the first colostral day the protein and fat is high and then decrease on subsequent postpartum. Fox and MCS Wean (1998). In this study the average of the protein in the first day was 19% its higher than that reported by Kehoe et al.,(2007) found 14.9% and Tsioulaps et al., (2007).

In this study the average of the protein in the 3rd days was 5.24% its higher than that reported by (Mohammed 2011) found 4.90%, and average of protein in the second days was 9.75% its higher than that reported by (Mohammed 2011) found 6.06%, In this study the average of the lactose in day one ,two and three wars, 2.36%, 3.6% and 4.72% respectively its higher than that reported by (Mohammed 2011) found in three days, 1.83%, 2.31% and 2.40% respectively. The difference can be due to seasonal variations and type of feed.

Table (4.7) Effect of colostral days on colostrum chemical and physical composition of the cows.

Parameters	Cow Days After Parturition			L.of Sig
	Day1	Day2	Day3	
MOISTURE	$74.97^{b}\pm4.01067$	$79.75a^{b}\pm0.90967$	$85.87^{a}\pm0.583367$	*
PROTEIN	$19.00^{a}\pm0.408256$	$9.75^{b}\pm0.648717$	$5.24^{c}\pm0.271857$	***
FAT	$6.50^{a}\pm0.143846$	$5.64^{b}\pm0.114337$	$3.38^{c}\pm0.154785$	***
ASH	$1.61^{a}\pm0.082601$	$1.26^{b}\pm0.085086$	$0.76^{c}\pm0.03937$	***
LACTOSE	$2.36^{c}\pm0.094373$	$3.6^{b}\pm0.08165$	$4.72^{a}\pm0.179699$	***
TS	$29.54^{a}\pm0.707443$	$20.25^{b}\pm0.90967$	$13.84^{c}\pm0.736642$	***
SNF	$23.04^{a}\pm0.567318$	$14.89^{b}\pm0.841718$	$10.74^{c}\pm0.435402$	***
pH	$5.56^{c}\pm0.128087$	$5.90^{b}\pm0.040825$	$6.23^{a}\pm0.110868$	**
ACIDITY	$0.44^{a}\pm0.010801$	$0.36^{b}\pm0.002887$	$0.26^{c}\pm0.014434$	***

Different superscript letters (a to c) within the same raw showed significant differences among the groups (P<0.05).Level of.sig= Level of significant.

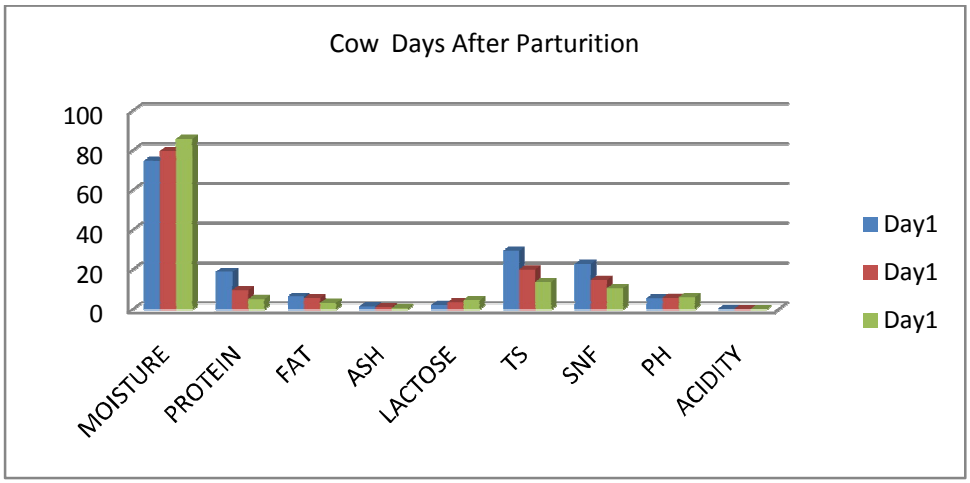

Fig (**7) Effect of colostral days on colostrum chemical and physical composition of the cows.**

The data pertaining to the mean physical and chemical composition of colostrums obtained from goats in three days after postpartum is portrayed in table (4.8) Fig (8).

The result indicated highly significant difference ($P<0.05$) between three days, in day one protein, fat, ash, lactose T.S, SNF, and acidity it's higher. Also had highly significant ($P < 0.05$) effect on moisture and Ph.

