# INTERRELATIONSHIPS BETWEEN SOMATIC CELL COUNT AND BIOCHEMICAL CHANGES IN EGYPTIAN CAMEL MILK.

**B.G.A. Fahmy and Maha M. Mohamed**

*Biochemistry, Nutritional deficiency diseases and toxicology department, Animal Health institute –Dokki-Cairo*

## ABSTRACT

The variations in chemical composition of dromedary camel *(Camelus dromedarius)* reared in Marsa Matroh governorate during lactation were investigated. Colostrum and milk samples from 10 she camels in their first season of lactation were collected periodically from parturition until 90 day postpartum (PP). Samples were analysed for somatic cell count (SCC), fat, protein, casein, lactose, IgG1 and minerals.

Large variations occurred in biochemical properties throughout the study period. Within whole period, the concentration of casein decreased by 60%, IgG1 by 94%, and lactose increased by 34%. The average contents of gross composition were 14.23% protein, 4.44% lactose, 0.27% fat, 0.77% ash, and 20.16% total solids in colostrum at 12 hour PP, and the respective mean values were 3.55, 4.24, 5.65, 0.87, and 14.31% for regular milk on 90$^{th}$ day. A 10-fold increase was shown in fat content during the first 24 h, whereas a sharp decrease was shown during the first 24 h of lactation in protein, ash, and total solids contents. Variation in lactose content was small (4.24 to 4.71%) throughout the study period. Total N, non-protein N, casein, and whey protein were found to be 2.23, 0.06, 0.86, and 1.31 g/100 mL for the colostrum at 12 hour PP; and 0.56, 0.04, 0.45, and 0.07 g/100 mL for the milk at 90 day PP. Percentages of caseins increased steadily, whereas whey proteins declined gradually until 3 month of lactation.

The levels of Ca, P, Na, K, and Cl were 222.58, 153.74, 65.0, 136.5, and 141.1 mg/100 g, respectively, at 12 hour PP; the values of the minerals were 154.57, 116.82, 72.0, 191.0, and 152.0 mg/100 g, respectively, for the regular milk on 90 day.

Sodium dodecyl sulfate-PAGE and densitometry results demonstrated that dromedary camel *(Camelus dromedarius)* colostrum is rich in immunoglobulins, serum albumin, and 2 unknown fractions, which are reduced in amount (%) within 2 days of lactation. It seems that there is

lack of lactoglobulin in dromedary camel *(Camelus dromedarius)* milk, whereas casein and lacto-albumin start at a low level and increase gradually until they reach their regular levels in the milk.

The somatic cell count (SCC) of camel's milk was determined by the Fossomatic method and compared with biochemical compositions of the milk, The somatic cell count (SCC) ranged from 28.20 x $10^3$ to 120.60 x $10^3$ cells/ml with mean 68.87 x $10^3$ cells/ml in the whole period. The level of somatic cell count (SCC) ranged from 28.20 x $10^3$ to 65.78 x $10^3$ cells/ml with mean was 42.21 x $10^3$ cells/ml in colostrum milk. The colostrum milk samples (24 hours) had significantly ($p < 0.01$) lower than mean values for total SCC and negative correlation with total nitrogen (TN), whey protein nitrogen (WPN) and positively with NPN and casein levels. The level of somatic cell count (SCC) of regular ranged from 76.11 x $10^3$ to 120.60 x $10^3$ cells/ml with mean was 97.53 x $10^3$ cells/ml in regular milk from 5 to 90 days. The regular milk samples (90 days) had significantly ($p < 0.01$) higher than mean values for total SCC. There was a strong significant positive correlated with total nitrogen (TN), whey protein nitrogen (WPN) and casein and negatively correlated with NPN.

**(Key words:** dromedary camel *(Camelus dromedarius)*, colostrum, milk, chemical composition, **NFCM** = non-fat camel milk, **PP** = postpartum, TN = total nitrogen, **WPN** = whey protein nitrogen and **SSC** =somatic cell count, **ImmunoG = immunoglobulin, LactoF=** lactoferrin, **LG =lactglobulin, MW = molecular weight, casein a-LA=lacto albumin**).

## INTRODUCTION

There are different species of camels belonging to the genus Camelus; the one-humped dromedary camel *(Camelus dromedaryius)* and the two-humped bactrian camel *(Camelus bactrianus)* ***(Sawaya et al., 1984)***. The total population of camels in the world is about 18 million, of which 16 million are dromedaries ***(Wasfi et al, 1999)***. The dromedaries are found particularly in arid and semiarid zones of North and East Africa, the Indian subcontinent, and Saudi Arabia ***(Mehaia et al., 1995)***. Dromedaries are mainly used for meat and milk production.

Camel milk is mainly used for feeding. Camel milk is an important nutrition source for inhabitants in arid and semiarid areas ***(Farah, 1996)***. Unlike other milk producing animals, camels can thrive under

extreme hostile conditions of temperature, drought, and lack of pasture, and still produce milk ***(Yagil and Etzion, 1980)***.

The female comes into heat for the first time at the age of 4 to 5 yr old, and the breeding season lasts from mid-December until mid-April. Pregnancy lasts 395 to 405 day and lactation takes place during August -February. Dromedary camels (Camelus dromedarius) can produce 0.25 to 1.5 kg of milk daily in addition to the amount taken by the calf. The milk yield in the first 3 month of lactation is higher than during the rest of lactation. Camel milk is one of the important sources of food for local people. It can be used for making various dairy products such as butter, yogurt, cheese, and milk tea ***(Alhadrami et al., 2003)***.

The general composition of camel milk varies in various parts of the world with a range of 3.5 to 4.5% protein, 3.4 to 5.6% lactose, 3.07 to 5.50% fat, 0.7 to 0.95% ash, and 12.1 to 15% TS ***(Gnan and Sheriha, 1986)***. This wide variation in the constituents of milk may be attributed to several factors such as breed, age, the number of calvings, nutrition, management, the stage of lactation, and the sampling technique used ***(Abu-Lehia, 1987 and Alshaikh and Salah, 1994)***.

Some counting methods, such as direct microscopic SCC and Coulter counter, have been modified to adapt to camel milk ***(Fthenakis et al., 1991)***, which has a higher fat content than cow milk. The Fossomatic SCC method, which was used in the present study, automatically processes milk samples so that they need no prior adaptation. However, optimal conditions for this method have not been specified for camel milk.

Indirect tests, such as the measurement of SCC or other testes, provide information about the status of the quarter ***(Mattila, 1985)***. The reduction of SCC associated with evidence of improved milk hygienic ***(Katsoulos et al., 2009)***. The peak SCC value was in morning milk and decrease in the proportion of prolonged milking interval PMN ***(Lakic et al., 2009)***.

