BUFFALO COLOSTRUM: COMPOSITION AND IMMUNOGLOBULIN CONTENT IN RELATION TO IMMUNE STATUS OF NEWBORN CALVES

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SUMMARY

Colostrum samples from 98 buffalo cows in first to sixth lactation or more, as well as blood samples from 34 cows and their neonates were collected to investigate the influence of parity on: 1) Immunoglobulins (Ig) and chemical composition of colostrum and, 2) Passive immunity transfer to neonatal calves. Colostrum from the first 6 postpartum milkings was collected from each cow during two years (2004/2005) and a representative samples were used for analysis. Chemical composition (fat, protein, lactose, solid not fat and total solids) was performed on all the samples using Milko Scan, whereas immunoglobulin fractions (IgG, IgM and IgA) were determined during the first year (2004) using single radial immunodiffusion technique. Blood samples were obtained from 34 dams during the last month prepartum and from their offspring during the first month of life to evaluate the immunity transfer.

Weight of colostrum at first milking (FMW) increased (P<0.01) linearly with the advancement of lactation number. Mean of FMW in the first lactation cows was 1.45 kg compared with 4.70 kg of sixth lactation cows. The highest (P<0.01) Ig concentrations were observed in colostrum of first and second parities, whereas the lowest were in the sixth parity. Least squares means of Ig concentrations of the first 6 milkings for IgG were 6.31, 5.68, 5.03, 4.19, 3.67 and 3.99 g/dl; for IgM were 0.96, 0.89, 0.82, 0.69, 0.69 and 0.64 and for IgA were: 0.40, 0.34, 0.32, 0.25, 0.27 and 0.24 g/dl. The chemical composition of colostrum differed significantly with lactation number. First lactation cows had higher (P<0.01) colostral protein and consequently solid not fat (SNF) content compared to multiparous cows. However, colostral fat and lactose were lower (P<0.01) in the first lactation cows compared to the older cows. The highest protein, total solids and SNF percent were in the first postpartum milking, and then the values decreased significantly with subsequent milkings. On the other hand, fat and lactose were the lowest in the first milking and increased (P<0.01) gradually with milking intervals. Plasma IgG, IgM and IgA concentration increased in buffalo cows with the advancement of pregnancy to reach the highest levels at parturition. Similarly, plasma Ig of calves increased with the advancement of age from 7 to 28 days. However, plasma Ig concentration of dams and passive immunity transfer of calves were not affected significantly by lactation number of dams. The correlation coefficients among colostral Ig fractions and both protein and consequently SNF were highly significant. In general, parity and milking number are

major factors for alteration of immunity and chemical composition of buffalo colostrum.

INTRODUCTION

Colostrum is the first postpartum mammary secretions containing extra amounts of immunoglobulins (Ig), proteins, vitamins and minerals in addition to hormones and related growth factors, which are vital to the neonatal calf (Campana and Baumrucker, 1995). Colostral intake supports the adaptation of calves to their new environment and establishes passive immunity (Stott and Fellah, 1983). In addition, colostrum supports development and function of gastrointestinal tract and influences metabolic and endocrine systems and neonatal nutritional status (Guilloteau *et al.* 1997; Hadorn *et al.*, 1997; Buhler *et al.*, 1998 and Hammon and Blum, 1999). Without colostrum consumption survival and health of the neonates are seriously influenced. Health problems including diarrhea and pneumonia are increased, thus growth rate and mortality rate are influenced (Nocek, *et al.*, 1984 and Robison *et al.*, 1988).

Passive immunity is provided when maternal colostrum containing large amount of IgG is fed to neonatal calves within the first few hours of birth (Quigley *et al.*, 2001). Immunoglobulins are absorbed in the first period (perhaps 24- 36 hours) as intact molecules by apical tubular system of intestinal cells conferring immunity to the calf. The quantity of colostrum fed and its Ig content in addition to immediate intake plays crucial roles in the passive transfer of Ig to the calf (Quigley and Martin, 1994).