The highest protein ,fat ,ash T.S ,SNF and acidity was obtained in colostrums samples of the day one, while the highest moisture, lactose and pH was obtained colostrum sample of the day three.

the fat content in the reported by Graf et al .,(1970) observed an increase in the colosrum fat percentage at 24 h postpartum.

Table:(4.8) Effect of colostral days on colostrum chemical and physical composition of the goats.

Parameters	Goat Days After Parturition			L.of Sig
	Day1	Day2	Day3	
MOISTURE	72.13^{a}±0.675961	84.10^{a}±4.408326	82.00^{a}±4.463689	**
PROTEIN	15.26^{a}±0.471664	9.52^{b}±0.182956	3.75^{c}±0.0263	***
FAT	8.25^{a}±0.510718	6.19^{b}±0.284587	4.32^{c}±0.228706	***
ASH	1.86^{a}±0.089849	1.03^{b}±0.057933	0.86^{b}±0.136076	***
LACTOSE	2.50^{c}±0.136038	3.65^{b}±0.083317	4.41^{a}±0.048713	***
TS	27.87^{a}±0.675961	20.38^{b}±0.297108	13.50^{c}±0.109649	***
SNF	19.62^{a}±0.34666	14.15^{b}±0.2156	9.02^{c}±0.045552	***
pH	5.56^{a}±0.055434	6.29^{a}±0.404338	6.25^{a}±0.06455	*
ACIDITY	0.42^{a}±0.014361	0.35^{b}±0.018708	0.24^{c}±0.01315	***

Different superscript letters (a to c) within the same raw showed significant differences among the groups (P<0.05).Level of.sig= Level of significant.

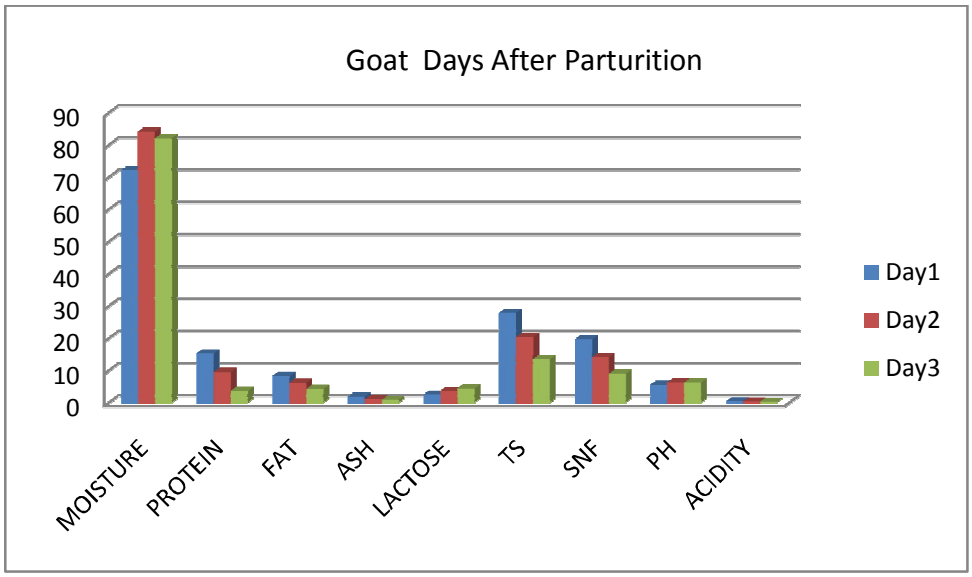

Fig (8) **Effect of colostral days on colostrum chemical and physical composition of the goats.**

The data pertaining to the mean chemical composition of colostrums obtained from camels in three days after postpartum is portrayed in table (4.9) Fig (9).

The result indicated higher significant difference ($P<0.05$) between three days ,. Also had highly significant ($P < 0.05$) effect on moisture and pH in day three.

The highest protein ,fat ,ash, lactose, T.S ,SNF and acidity was obtained in colostrums samples of the day one , while the highest moisture, and pH was obtained colostrums sample of the day three.

In this study the average of the protein in the first day was 13.45% its lower than that reported by (Mustafa 2014) found 14.91%. the average of the fat in the 3rd days was 3.75% its higher than that reported by (Mustafa 2014) found 2.78%. In this study the average of the lactose in the second days was 9.2% its higher than that reported by (Mustafa 2014) found 5.63%. The difference can be due to seasonal variations and type of feed and availability of drinking water.