An inverse relationship between SCC and milk yield has been demonstrated ***(Blood and Radostits, 1989)***. More milk and fat-corrected milk with a lower somatic cell count ***(Sobhanirad et al., 2009)***. The increase in SCC was associated with the reduction in daily milk yield ***(Barlowska et al.,2009)***. A positive correlation between CMT scores and bacterialogical classes and between CMT scores and SCC was recorded ***(Abdel Gadir Atif et al.,2006)***. The SCC was

unaffected by milking omissions and in both stages of lactation *(Castillo et al., 2009)*. With the increasing interest in the production of camel' milk, a need has arisen for a means of monitoring SCC *(Zadnik et al., 1993)*. Previous studies have confirmed that bacteriological examination of milk and milk SCC are reliable methods for detecting subclinical mastitis *(Neave, 1975)*. Somatic cell count of camel' milk has not been studied extensively; consequently an accepted "normal" value has not been established *(Fthenakis et al., 1991)*. The physical and chemical changes in milk during early lactation, and how these changes were affected by in the first lactation, with the purpose of discriminating between colostrum and normal milk *(Gonzalo et al., 2002)*.

The information about camel milk chemistry is very limited in Egypt. The objective of this work was to study the 1. Determinations of chemical composition and protein fractions of camel milk from Dromedary camels *(Camelus dromedarius)*. 2. The relationships between somatic cell counts (SCC) and the chemical compositions of milk. 3. Establish a threshold value or at least mean value, which could be regarded as the upper limit for normal SCC of camel's milk.

## MATERIALS & METHODS

### 1. Animals:

Ten 5 years old female Dromedry camels *(Camelus dromedarius)* close to giving birth for the first time was reared in camel production unit, Animal Production Institute. These camels were belonged to Marsa Matroh governorate. They were kept under management before giving birth and after parturition. All camels in the study were fed the same diet (50% cornstalk + 50% dry clover) supplemented with 1.5 kg of grain concentrate (70% corn + 30% soybean cake after oil extraction) and 30 g of table salt for each animal daily.

### 2. Collection of Milk Samples:

Samples were collected immediately following parturition at 12, 24, 36, 48, and 72 hour, and 5, 7, 15, 30, and 90 day postpartum. All the collected samples were measured immediately for SSC and other stored at -40°C until analysis. The samples which were taken at the same stage of lactation were thawed, pooled, and portions were taken for analyses.

### 3. Analyses of TS, Fat, Ash, and Lactose:

Total solids were determined gravimetrically after drying in a forced-draft oven at 105°C until a

steady weight was achieved. Fat percentage was determined according to the method of Rose-Gottlieb, and ash content was measured gravimetrically *(Aggarawala and Sharma, 1961)*. Lactose content was determined by the difference of TS minus other solid components.

**4.Determination of Protein Fractions:** Nitrogen content was determined by the Kjeldahl method. A nitrogen conversion factor of 6.38 was used for calculation of protein contents of milk samples and various fractions. The concentrations of total nitrogen (TN), whey protein nitrogen (WPN), casein N, and NPN were analyzed according to the procedure of *Guo et al., (2001)*. Freeze-dried nonfat camel milks (NFCM) were prepared from the milk samples collected during the study period 12 h to 90 d postpartum (PP)]. Protein profiles in each sample were examined by SDS-PAGE under reducing conditions according to *Laemmli, (1970)*. The experiment was performed using a Mini-Protean II Cell (BioRad Laboratories, Hercules, CA) with a 4% acrylamide stacking gel and a 12% separating gel. Bovine milk protein standards including lactoferrin, BSA, $a_s$-CN, *if-CN*, K-CN, 3-LG, and a-LA were brusher from Sigma Chemical Co. (St. Louis, MO) were used for comparison, a Bench-Mark protein ladder (Invitrogen Corporation, Carlsbad, CA), consisting of proteins ranging in molecular weight from 10 to 220 kDa, was used as a molecular weight standard. Electrophoresis was carried out under constant voltage (200V) until the dye front was within 3 mm of the bottom edge of the gel. Gels were stained with 0.1% Coomassie Brilliant Blue R-250 in 10:40:50 acetic acid: methanol: water and destained in the same solvent system without dye.

**5. Densitometry:** Quantitative analyses of electrophoretic separations of camel milk proteins were performed using the Gel-Pro Analyzer 3.1 software from Media Cybernetics (Silver Spring, MD). Images of wet gels were acquired and converted from color to gray images. One dimensional gel image analyses (recognition of lanes and bands, calculation of molecular weight and amount of each band) were perfomed automatically by the software.

**6. Mineral Analysis:** Levels of Ca, K, Na, and Cl in the milk samples were determined with an atomic absorption spectrophotometer (Hitachi U-2000, Tokyo, Japan) according to standard methods *(AOAC, 1980)*. Phosphorus content was determined spectrophotometrically using the procedure of *Watanabe and Olsen (1965)*.

**7. Somatic Cell Counts:**

The milk samples collected for the biochemical analysis were also used for the SCC. The samples were heated to 40°C in a water bath and held at this temperature for 15 min. The samples were then double processed in a Fossomatic 360 (A/S N. Foss Electric, Hillerod, Denmark). Basically, the Fossomatic counter is a fluorescence microscope. The ethidium bromide dye penetrates the cell and forms a fluorescent complex with the nuclear DNA. Each cell produces an electrical pulse, which is amplified and recorded. The reagents were prepared following the manufacturer's instructions, which coincide with the method recommended by International Dairy Federation *(1984)*.

**8. Statistical Analyses:**

Data were analyzed by a procedure of the Fisher's protected-least-significant-difference test using SAS software (SAS Institute Inc., Cary, NC). This test combines ANOVA with comparison of differences between the means of the treatments at the significance level of $P < 0.05$. Correlation between values for SCC in milk samples was measured with Pearson's correlation coefficients; absolute values and inter-quarter ratios for SCC were used in the calculations. For the calculations, data were grouped according to day diagnosis. **Snedecor and Cochran (1980) and Farver, (1989).**

**RESULTS & DISCUSSION:**

**Gross Composition**

Changes in gross composition (protein, lactose, fat, ash, and TS) of dromedary camel *(Camelus dromedarius)* colostrum and milk during the 3 months lactation period are shown in table 1. Colostrum is produced for the first week, after which the secretion is considered regular milk **(Gorban and Izzeldin, 1997)**.