Table (4.9): Effect of colostral days on colostrum chemical and physical composition of the camels.

Parameters	Camel Days After Parturition			L.of Sig
	Day3	Day2	Day1	
MOISTURE	69.50^{c}±.6675	75.94^{b}± .1867	82.01^{a}±.562	***
PROTEIN	13.45^{a}±.2901	9.84^{b}±.2632	5.87^{c}±.4806	***
FAT	4.90^{a}±.1579	4.25^{ab}± .2471	3.75^{b}±.2640	**
ASH	1.66^{a}± .0850	0.96^{b}±.0259	0.86^{b}± .0150	***
LACTOSE	10.44^{a}± .4130	9.2^{a}± .5400	7.78^{b}± .3271	**
TS	30.43^{a}± .6503	24.01^{b}± .2182	18.00^{c}±.5627	***
SNF	25.40^{a}± .7587	20.01^{b}± .2998	14.50^{c}±.4974	***
pH	5.73^{b}± .1315	6.04^{ab}± .1028	6.31^{a}± .0718	**
ACIDITY	0.32^{a}± .0081	0.28^{b}± .0040	0.22^{c}± .0085	***

Different superscript letters (a to c) within the same raw showed significant differences among the groups (P<0.05).Level of.sig= Level of significant.

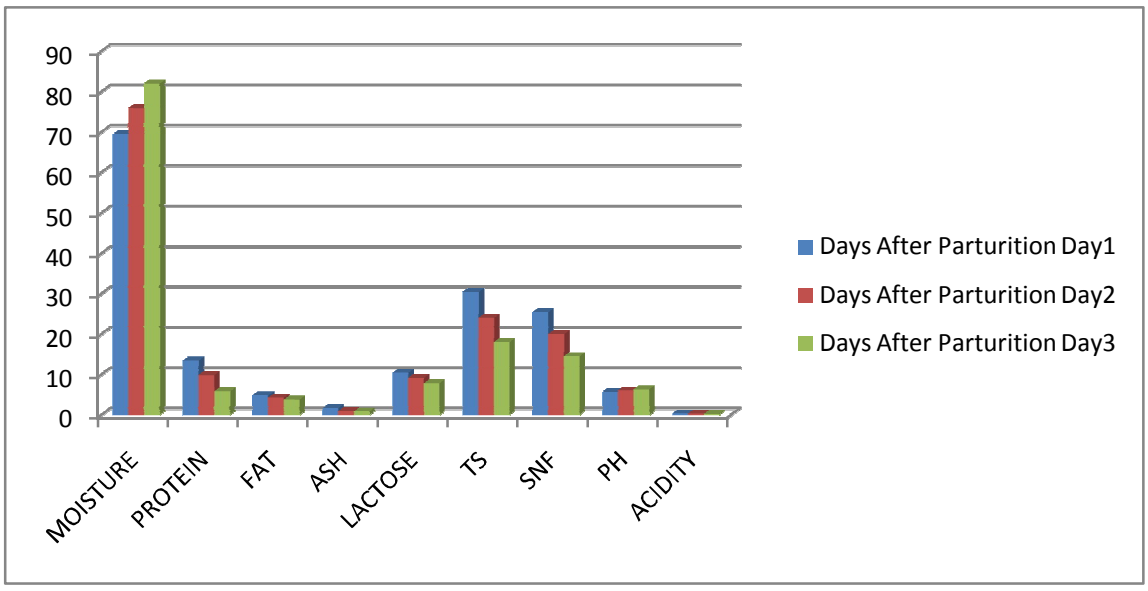

Fig (9): Effect of colostral days on colostrum chemical and physical composition of the camels.

CHAPTER FIVE

Conclusion

Colostrums basic composition at parturition contains: higher fat, protein, T.N.F and TS compare to normal milk.

moisture initiated with low levels then increased gradually during sample period. Lactose initiated with low levels then increased gradually during sample period in cows and goats while its initiated with high levels then decreased gradually during sample period in she camels. . The chemical characteristics of colostrums were greatly affected by colostral days and slightly by parity order.

Recommendations:

Further research is needed to investigate the immunological characteristic of colostrums and factors affecting it and the differences of this factors between species.

REFERENCES

Abdelatif , A. M . Ibrahim , M .Y . and Hassan , Y.Y. (2009). Seasonal variation in erythrocytic and leukocytic indices and serum proteins of female Nubian goats . Middle –Eas Journal of scientific Research , 4(3):168-174.

Abu- lehia, I, H, AL –Mohizea, and EL-Beheri. M.1989. Physical and chemical colostrums. Australian. J, of Dairy technology -19:368-371.

Abu-Iehie ,I,H,AL-Mohizea,I.S and EL- Beheri.M(1989). Physical and chemical characteristics of camel colostrums. Australian. J, of Dairy technology -19:368-371.

Ahmad et al., (2000) .Ahmad,R. A. Khan, M.T. Javed, I. Hus. The level of immunoglobulins in relation to neonatal lamb mortality in Pak- Karakul sheep. Vet. Arhiv., 70 (2000), pp. 129–139.

Ahuya . C.O, Ojange. J . M . K, Mosi . R.O, Peacock .C.P ,Okeyo .A,M, (2009). Performance of Toggenburg Dairy goats in smallholder production systems of the Eastern Highlands of Kenya, Small Ruminant Research, vol.83, pp.7—13.

Ali, K. E., 1973. A , note on lactose and chloride contents of human, cows goats and venders milk in Khartoum north Sudan. J. Vet. Sci and Anim. Husb., Vol. 14 (1) : 42-45.

Anifantakis, E. M., 1986. Comparison of the physiochemical properties of ewes and cows milk.In : international Dairy Federration (ED) ,Proceedings of the IDF Seminar Production snd Utilization of Ewes and goats milk Bulluten No. 202 Athens, Greece, pp.42-53.

AOAC (1990). Official methods of Analysis, Helrichk, (ed.), 115thed, Association of Analytical Cheimists, Inc. USA. D 777.

AOAC (1995). Association of Official Analytical Chemists International. Guidelines for collaborative study procedure to validate characteristics of a method of analysis. J. AOAC. 1995;78:143A–160A.

Argiillo, A., Castro,N., Zamorano., M.J.,Castroalonso,A., Capote, J.,2004. Passive transfer of immunity in kid gats fed refrigerated and frozen goat colostrum and commercial sheep colostrum. Small Ruminant Res.54. 237-241.

Argüello A, Castro N, Alvarez S, Capote J. (2005) Effects of the number of lactations and litter size on chemical composition and physical characteristics of goat colostrums. Small Ruminant Research.

Banchero et al., (2004) G.E. Banchero, G. Quintans, G.B. Martin, D.R. Lindsay, J.T. Milton. Nutrition and colostrum production in sheep. 1. Metabolic and hormonal responses to a high-energy supplement in the final stages of pregnancy. Reprod. Fertil. Dev., 16 (2004), pp. 633–643.

Blum, J.W. and H. Hammon, 2000. Colostrums effects gastrointestinal tract, and nutritional, endocrine and metabolic parameters in neonatal calves. Livestoc Predication Science, 66: 1151-1159.

Blum,J., 2006. Nutritional physiology of neonatal calves. Journal of Animal physiology and Animal Nutrition, 90:1-11.

Boyd, J. W. (1972). The relationship between serum immunoglobulin deficiency and disease in calves:a farm survey.Vet. Rec. 90:645-649.

Brandon, M. R., D. L. Watson, et al. (1971). The Mechanism of Transfer of Bovin Milk from the Colostrum Period to Early Lactation." Journal of dairy science 90:5012-5017.

Brone et al.,1999. R. Barone, F. Di Gregorio, M.A. Romeo, G. Schiliro, L. Pavone Plasma chitotriosidase activity in patients with beta-thalassemia.

Butler,J.E.1993. Bovine immunoglobulin: an augmented review. Vet ImmunoI. Immunopathol. 4:43-152.s.

Bysokogorskii, VA. And Veselov PV.(2010). Estimation of ant oxidizing properties of goat and cow milk .(Article in Russian). Vopr pitan 79 (1):56-8.

Carnicella.D Dario. M., Maria C. C.A Laudadio .V,Dario .C .(2008) The effect of diet , parity , year and number of kids on milk yield and milk composition in maltes goat , Small Ruminant Research, vol.pp 71-74.