There was a sharp decline in protein content from 14.23 to 9.63% within the first 24 houres. It continued decreasing gradually to reach 7.17% on 2 day of lactation, stabilized between d 2 to 7, and further decreased to 5.32, 4.87, and 3.55% at d 15, 30, and 90, respectively. A similar trend was observed in Najdi camel colostrum **(Abu-Lehia et al., 1989 and Gaili et al., 2000)** and Bactrian camel **(Zhang et al., 2005)**, where the protein content decreased from 13.00 to 5.12% within the first 24 hours and further decreased to 4.02% on $10^{th}$ day of lactation. **Ohri and Joshi (1961)** reported protein content decreased from 14.49% at the first milking day to 3.95% on d 6 of lactation in Indian camel colostrum. In contrast, Kazakhstan camel colostrum exhibited higher

protein content (19.4%) at parturition, and then decreased quickly to 3.6% within 2 day **(Bestuzheva, 1958)**. Moreover, the mean protein contents in pooled colostrum (1 to 7 day Post P) and regular milk (10 to 240 day Post Parturient PP) of dromedary camels in Saudi Arabia were 5.82 and 3.27%, respectively **(Gorban and Izzeldin, 1997)**, which were lower than those of dromedary camel *(Camelus dromedarius)* in Egypt.

The lactose content remained relatively stable during the study period from parturition up to 3 month PP. The values of the lactose content of dromedary camel *(Camelus dromedarius)* milk ranged from 4.24 to 4.44%, whereas for dromedary camel milk, the values ranged from 2.56 to 5.80% **(Mehaia et al., 1995 and Gorban and Izzeldin, 1997)**. It is well known that bovine colostrum is also rich in most of its components such as protein, fat, serum proteins, and ash. The only component that is low in bovine colostrum in the first days after parturition and increases subsequently is lactose **(Merin et al., 2001b)**. The same was reported for camel milk **(Yagil and Etzion, 1980; Abu-Lehia, 1991** and **Zhang et al., 2005)**, but was not confirmed in the present study or the work by **Merin et al. (2001b)**, possibly due to the determination of lactose by difference.

At 12 h after parturition, the ash content of Dromedary camels (Camelus dromedarius) colostrum was 1.22%. This was higher than that of Jordanian (0.57%) and Najdi (0.99%) camels and lower than that of Indian (2.6%) and Kazakhstan (3.8%) camel colostrum as reported by **(Yagil and Etzion 1980 and Abu-Lehia et al. 1989)**, respectively.

The ash content decreased significantly to 0.99% in the first 24 hours, and then fluctuated slightly thereafter with percentages ranging from 0.82 to 0.98%. In contrast, a steady decrease in ash content of colostrum was reported for the Najdi camel **(Abu-Lehia et al., 1989)**. Ash content ranged from 0.6 to 1.0% for dromedary camels **(Guliye et al., 2000)**, suggesting that camel milk may provide a satisfactory level of minerals for consumers **(El-Amin and Wilcox, 1992)**.

The TS content of colostrum showed a rapid decrease from 20.16 to 17.73% during the first 24 h, likely attributed to the sharp decrease in the protein content over the same period. The TS content remained relatively stable (17.39 to 18.22%) from 24 hours to 30 days PP, and then decreased to 14.31% on 90 days of lactation. **Abu-Lehia et al. (1989)** also reported a sharp

decrease in TS content in colostrum during the first days of lactation for Kazakhstan and Najdi camels. According to **Mehaia et al.,(1995)**, the TS content ranged from 10.0 to 14.4% in dromedary camel milk.

The contents of protein, lactose, fat, ash, and TS of Dromedary camels (Camelus dromedarius) milk at 90 d PP were 3.55, 4.24, 5.65, 0.87, and 14.31, respectively, which were comparable to the data (3.80, 5.10, 5.39, 0.69, and 14.98) reported by **Kheraskov (1961)** for the bactrian camel in Kazakhstan. The largest variations during lactation were in TS and fat contents (**Gaili et al., 2000**). **Guliye et al. (2002)** showed that the stage of lactation did not significantly affect the constituents in regular camel milk. Our data was coincided with **Alhadrami, (2003)**, the composition of camel milk is similar to bovine milk, and the average values of protein, lactose, fat, ash, and TS con-tents of camel milk were 3.4, 3.7, 4.1, 0.7, and 13.1%, respectively.

**NITROGEN DISTRIBUTION:**

Acute phase proteins (APPs), as alternative [illegible] Changes in nitrogen distribution of Dromedary camels (*Camelus dromedarius*) milk during the first 90 days of lactation are shown in Table 2. Total N decreased quickly within the first day. This decrease was attributed mainly to the decrease in WPN. No further major decrease in TN was observed between 1 and 7 days. The TN content began to decrease again, reaching 0.56 g/100 mL on 90 day. This decrease was likely attributed to the decrease in both casein N and WPN contents over the same period. Relatively higher content of TN was observed in Dromedary camels (Camelus dromedarius) milk compared with the published data (0.42 to 0.53 g/100 mL) **(Mehaia et al., 1995)**. Non-protein N contents were found to vary considerably (from 0.03 to 0.08 g/100 mL) throughout the period of this study. However, the concentrations of NPN as percentage of TN showed a trend of increase over the 90 d and the values were 7.89 and 7.14% on 30 and 90 day, respectively (Table 2). These results fall within the range of the published data (4.6 to 15.9%) for dromedary *camel* ***(Farah, 1993 and Mehaia et al., 1995)***. Non-protein N content in bovine milk has been reported in the range 0.025 to 0.035 g/100 g of milk (Walstra et al., 1984). Results of this study show that the average values of the NPN content in regular milk of Dromedary camels (*Camelus dromedarius*) are higher than those of bovine milk, which is

in agreement with other reports **(Abu-Lehia, 1987 and Mehaia et al., 1995)**. According to **Mehaia et al. (1995)**, the NPN fraction has biological importance due to the content of free amino acids (such as taurine), B vitamins, and nucleotides and their precursors such as orotic acid **(Zhang et al., 2005)**.

Casein is the major protein component of milk and certain dairy products such as cheese. The content of casein N remained relatively stable (ranging from 0.80 to 0.90 g/100 mL) during the first week of lactation (Table 2). After that, casein N began to decrease and reached 0.45 g/100 mL on d 90. The casein number of Dromedary camels (Camelus dromedarius) milk was found to increase steadily from 38.57% at parturition up to 79.52% at 15 d PP; and stabilizing around 80% thereafter. The casein number of Dromedary camels' milk was higher than that of dromedary camel milk in Saudi Arabia **(Farah, 1993 and Mehaia et al., 1995)**, but very close to the reported data (79.2%) for bovine milk **(Abu-Lehia, 1987)**.

Highest concentration (0.86 ± 0.01 g/100 mL) of WPN was observed in Dromedary camels (Camelus dromedarius) colostrum at parturition (Table 2). The WPN content decreased by about 50% within the first 24 hour and continued to decline steadily thereafter reaching 0.07 g/100 mL on 90 day, whereas the levels of WPN as percentage of TN in camel milk decreased gradually from 58.74% at parturition to 12.5% at 90 day. According ***to Elagamy (2000)***, the biological value of whey protein is the highest among the milk proteins due to its antimicrobial factors such as lysozyme, lactoferrin, and immunoglobulins. Because Dromedary camels (Camelus dromedarius) colostrum contains more WPN, it is of higher biological value than regular milk, suggesting the importance of colostrum in providing the newborn with immunity. On the other hand, the WPN content and the ratio of WPN to casein No of and Bactrian camel milk **(Zhang et al., 2005)** were lower compared with dromedary camel milk **(Farah, 1993 and Mehaia et al., 1995)**.

**MINERALS:**

Table 4 shows the changes of 4 major minerals (Ca, P, Na, and K) and Cl contents in Dromedary camels **(Camelus dromedarius)** colostrum and regular milk during lactation. The content of $Ca^{2+}$ showed a sharp decrease during the first day of lactation, after which it increased slightly up to day 7, and

then decreased gradually to the lowest value of 154.57 mg/100 g on 90 day. The P content showed a similar trend to Ca during the 90 day lactation period, but was lower than the Ca content throughout lactation. The contents of Na and K varied considerably during the lactation period but, in general, Na content was higher and K content was lower in colostrum than in regular milk. A large variation was found in Cl content throughout the lactation period with a concentration of 152.0 mg/100 g on 90 day. This value was slightly lower than the Cl content (167.3 mg/100 mL) reported by **Guliye et al.,(2000 and 2002)** for Bedouin camel milk, but considerably higher than that (43 mg/100 g) reported for Libyan camel milk **(Gnan and Sheriha, 1986)**.

The major mineral contents (Ca, P, Na, and K) of Dromedary camels (Camelus dromedarius) milk were comparable to some of the data (30 to 197, 45 to 138, 23 to 69, and 60 to 214 mg/100 g, respectively) reported for dromedary camel, which showed a large variation among different studies (**Farah, 1993; Mehaia et al., 1995 and Gorban and Izzeldin, 1997**). The variations in the major mineral contents of camel milk could be due to breed, feeding, stage of lactation, drought conditions, or analytical procedures (**Farah, 1993 and Mehaia et al., 1995**). When compared with bovine milk, contents of Ca, P, Na, and K in camel milk at 90 d PP were substantially higher than those in bovine milk (124, 96.2, 57.5, and 126.0 mg/100 mL, respectively) as reported by **Mehaia et al. (1995)**. Our results were not agree with results of **Chen et al., (2010)** that milk components (fat, protein, lactose, casein, and total solids) among the 3 groups were similar between milk of goat milk with mean SCC levels of 410,000 (low), 770,000 (medium), and 1,250,000 (high) cells/mL. The results also pointed to a significant increase in proteolysis related to SCC levels, showing that intact casein, alpha 1 and beta-casein, decreased as the SCC of milk increased, and that the proteolytic fragments, mainly alpha 1, increased with SCC levels (**Revilla et al.,2007; Castro-Alonso et al., 2009 and Revilla et al.,2009**).

**SDS-PAGE and Densitometry**

Gel electrophoretic patterns of freeze-dried NFCM prepared from raw camel milk samples obtained during the 3-mo lactation period are shown in table 3. Quantitative determinations of the milk proteins were carried out by densitometry analysis on the gels using the Gel-Pro Analyzer software and the data

(expressed as percentage of total protein) were presented in Table 2. It is shown that Dromedary camels (Camelus dromedarius) colostrum contained considerably high level of serum proteins in the first days of lactation (table 3), which decreased quickly thereafter. Caseins showed an opposite trend to serum proteins, increasing significantly, to a maximum level in about 1 wk (Table 3). The SDS-PAGE results agreed well with those for WPN and casein N based on nitrogen distribution analysis reported in this study. it is possible to observe protein bands with apparent molecular weights of 11.9, 26.0, 31.2, 70.3, and 80.0 kDa, respectively, which were comparable to bovine a-LA (11.2 kDa), 3-CN (26.0 kDa), $a_s$-CN (31.0 kDa), BSA (65.4 kDa), and lactoferrin (76.9 kDa). In addition, bands of 42, 55 kDa (designated as MW42 and MW55, respectively), and a band at about 210 kDa (more intense in colostrum) were also observed. **Merin et al. (2001a)** observed a similar band of 42 kDa in dromedary camel milk. With respect to the band of 210 kDa, it is presumed to be immunoglobulins (mainly IgG) and 44 Da in Bactrian camel **(Zhang et al., 2005)** . A molecular weight of about 160 kDa from chromatography for IgG in dromedary camel milk has been reported **(Merin et al., 2001a)**. On the other hand, Dromedary camels (Camelus dromedarius) colostrum and milk showed the absence of proteins having electrophoretic mobility comparable with bovine *f3-LG* (16.1 kDa) (table 3). This result is in agreement with published data **(Ochirkhuyag et al., 1998; Elagamy, 2000; Merin et al., 2001a)**. The previous result is associated with change in milk proteins, III-casein, I-casein, lactalbumin and lactoglobulin with increase in milk with SCC scores **(Rodrguez-Nogales et al., 2007).** The major whey protein bands in Dromedary camels (Camelus dromedarius) colostrum belong to camel serum albumin, Ig, a-LA, and (Table 3). On the other hand, the electrophoretic patterns of Dromedary camels (Camelus dromedarius) colostrum and milk samples showed 2 main protein bands (designated as camel $ns_1$-CN and 3-CN) in the area of caseins with estimated molecular weights of 31 and 26 kDa, respectively, similar to the published data for dromedary camel milk **(Larsson-Raznikiewicz and Mohamed, 1986)**. Compared with bovine casein, the bands of camel casein have lower electro-phoretic motilities, which is in agreement with the results reported by **Farah and Farah-Riesen (1985)**. According to **Larsson-Raznikiewicz and Moha-**

med (1986), bovine caseins contain strongly hydrophilic and hydrophobic regions that may give under and\or overestimated values of molecular weight lactoferrin, whereas in camel milk, the bands of camel serum albumin, a-LA, and lactoferrin were found with high intensities (table 3). The 2 unknown fractions (MW42 and MW55) also showed high inten-sities in Alxa Bactrian camel (Zhang et al., 2005) camel colostrum. However, the nature of the 2 protein fractions has yet to be determined. According to *Abu-Lehia et al. (1989)*, the colostrum consists mainly of Ig and other serum proteins, which provide the new-born calves with nutrients and passive immunity and sup-port the growth of symbiotic intestinal flora. It is clear that, in camel colostrum, the percentage level of Ig, MW42, and MW55 declined quickly, whereas casein and a-LA started at a low level and increased gradually until they reach their normal concentrations in the milk determinations from SDS-PAGE. The same could be assumed for camel caseins

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**SOMATIC CELL COUNT (SCC):**

The SCC is to be used to classify an udder health status, detection of mastitis in camels, (**Obied et al., 1996 and Bekele and Molla, 2001**) as positive or negative for mastitis (**Jorgensen, 1986 and Younan et al., 2001**). The SCC gave a better indication of the presence of pathogenic micro-rganisms in milk samples, the somatic cell count (SCC) ranged from 1.01 x $10^5$ to 11.78 x $10^6$ cells/ml in quarter camel milk samples that contained bacteria *(Guliye et al., 2002)*. The ability of the SSC tests to predict a positive bacteriology increased slightly when 2 or 3 tests were combined *(Barbour et al., 1985)*. Also, previous studies have conf-irmed that milk SCC is reliable methods for detecting subclinical mastitis *(Neave, 1975)*. With the increasing interest in the prod-uction of camel' milk, a need has arisen for a means of monitoring subclinical mastitis *(Zadnik et al., 1993)*. Little attentions for detec-tions of SSC in colostrum and first three months were observed in healthy non infected udder.