Castro et al.,(2005). N. Castro, J. Capote, S. Alvarez, A. Arguello. Effects of lyophilized colostrums and different colostrum feeding regimens on passive transfer ofimmunoglobulin G in Majorera goat kids.J. Dairy Sci., 88 (2005), pp. 3650–3654.

Castro et al.,(2011). N. Castro, J. Capote, R.M. Bruckmaier, A. Arguello. Management effects on colostrogenesis in small ruminants: A review.

Castro-Alons et al.,(2008) A Castro-Alonso, N. Castro, J. Capote, A. Morales-DelaNuez, I. Moreno-Indias, D. Sanchez-Macias, P. Herraez, A. Argullo.Short communication: Apoptosis regulates passive immune transfer in newborn kids. J. Dairy Sci., 91 (2008), pp. 2086–2088.

Chen et al.,(1999) J.C. Chen, C.J. Chang, H.C. Peh, S.Y. Chen. Serum protein levels and neonatal growth rate of Nubian goal kids in Taiwan area. Small Rumin. Res., 32 (1999), pp. 153–160.

Chen, J.C., Chang,C.J., Peh, H,C., Chen, S.Y., 1998. Total protein and globulin contents of mammary secretion during early postpartum

period of Nubian goats in the Taiwan area. Small Rumin. Res 31, 67-73.

Christiansen, S. Guoand, M., and Kjeldn, Derek. 2010. Chemical composition and nutrient profile of low molecular weight fraction of bovine colostrums. Int, Dairy J.,20(9); 630-636.

Christley et al.,(2003) R M. Christley, K.L. Morgan, T.D.H. Parkin, N.P. French. Factors related to the risk of neonatal mortality, birth-weight and serum immunoglobulin concentration in lambs in the UK. Prev. Vet. Med., 57 (2003), pp. 209–226.

Csapo,J ., Csapo,Z., Martin, T.G.,Szentpeteri,J.,Wolf,G.,1994. Composition of colostrum from goats, ewes and cows producing twins.Int. Dairy J., 445-458.

Da Nobrega et al.,(2005) J.E. da Nobrega, F. Riet-Correa, R.S. Nobrega, J.M. de Medeiros, J.S. de Vasconcelos, S.V.D. Simoes, I.M. Tabosa Perinatal mortality of lambs in the semi-arid region of Paraiba, Brazil. Psesqui. Vet. Bras., 25 (2005), pp. 171–178.

Daniels, L. B., J. R. Hall. Q.R. Hornsby, and J.A. Collins 1977. Davidson, J. N, Yancey, S.P., Campbell, S.G.

EL Naim,Y.A(1979). Some productive traits of Sudan Nubian Goat .M.V.Sc. thesis, University of Khartoum, Sudan.

Elabid, K. E . (2008). Various factors affecting birth weight of Sudanese Nubian goat kids. Research Journal of Agriculture and Biological Sciences, 4(6):700-703.

Farmer,C., and Quesnel, H, 200 Nutritional, hormonal,and environmental effects on colostrum in sows. J. Anim . Sci., 87(13), 56-64.

Foley J.A.and D.E. Otterby.1978. Availability, stroge, treatment, composition, and feeding value of surplus colostrums : areview.J.Dairy Sci.61:1033-1060.

Foly, J.A. and D. E. Otterby. 1978. Availability, storage, treatment, composition, and feeding value of surplus colostrums : arivew.J.Dairy Sci. 61:1033-1060.

Fox, P. F. and P. L. H. McSweeney, 2003. Advanced Dairy Chemistry – Volume 1Proteins, Third Edition, Part A. New York, New York, USA: Kluwer Academic /Plenum Publishers

Fox, P.F.,P . L. H. McSweeny.1998. Dairy chemistry and biochemistry.Ist editition, Bury St . Edmundsury press Ltd ., Blackie Academic& professional Growth of milk replacer kids fed under three different management s .J. Appl. Anim. Res., 25 (2004), pp. 37–40.

Gorban, A. M. and Lzzeldin, O. M.1997. Mineral content of camel milk and colostrums. J. Dairy, Res., 64(3) : 471-474.

Gorova, R., Pavlikov, E; Blasko, J. Meluchova, B; Kubinec, R; Margetin, M. and Sojak, L.2011. Temporal variations in fatty acid composition of individual ewes during fires colostrums day Small Rumin. Res.,95(2-3):104-112.