The somatic cell count (SCC) ranged from 28.20 x $10^3$ to 120.60 x $10^3$ cells/ml with than 68.87 x $10^3$ cells/ml in the whole period. The mean level of somatic cell count (SCC) ranged from 28.20 x $10^3$ to 65.78 x $10^3$ cells/ml with was 42.210 x $10^3$ cells/ml in colostrum milk.

The colostrum milk samples (24 hours) had significantly lower ($p < 0.01$) than mean values for total

SCC. There was a weak negative correlation coefficient between the SCC and total nitrogen (TN), and a high significant negative correlation with whey protein nitrogen (WPN) and low positive correlations with NPN and medium positive correlation coefficient (between the SCC and casein. The result indicated that the presence and elevations of somatic cell count may connected with protein metabolism mainly especially in first days of lactations, statues of udder, feeding, nutrient supply of dam rather ***(Madsen et al., 2004)*** than any health or environmental conditions ***(El-Amin and Wilcox,1992)***. The camel was milking once day, this is way increase protein parameters (increased fat and protein content; decreased lactose and whey protein) ***(Zeng et al., 2009)*** that a single prolonged milking interval (PMI) is associated with a short-lasting increase in milk somatic cell count (SCC) ***(Lakic et al., 2009)***. An increased SCC level was connected with raise in total crude protein content ***(Barlowska et al., 2009)***.Increase of amyloid A (MAA) and haptoglobin (MHp) concentrations increases with increase of SCC scores, ***(Heringstad et al., 2008 and Safi et al., 2009)***.

The threshold level of somatic cell count (SCC) of regular ranged from 76.11 x $10^3$ to 120.60 x $10^3$ cells/ml with mean was 97.530 x $10^3$ cells/ml in regular milk from 5 to 90 days. The regular milk samples (90 days) had signifycantly ($p < 0.01$) higher than mean values for total SCC. There was a strong significant positive correlation coefficient between the SCC and total nitrogen (TN), whey protein nitrogen (WPN). Medium significant negative was correlated with NPN and low positive correlation coefficient between the SCC and casein. The SSC sample determinations were 64.5% had SCC less than 50 x $10^3$ cells/ml, 81.9% had SCC less than 150 x□□$10^3$, and 92.4% had less than 250 x□□$10^3$ cells/ml. the result approved the previous observations but reverse to that an inverse relati-onship between SCC and milk yield has been demonstrated by ***Blood and Radostits, (1989)***. Our result in agreement with the value for SCC was significantly influenced by the stage of lactation ***(Abdurahman, 1996)***. The somatic cell count (SCC) increased from 1.01 x $10^5$ to 11.78 x $10^6$ cells/ml with Quarter milk samples that contained bacteria ***(Guliye et al., 2002)***.

Somatic cell score (SCS) depends on the genetic, permanent environmental, and residual variances ***(Caccamo et al., 2008)***. Somatic cell count of camel' milk has not

been studied extensively; conesquently an accepted "normal" value has not been established *(Fthenakis et al., 1991)*.Some counting methods, such as direct microscopic SCC and Coulter counter, have been modified to adapt to camel milk, which has a higher fat content than cow milk. Indirect tests, such as the measurement of SCC or other testes, provide information about the inflammatory status of the quarter *(Mattila, 1985* **and** *Middleton et al, (2002 and 2004)*. The average SCC in milk samples from camel's udder halves was 89 x$10^3$ cells/ml, which is comparable to SCC in uninfected udder quarters of cows *(Dohoo and Donald. 1988)*. In our investigation, the SCC in the udder halves of camel was comp-arable to those in quarters of cows *(Pengov, 1995 and 2001)*. The cutoff points for SCC had to be relatively higher than observed and observed with others *(Pyo¨ra¨ la¨ and Kaartinen. 1990)*. A critical issue is where to set the cutoff point for SSC *(Pyo¨ra¨ la¨, 1995 and Pyo¨ra¨ la and Pyo¨ra¨ la¨¨, 1997)*. The accuracy and evaluations of SSC and its efficacyis were very important. Under actual herd conditions, use of SCC determines udder statues are usually sufficient, and examin-ations can subsequently be made on quarters. SSC is practical and accurate enough to estimate SCC at the herd level were recently reviewed *(Schukken and Deluyker, 1995; Watanabe et al., 2008 and Bouwstra et al.,2008)*, showing that sufficient knowledge about desi-gns and statistical methods exist; however, consensus about "the definition means level". Duplicate sampling would be the method of choice, milk SCC, perhaps using the threshold values presented here. Moreover, the importance of SSC as a limiting factor in milk yield is not at all well documented in dairy camel, and, although a negative relationship between SCC and milk yield has been shown in dairy ewes and cattle *(Fuertes et al., 1998)*. Neither significant correlation between the SSC content of milk and lactalbumin nor significant variation in SSC contents during different stages of lactation was detected. *Abdurahman,(1995) and Abdurahman et al.,(2002)* mentioned that serum albumin concentrations released from dam-aged epithelial cells as well as other somatic cells in milk and resulting the concentrations of serum albumin, resulting from increased vascular permeability, serum albumin content in milk was not affected by infection status of the quarter, there were, however, large

variations in serum albumin levels .Our result is conceded with, ***Eibl et al., (1992)*** who found that the cell counts were to depend on the lactation period following parturition the cell count. This number decreased towards the 24th week of lactation. At the end of lactation this value increased again. Somatic cell counts (more than 2,500,000 cells ml-1 high SCC) had lower values of dry extract and fat and high values of pH and fat acidity and were described ***(Revilla et al., 2009 and Castro-Alonso et al., 2009).*** Somatic cell count seemed to affect mammary epithelial permeability. The differences in SCC count due to enzymatic (proteolytic) activity due to lead one to suppose that the quality of the protein fraction ***(Ogola et al., 2007; Zeng et al., 2007 and Abeni et al., 2008).*** Our result is coincided with result on SCC in ewe's Milk where there was correlations between urea nitrogen (MUN) (-0.0096), and the percentages of milk comp-onents (milk fat (-0.3125), protein (-0.8910), and lactose (-0.8012). and associations between them and SCC ***(Park et al., 2007).***

## CONCLUSIONS:

The present data revealed the following conclusions: 1. there were higher protein, lower casein N, and markedly higher WPN contents in Dromedary camels (Camelus dromedarius) colostrum than those in milk. 2. Both colostrum and regular milk had considerable level of lactose. 3. The colostrum is rich in immunoglobulins and serum albumin, whereas levels of casein and a-LA were relatively low and increased gradually until the average values reached the levels of regular milk. 4. It is shown that there is lack of 3-LG in the Dromedary camels (Camelus dromedarius) milk. 5. There were gross differences between SSC in colostrum and the regular milk. 6. The somatic cell count (SCC) ranged from 28.20 x $10^3$ to 120.60 x $10^3$ cells/ml with main 68.87 x $10^3$ cells/ml in the whole period. The mean level of somatic cell count (SCC) ranged from 28.20 x $10^3$ to 65.78 x $10^3$ cells/ml with was 42.210 x $10^3$ cells/ml in colostrum milk. 7. The level of somatic cell count (SCC) of regular milk ranged from 76.11 x $10^3$ to 120.60 x $10^3$ cells/ml with mean was 97.53 x $10^3$ cells/ml in regular milk from 5 to 90 days. 8. The SSC of colostrum milk were correlated positively with total nitrogen (TN), NPN and casein levels and negatively with whey protein nitrogen (WPN). This SSC profile was in regular milk correlated positively with total

nitrogen (TN), whey protein nitrogen (WPN) and casein level and negatively correlations with NPN level. 9. the overall conclusion based on the results in this study is, that the measurement of the SCC in camels' milk can be an effective tool for monitoring udder statues. 10. The mean value should be less than 150 x $10^3$ cells/ml. As information about camel milk chemistry is limited, especially in Egypt, more systematic studies are needed in this area.

**Table 1: Total solid, Protein, lactose, fat and ash content % in colostrum and milk of Dromedary camels (Camelus dromedarius) during the lactation period.**

| Time | Total solid | Protein | Lactose | Fat | Ash |
|---|---|---|---|---|---|
| 12 hours | 20.16 ±0.43$^{a}$ | 14.23±0.21$^{a}$ | 3.24± 0.11$^{a}$ | 4.65± 0.08$^{a}$ | 1.22±0.09$^{c}$ |
| 24 hours | 17.73 ±0.22$^{b}$ | 13.06±0.16$^{b}$ | 3.84± 0.09$^{a}$ | 5.01± 0.09$^{a}$ | 0.99±0.01$^{d}$ |
| 36 hours | 17.39 ±0.17$^{b}$ | 13.74±0.11$^{c}$ | 2.44± 0.05$^{b}$ | 5.15± 0.10$^{a}$ | 0.82±0.05$^{e}$ |
| 48 hours | 16.98 ±0.33$^{b}$ | 13.04±0.18$^{b}$ | 3.94± 0.15$^{c}$ | 4.15± 0.01$^{f}$ | 0.72 ±0.02$^{f}$ |
| 72 hours | 14.39 ±0.23$^{cf}$ | 9.63±0.03$^{a}$ | 4.01± 0.19$^{a}$ | 5.95± 0.12$^{f}$ | 0.89±0.03$^{cf}$ |
| 5$^{th}$ day | 13.89 ±0.41$^{cf}$ | 4.02±0.07$^{bd}$ | 4.84± 0.71$^{b}$ | 4.98± 0.19$^{g}$ | 0.85 ±0.01$^{cf}$ |
| 7$^{th}$ day | 14.46 ±0.31$^{f}$ | 5.12±0.08$^{a}$ | 4.44± 0.52$^{a}$ | 4.15± 0.21$^{h}$ | 0.98±0.01$^{f}$ |
| 15$^{th}$ day | 10.00 ±0.41$^{g}$ | 5.32±0.09$^{bd}$ | 3.77±0.81$^{a}$ | 5.05± 0.08$^{a}$ | 0.83± 0.01$^{g}$ |
| 30$^{th}$ day | 18.22 ±0.42$^{h}$ | 4.87±0.08$^{bk}$ | 4.08± 0.41$^{r}$ | 5.35± 0.01$^{k}$ | 0.87 ± 0.02$^{h}$ |
| 90$^{th}$ day | 14.31 ±0.38$^{b}$ | 3.55±0.01$^{brk}$ | 4.24± 0.01$^{g}$ | 5.65± 0.01$^{k}$ | 0.98± 0.01$^{b}$ |

a, b, c, d, e, f, g, h, r, k The same letters in a column denote means that are not significantly different (P > 0.05) based on Fisher's protected least significant difference test for multiple comparisons. 'Data are means of triplicate determinations.

**Table 2: Nitrogen distribution (g/100 mL; % of N given in parentheses) in colostrum and milk of Dromedary camels (Camelus dromedarius) during the lactation period.**

| Time | Total N | NPN | Casein N | Whey protein N (WPN) | WPN: Casein N |
|---|---|---|---|---|---|
| 12 hours | 2.32 ±0.01$^{a}$ | 0.06± 0.01$^{a}$ | 0.86± 0.01$^{a}$ | 0.86 ± 0.01$^{a}$ | 46:54 |
| 24 hours | 1.26±0.01$^{d}$ | 0.03± 0.06$^{b}$ | 0.82± 0.00$^{a}$ | 0.41± 0.01$^{a}$ | 33:67 |
| 36 hours | 1.29±0.00$^{e}$ | 0.08± 0.01$^{b}$ | 0.82± 0.00$^{a}$ | 0.39± 0.01$^{a}$ | 32:68 |
| 48 hours | 1.12±0.02$^{f}$ | 0.07± 0.01$^{b}$ | 0.81± 0.015$^{a}$ | 0.24 ± 0.01$^{f}$ | 23:77 |
| 72 hours | 1.14 ±0.03$^{ef}$ | 0.06± 0.03$^{a}$ | 0.82± 0.01$^{a}$ | 0.27± 0.00$^{f}$ | 25:75 |
| 5$^{th}$ day | 1.15±0.01$^{ef}$ | 0.07 ± 0.01$^{b}$ | 0.86± 0.01$^{b}$ | 0.21± 0.01$^{g}$ | 20:80 |
| 7$^{th}$ day | 1.16 ±0.01$^{f}$ | 0.08± 0.02$^{b}$ | 0.90± 0.02$^{a}$ | 0.18± 0.01$^{h}$ | 17:83 |
| 15$^{th}$ day | 0.83± 0.01$^{g}$ | 0.05± 0.01$^{bd}$ | 0.66±0.01$^{r}$ | 0.12± 0.01$^{r}$ | 15:85 |
| 30$^{th}$ day | 0.76± 0.02$^{h}$ | 0.06± 0.02$^{bk}$ | 0.61± 0.01$^{r}$ | 0.09± 0.01$^{k}$ | 13:87 |
| 90$^{th}$ day | 0.56± 0.01$^{b}$ | 0.04± 0.01$^{ab}$ | 0.45± 0.01$^{g}$ | 0.07± 0.01$^{k}$ | 14:86 |

a, b, c, d, e, f, g, h, r, k The same letters in a column denote means that are not significantly different ($P > 0.05$) based on Fisher's protected least significant difference test for multiple comparisons. 'Data are means of triplicate determinations.