Graf, F.,Osterkorn.,K., Fautz., J.,Frahm, K., Gall, C.,1970. Arb. Inst.Tierziich.Vererbungs-u Konstitutionsfor. Univ. Miinchen, Heft 8, 45-52.

Gubartallah, K. A. , Ahmed, A. Babiker, A.O. and Babiker, A. (2005). Comparative studies on reproductive performance of Nubian and saanen bucks under the climatic conditions of Khartoum .Journal of animal and Veterinary Advances , 4(11):942-944.

Gulliksen, SM;Lie, KI; Solverod, L and Osteras O.(2008) Risk factors associated with colostrums quality in Norwegian dairy cows. J Dairy Sci, 91(2):704-721.

Herandez –Castellano, L.E.,Torres , A., Alavonine, A., Ruiz –Diaz, M.D.Arguello, A.,Capote J.and N. Castro, N., 2011. Effect of milking frequency on milk immunoglobulin concentration (IgG, IgM and IgA) and chitotriosidase activity in Majorera goats. Small Rumminant Res., 98 (1-3)70-72.

Horne . D.S., parker,T.G ; Donelly, W.J; and Davies,D.T.,1989. Factor affecting the ethanol stability of bovine skim milk. IVV. Lactation and compositional effects J.Dairy.RES. 53:407-417.

Huber, J. T., 1974. Nutrient needs of the per – ruminant calf. Pages 128-132 in proc. 7th Annu. Conv. Amer. Ass. Bovine Pract.

Hunt.E. 1990. Critical colostrum. Dairy Herd Workshop 1(1) :16-20.

Ismail , A.M., Yousif , I .A. and Fadlelmoula, A.A. (2011). Phenotypic variations in birth and body weight of the Sudanese Desert goats. Livestock Research for Rural Development, 23(2). J. Appl. Anim. Res., 39 (2011), pp. 85–93.

Jackson, S. M. 2003. Appendix 4: Marsupial milk. Milk formulas and comparison with montreme and eutherian milk. In : Australian mammals :Biology and captive management. Collingwood, Australia, CSIRO Publishing.

Jackson, S.M. 2003. Appendix4: Marsupial milk, milk formulas and comparison with monotreme and etherian milk in:Australian mammls: Biology and captive management.collingwood, Australia, CSIRO Publishing. *Journal of Dairy Science*, 90, 4108-4116.

Jenn Bentley, 2014.ISU Extension Dairy Field Specialists, NE and SE Iowa Vacant Position in NW Iowa. www.extension.iastate.edu/dairyteam.

Kehoe, S. I., A. J. Heinrichs, et al. (2007). "A Survey of Bovine Colostrum Compositionand Colostrum Management Practices

Pennsylvania Dairy Farms (Erratum:2008 May, v. 91, no. 5, p. 2164.)." Journal of dairy science **90**: 4108-4116.

Khalid, A., Alia, . S and Abdalla, M.A,2007. Milk composition of dromedary camel(camelus dromedary): nutritional effects and correlation to corresponding blood parameters. Pakistan Journal of biological Science 10(16):2724-2727.Asian Net work for scientific information.

King, J. O. L., 1980. Factors affecting the butter fat content of cows milk. The veterinary Record, 132-134.

Koldovsky, O. 1980. Search for role of milk borne biologically active peptides for the sukling. J. Nutr., 119:1551.

Kudouda, M.E.M.(1985). Growth, reproductive Sudanese and productive performance of Nubian goats. MSc (Agric), Thesis University of Khartoum,Sudan.

Kulkarni, P.R.,and Pimaple, N.V., 1989. Colostrum are view. Indian J. Dairy Sci., 42:216.

Kume, S., and Tanabe, S ., 1993. Effect of parity on colostrums mineral concentrations of Holstein cows and value of colostrums as mineral source for newborn calves. J. Dairy Sci.,76: 1654-1660.

Larry Tranel. 2014. ISU Extension Dairy Field Specialist, NW Iowa

Lascelles,(1979) AK Lascelles. Immune system of thse ruminant mammary gland and its role in the control of mastitis. J. Dairy Sci., 62 (1979), pp. 154–167.

Lérias et al., (2014). J.R. Lérias, L.E. Hernández-Castellano, A. Suárez-Trujillo, N. Castro, A. Pourlis, A.M. Almeida. The mammary gland in small ruminants: Major morphological and functional events underlying milk production—A review. J. Dairy Res., 81 (2014), pp. 304–31.

Lérias et al.,(2013). J.R. Lérias, L. Hernández-Castellano, A. Morales-DelaNuez, S. Araújo, N. Castro, A. Argüello, J. Capote, A. Almeida. Body live weight and milk production parameters in the Majorera and Palmera goat breeds from the Canary Islands: Influence of weight loss. Trop. Anim. Health Prod., 45 (2013), pp. 1731–1736.

Levieux, D. and A. Ollier, 1999. Bovine immunoglobulin G, beta-lactoglobulin, alphalactalbumin and serum albumin in colostrum and milk during the early post.

Long, C.(1961). London Biochemists Handbook, London and F .N .Spon, Ltd.

Marsico et al., 1993.G. Marsico, A. Vicenti, P. Centoducati, A. Braghieri. Influence of weaning age on productive performance of kids slaughtered at 107 days of age. Small Rumin. Res., 12 (1993), pp. 321–328med. Sci. 49: 613-623.

Min, B.R. , Hart, S.P. , Sahlu. T . and Satter ,L . D.(2005). The effect of diets on milk production and composition , and on lactation – curves in pastured dairy goats. J .Dairy Sci ., 88(7):2604-15 www.ncbi.nlm.nil. Gov/pubmed /15956322.

Ministry for animal resources, fishery and range.(2012)

Mohammed,(2014). Effect of parity order on chemical composition of bovine colostrum . University of Khartoum**.**

Morand-Fehr,P., 1989. Influence of environment on mortality of kids Colloq. Inst.Natl.Rech.Agron. 28,31-46.

Moreno-Indias et al., 2012.b. I. Moreno-Indias, D. Sanchez-Macias, N. Castro, A. Morales-DelaNuez, L.E. Hernandez-Castellano, J. Capote, A. Arguello. Chemical composition and immune status of dairy goat colostrum fractions during the first 10 h after partum. Small Rumin. Res., 103 (2012), pp. 220–224b.

Moreno-Indias et al.,2012.a .I. Moreno-Indias, A. Morales-DelaNuez, L.E. Hernandez-Castellano, D. Sanchez-Macias, J. Capote, N. Castro, A. Arguello. Docosahexaenoic acid in the goat kid diet: Effects on immune system and meat quality. J. Anim. Sci., 90 (2012), pp. 3729–3738 a.

Muller. L.D. and D.K. Ellinger.1980. Colostrum immunoglobulin concentrations among breeds of dairy cattle. J. Dairy Sci., 64 :1727 1730.

Musa, O. I .2001 Characteristics lipid of camel(camelus dromederius) milk and colostrums. Ph . D . Thesis, faculty of agriculture, University of Khartoum , Sudan.

Mustafa (2014). M. Assessment of cows and she camel colostrum and same factors affecting their chemical composition. University of Khartoum.

Musumeci et al.,2005. M. Musumeci, L. Malaguarnera, J. Simpore, R. Barone, M. Whalen, S. Musumeci.Chitotriosidase activity in colostrum from African and Caucasian women. Clin. Chem. Lab. Med., 43 (2005), pp. 198–201.

Naylor, Jonathan .,M, Ralston, Sarha, L. 1991. Large Animal Clinical Nutrition Mos by Year Book Missourc. Pp., 242.

Newsletter edited. www.extension.iastate.edu/dairyteam.

Ogawa, K. et al. Nutr 1992; Scammon R.E. and Doyle, L.O. Observations, on **Volatile fatty acids, lactic acid, and pH in the stools of breast-fed and bottle-fed infants. J Pediatr Gastroenterol** the capacity of the stomach in the first 10 days of postnatal life. Am J Dis Child 1990; 20:516-538.partum period. Journal of Dairy Research, 66(3), 421-430.

Pritchett, L.C.,Gay, c.c.,Besser, T.E., Hancook, D.D., 1991. Management and production factors influencing immunoglobulin

G1 concentration in colostrum from Holstein cows .J. Dairy Sci. 74, 2336-2341.

Ontsouka, CE; Bruckmaier, RM; Blum, J.W., 2003. Fractioned milk compositionduring removal of colostrums and mature milk. J. Dairy Sci .,86:2005-2011.

Quigley III, J.D., Martin, K.R., Dowlen, H.H., Wallis, L.B., Lamar, K.,1994. Immunoglobulin concentration, specific gravity, and nitrogen fractions of colostrum from Jersey cattle. J. Dairy Sci 77, 264-269.