**Table 3: Changes of protein components (% of total protein) in non fat camel milk (NFCM) prepared from Dromedary camels (Camelus dromedarius) colostrum and milk samples obtained during the lactation period) Protein component[2] (%).**

| Time | ImmunoG | LactoF | LG | MW55 | MW42 | Casein | a-LA |
|---|---|---|---|---|---|---|---|
| 12 hours | 2.05±0.16$^{b}$ | 3.69±0.81$^{b}$ | 9.83± 2.93 | 11.50±1.56$^{b}$ | 14.50±1.84$^{a}$ | 32.86±4.12$^{d}$ | 8.94±1.17$^{b}$ |
| 24 hours | 1.88±0.13$^{bc}$ | 4.01±0.83$^{b}$ | 9.55± 1.77 | 9.40±1.27 | 13.49±3.66$^{b}$ | 38.01±2.45$^{d}$ | 8.89±2.00$^{a}$ |
| 36 hours | 2.28±0.37$^{a}$ | 4.82±0.81$^{b}$ | 9.37±2.16 | 8.32±0.98$^{c}$ | 12.99±2.96$^{c}$ | 34.94±2.60$^{d}$ | 10.60±0.71$^{cde}$ |
| 48 hours | 0.92±0.06$^{d}$ | 4.71±0.86$^{b}$ | 9.96±2.33 | 4.98±0.40$^{d}$ | 8.16±2.07$^{e}$ | 37.34± 1.87$^{d}$ | 15.82±1.10$^{ab}$ |
| 72 hours | 0.63±0.05$^{d}$ | 3.79±0.74$^{b}$ | 9.84±0.80 | 4.25±0.08$^{def}$ | 5.21±0.46$^{cd}$ | 46.77± 3.85$^{b}$ | 14.03±2.31$^{ac}$ |
| 5$^{th}$ day | 1.02±0.51$^{cd}$ | 4.10±0.06$^{b}$ | 8.53±1.99 | 4.79±0.05$^{de}$ | 3.10±0.09$^{d}$ | 55.75±7.21$^{b}$ | 12.43±0.74$^{bcd}$ |
| 7$^{th}$ day | 0.90± 0.3$^{d}$ | 3.27±0.08$^{bc}$ | 9.16±0.06 | 3.07±0.35$^{ef}$ | 2.30±0.58$^{d}$ | 57.97±6.83$^{b}$ | 13.56±1.64$^{abcd}$ |
| 15$^{th}$ day | 0.65±0.07$^{d}$ | 2.35±0.46$^{b}$ | 9.42±1.24 | 2.70±0.19$^{f}$ | 2.03±0.33$^{d}$ | 58.93±3.14$^{b}$ | 15.71±2.27$^{ab}$ |
| 30$^{th}$ day | 0.93±0.47$^{d}$ | 2.91±0.82$^{b}$ | 9.89±1.99 | 2.74±0.33$^{f}$ | 1.89±0.14$^{d}$ | 55.97±5.44$^{b}$ | 16.53± 2.59$^{a}$ |
| 90$^{th}$ day | 1.60±0.42$^{bc}$ | 7.28±2.04$^{a}$ | 6.71±1.23 | 5.21±0.56$^{c}$ | 2.46±0.49$^{d}$ | 52.24±0.19$^{c}$ | 15.00±0.42$^{ab}$ |

a, b, c, d, e, f The same letters in a column denote treatments that are not significantly different (P > 0:05) based on Fisher's protected least significant difference multiple comparisons.

**Table 4: Major minerals and cl contents (mg/100 g)in camel milk from Dromedary camels (Camelus dromedarius) colostrum and milk samples obtained during the lactation period.**

| Time | Ca | Inorganic phosphorus | Na | K | Cl |
|---|---|---|---|---|---|
| 12 hours | 222.58±0.18$^{a}$ | 153.74± 0.53$^{bc}$ | 65.00± 2.41 | 136.50± 1.20$^{a}$ | 141.1± 2.97$^{a}$ |
| 24 hours | 280.17±0.17$^{b}$ | 153.69± 0.88$^{bc}$ | 67.15± 2.93 | 121.59± 1.56$^{b}$ | 144.50± 1.84$^{ab}$ |
| 5$^{th}$ day | 220.45± 0.14$^{bc}$ | 144.01± 0.84$^{b}$ | 58.10± 3.77 | 119.40± 1.27$^{b}$ | 113.49± 3.66$^{ab}$ |
| 7$^{th}$ day | 212.50± 0.37$^{a}$ | 145.82± 0.86$^{b}$ | 59.10± 2.16 | 108.32± 0.98$^{c}$ | 142.99± 2.96$^{a}$ |
| 15$^{th}$ day | 178.15± 0.16$^{d}$ | 143.71± 0.89$^{b}$ | 58.15± 2.33 | 104.89± 0.40$^{d}$ | 108.16± 2.17$^{c}$ |
| 30$^{th}$ day | 176.10± 0.25$^{d}$ | 138.79± 0.78$^{b}$ | 57.25± 2.80 | 94.25±0.28$^{ef}$ | 155.21± 0.46$^{d}$ |
| 90$^{th}$ day | 154.57± 0.51$^{cd}$ | 116.82± 0.66$^{bc}$ | 72.00± 1.99 | 91.00± 0.45$^{de}$ | 152.00± 1.89$^{d}$ |

a, b, c, d, e, f The same letters in a column denote treatments that are not significantly different (P > 0:05) based on Fisher's protected least significant difference multiple comparisons.

**Table 5: Somatic cell count (SSC) and Correlations (Pearson Correlation) and its Sig. (2-tailed is in colostrum and milk of Dromedary camels (Camelus dromedarius) during the lactation period.**

| Time | SSC | (Pearson Correlation) and its Sig | | | |
|---|---|---|---|---|---|
| | | Total N | NPN | Casein | Whey protein N (WPN) |
| 12 hours | 36.07 ± 4.8b$^{a}$ | -0.444 (0.199) | 0.034(0.925) | 0.839(0.002)** | -0.835(0.003)** |
| 24 hours | 28.20 ± 4.2c$^{b}$ | -0.378 (0.128) | 0.023 (0.928) | 0.600 (0.016)** | -0.822 (0.001)** |
| 36 hours | 30.0 ± 2.7$^{c}$ | -0.444 (0.199) | -0.132 (0.715) | -0.724 (0.018)** | 0.656 (0.039)* |
| 48 hours | 51.0 ± 9.4$^{d}$ | -0.378 (0.128) | -0.070 (0.785) | -0.511 (0.040)* | 0.467 (0.050)* |
| 72 hours | 65.78 ± 0.03$^{e}$ | 0.034 (0.925) | -0.132 (0.715) | 0.183 (0.613) | -0.246 (0.493) |
| 5$^{th}$ day | 66.11± 0.01$^{ef}$ | 0.023 (0.928) | -0.070 (0.785) | 0.070 (0.785) | -0.023 (0.928) |
| 7$^{th}$ day | 87.81 ± 0.01$^{f}$ | 0.839 (0.002)** | -0.724 (0.018)* | 0.183 (0.613) | -0.822 (0.003)** |
| 15$^{th}$ day | 90.65 ± 0.01$^{g}$ | 0.600 (0.016)** | -0.511 (0.040)* | 0.070 (0.785) | -0.600 (0.016)** |
| 30$^{th}$ day | 120.60 ± 0.02$^{h}$ | 0.822 (0.001)** | -0.467 (0.060) | 0.023 (0.928) | 0.600 (0.016)** |
| 90$^{th}$ day | 112.5 ± 0.01$^{k}$ | 0.835 (0.003)** | -0.656 (0.039)* | 0.246 (0.493) | 0.822 (0.003)** |

a, b, c, d, e, f, g, h, r, k The same letters in a column denote means that are not significantly different (P > 0.05) based on Fisher's protected least significant difference test for multiple comparisons.

**** Correlation is significant at the 0.01 level (2-tailed).**

* Correlation is significant at the 0.05 level (2-tailed).

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## الملخص العربي

## ارتباط عدد الخلايا الجسدية والتغيرات الحيوية في البان الجمال المصرية

**باسم ج. ا. فهمى و مها محمود محمد**
**قسم الكيمياء الحيويه وامراض النقص الغذائى والسموم**
**معهد بحوث صحه الحيوان الدقي**

**الكيمياء الحيوية ، وأمراض نقص التغذية وقسم علم السموم ، معهد صحة الحيوان ، الدقي القاهرة**

الاختلاف في التكوين الكيميائي للالبان للهجن الجمل العربي (وحيدة السنم) التى تربت في محافظة مرسى مطروح اثناء فتره خلال نشونها حتى 90 يوما. اخذت عينات حليب الإبل من 10 نوق في الموسم الأول من الرضاعة تم جمعها بشكل دوري من الولادة حتى 90 يوما بعد الولادة . وتم تحليل عينات لعدد الخلايا الجسدية والدهون والبروتينات، الكازين، اللاكتوز، والاجسام المناعيه والمعادن.

تغيرات كبيرة حدثت في الخصائص الكيميائية الحيوية طوال فترة الدراسة. انخفض تركيز الكازين بنسبة 60 ٪ ،وانخفض IgG1 بنسبة 94 ٪ ، اما مستوى اللاكتوز لم يتغير. محتويات الكولسترم كان 14.23 ٪ من البروتين ، اللاكتوز 4.44 ٪ ، 0.27 ٪ من الدهون ، 0.77 ٪ رماد ، و 20.16 ٪ من مجموع المواد الصلبه، وقيم كل منها كانت 3.55 ، 4.24 ، 5.65 ، 0.87 ، و 14.31 ٪ للحليب العادي على 90 يوم. وبزيادة 10 أضعاف هو مبين في محتوى الدهون خلال أول 24 ساعة.

في حين أن الانخفاض الحاد كماهو مبين خلال أول 24 ساعة من بدء الرضاعة في البروتين ، والرماد ، ومحتوى المواد الصلبة الكلية. التفاوت في محتوى اللاكتوز كانت صغيرة (4.24 إلى 4.71 ٪) طوال فترة الدراسة. مجموع النيتروجين ، الكازين وبروتين مصل اللبن وتبين أن 2.23 ، 0.06 ، 0.86 ، و 1.31 مل g/100 لاللبأن بمستوى 0.56 ، 0.04 ، 0.45

، و 0.07 مل 100/g للبن في 90 يوم من اللبن العادى. النسب المئوية للكازيين تزداد زيادة مطردة في حين انخفض بروتينات مصل اللبن تدريجيا حتى 30 يوم بدء الرضاعة .

مستويات الكالسيوم والفوسفور ، الصوديوم ، كاف ، والكلور كانت222.58 ، 153.74 ، 65.0 ، 136.5 ، و 141.1 mg/100 ، على التوالي ، في 24 ساعه اما القيم من المعادن كانت 154.57 ، 116.82 ، 72.0 ، 191.0 ، و152.0 mg/100 على التوالى ، لد الحليب العادي على 90 يوما.

وباستخدام التحليل الكهربائى لمصل اللبن وجدات النتائج وقياس كثافة أثبتت أن الإبل الجمل العربي (وحيدة السنم) فى الكوليسترم غنية المناعية ، بمصل الزلال ، و 2 من البروتينات غير معروف ، والتي تخض من خلال الرضاعة. يبدو أن هناك نقص في 3 lactoglobulin في الجمل العربي( وحيدة السنم) فى الحليب ، في حين وان الكازين ، الألبومين اللبن تبدأ عند مستوى منخفض ، وتزيد تدريجيا حتى تصل إلى مستوياتها العادية في الحليب العادى.

تعداد الخلايا الجسدية من لبن الإبل الذي تحدده طريقة Fossomatic وبالمقارنة مع التركيبات الكيماوية الحيوية في الحليب ، وجد ان تعداد الخلايا الجسدية تراوحت ما بين 28.20 إلى 120.60 خليه بمتوسط 103 X $10^3$ خلية / مل مع 68.87 $10^3$ خلية / مل في الفترة كلها. فى الكوليستروم كان مستوى عدد الخلايا الجسدية تراوحت ما بين 28.20 إلى 65.78 $10^3$ خلية / مل كان مع 42.21 س $10^3$ خلية / مل . تعداد الخلايا الجسديه فى عينات حليب اللبأ (24 ساعة) كان كبيرا خلال تلك الفتره .وقد وجد علاقه بين تعداد الخلايا الجسديه أقل من متوسط بترابط سلبي مع النيتروجين الكلي ، ومصل النيتروجين (WPN) وبترابط إيجابي مع NPN ومستوي الكازين. على مستوى عدد الخلايا الجسدية وتراوحت فى الالبان العادية من 76.11 إلى 120.60 $10^3$ خلية / مل مع 97.530 يعني كان $10^3$ خلية / مل في الحليب العادي من يوم 5 حتي 90 يوما. اضهرت ان عدد الخلايا الجسديه SSC كان كبيراعلى المتوسط العام كما وانه يوجد ارتباط قوي إيجابي كبيرمع النيتروجين الكلي ، ومصل النيتروجين (WPN) والكازين وعكسيا معNPN .