Rodriguez et al.,2008 A.B. Rodríguez, R. Landa, R. Bodas, N. Prieto, A.R. Mantecon, F.J. Giraldez. Carcass and meat quality of Assaf milk fed lambs: Effect of rearing system and sex Meat Sci., 80 (2008), pp. 225–230.

Ramet, J. P. (2001). Technology of making cheese from came milk FEO Rome.

Rodriguezet al 2009 C. Rodríguez, N. Castro, J. Capote, A. Morales-DelaNuez, I. Moreno-Indias, D. Sanchez-Macias, A. Arguello . Effect of colostrum immunoglobulin concentration on immunity in Majorera goat kids J. Dairy Sci., 92 (2009), pp. 1696–1701.

Roy , J. H. B. 1980. The Calf 4th ed . Butterwoeths , London.

Santschi, D. E., Witschi, A. K. M. and Kreuzer, M 2009. Colostrum and milk fatty acids of dairy cows as influenced by extruded supplementation during the transition period. Canadian Journal of Animal Science 89 (3):383 -392.

Sawaya, W. N; Khalil,J. K; Al-Shalaht, A. and Mohammed, H. (1984).Chemical composition and nutritional quality of camel . J. Food. Sci.49:744-747.

Shearer, J.,Mohammed, H.O., Brenneman ,J.S.and Tran,T.Q.,1992.factor associated concentration of immunoglobulin in colostrums at the first

milking post-calving. Prevent. vet.Med. Ser. A.14:143-154 King, J.O. L., 1980. Factors affecting the butter fat content of cow milk. The veterinary Record, 132-134.

Smith D. E. and Vies, B.K. (1992). Chemical and physical methodse in standard methods for the examination of dairy products (edited by marshal,R.T).

Stewart, S., Godden, S., Bey, R., Rapnicki, P., J., Fransworth, R., Scanlon, M., Arnold, M., Arnold,Y., Clow,L. M.,and Ferrouillet,C., 2005. Preventing bacterial contamination and proliferation during harvest, storage and feeding of fresh bovine colostrums. J. Dairy Sci.88:2571-2578.

Szulc,T.and Zachwieja, A(1998). Siara. Aliksir zycia oseskow. WYD AR Wrroclaw.

Tizard, I. R. (2004). Immunity in the fetus and new born. In: veterinary immunology. An introduction. 7th edition, Philadelphia, Pennsylvania, w. B. Saundres company,PP. 221-233.

Topel, A . 2004. Chemi und physick der ilch :naturstoff-Rohstoff-Lebensmittel. I. Auflago, Hamburg, Deutschland, Bhrs Velrag GmbH and Co.KG.

Tsiiulpas, A. S., Lewis, M.J., 2007. Changes in physical properties of Bovine Milk from the colostrum to Early Lactation. J., 90:5012-5017.

Tucker,H.A.,1985. Endocrine and neural control of the mammary gland. In: Larson, B.L. Lactation. The Lowa State University press,Ames,IA,P.39.

Walstra, P., Wouters ,J.T., 2006. Dairy Science and Technology. Boca Raton, FL, CRC., Press.

Warner, R. G.,1981. Relationship between serum immunoglobulin levels and incidence of respiratory disease in calves. J.Am. Vet.Med. Assoc.1:701-708.

Wilson , R. T., Araya, A. and Melaku, A. 1990. The one humped camel. Technical paoers series NO . 3 New York UNSO.Pp300.

Wu WZ , Wang .XQ , Wu GY, Kim SW, Chen F, Wang . J.J., 2010. Differential composition of proteomes in sow colostrums and milk from anterior and posterior mammary glands. J. Anim. Sci 88(8):2657-2664.

Yagil, R., and Etzion., 1980. Milk yield of (Camelus dromederius) in drought area. J. of Dairy Res , 47: 159-166.

Zeiger 2003, R.S. Food allergen avoidance in the prevention of food allergy in infants and children. Pediatrics 2003; 111(6):1662-1671.

Zhang, H. J.Yao,ID.Zhao,IH. Liu,I J . Li, 2 and M. Guo2. (2005). Changes in chemical composition of Allxa Bactrian camel milk during lactation, J. Dairy SCI. 88: 3410 – 3420.

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Appendix(1) Collection of colostrum samples

Appendix(2) Colostrum samples containers