The classes of Ig includes IgG (IgG_1 and IgG_2) representing most of the Ig with the remainder as IgM and IgA. Butler (1994) reported that IgG_1 comprises over 75% (4.6 g/dl) of the Ig in colostral whey followed by IgM (0.68 g/dl), IgA (0.54 g/dl) and IgG_2 (0.29 g/dl). Many researchers reported that IgG_1 is transferred from the blood of the dam to the mammary gland during the last period of pregnancy, whereas IgM and IgA are synthesized in the mammary gland (Larsson *et al*., 1980 and Geene, 1984). The volume and concentration of Ig are influenced by lactation number and breed of cows (Klobasa *et al*., 1998). Colostral Ig was higher in primeparous buffalo cows compared to multiparous (Salama, *et al.*, 1997). On the other hand, Mechor *et al.* (1992) noted that colostral Ig was not affected by parity. Murrah buffaloes had higher concentrations of protein and Ig than several crossbreeds of cows (Singh *et al*., 1993).

The Ig concentrations are related inversely to the volume of secreted colostrum (Pritchett *et al.*, 1991). The first colostrum milked is the richest in its Ig content and the concentration decrease rapidly in the succeeding milkings (Stott *et al.,* 1981 and Salama *et al,* 1997 and Kelly, 2003). The content of Ig was positively correlated with total solids (TS) and protein and negatively with fat (Mechor *et al.*, 1992 and Salama *et al*., 1997). A few studies were conducted on colostral composition and immunity of buffaloes and their relations with parity. Therefore, this study was performed to evaluate the influence of parity on chemical composition and immunoglobulins of buffalo colostrum and passive immunity transfer to neonates.

MATERIAL AND METHODS

The present study was conducted at Animal Production Research Station of Mahallet Mousa, Kafr El-Sheikh governorate belonging to APRI. Colostrum samples were collected as soon as possible after parturation from 98 buffalo cows in $1^{st} - 6^{th}$ lactation or more during the years 2004 and 2005. Each cow was completely hand-milked after induction of milk letdown with 10 IU of oxytocin /cow spiecially with heifers (which was more difficult in milking**).** Colostrum was milked twice daily during the first 3 days postpartum. Colostrum weights were recorded for each milking and colostrum samples were taken in two clean vials and kept frozen until analysis. Cows were fed in the first year (2004) 3-5 kg kg concentrate, 4 kg berseem (*Trifolium Alexanrenum*) hay and 5 kg rice straw. In second year (2005), cows were fed the same rations as in 2004 plus 5-7 kg corn silage. Chemical composition of colostrum was determined using Milko Scan analyzer (Model 133 B, Denmark). The first day colostrum samples were diluted 1:1 with distelled water before releasing into Milko Scan. Immunoglobulins (Ig)G, IgM and IgA of colostrum were determined in colostral whey using single radial immunodifussion accoding to Fleenor and Stott (1981). Immunoglobulins were determined on only 44 cows in the 1st year, whereas chemical composiotion of colostrum was determined in two years (2004 and 2005).

Blood samples of 34 cows and their calves were collected (in the 1st year) from jugular vein into heparinized tubes three times during the last month of gestation for cows (at day 30, 15 and 0 of expected parturition date) and the first month of age for calves (day 7, 14 and 28 of age). Blood samples were centrifuged (at 3000 r.p.m for 15 min.) to separate plasma and frozen until immunoglobulins determination. The newborn calves were separated from their dams after birth and offered colostrum artificially by nipple and bottle as soon as possible after calving for 3 days. After that, they were housed in individual concrete pens bedded with rice straw. Each calf was fed 10% of birth weight of whole buffalo milk artificially by nipple and bucket two times daily until 4 weeks of age.

Data of chemical composition, immunoglobulin concentration and colostrum milking weight were analyzed using the general linear model (GLM) of SAS (1996). The statistical model of colostral chemical composition included the effect of parity, time of sampling, experimental year and their interactions. Data concerning colostral and blood immunoglobulins of dams and calves were analyzed using two way classification model that included parity, time of sampling and their interaction. As well as, milking weight model included the effect of parity and experimental year. The correlation coefficients among colostral compositions and immunoglobulins also were estimated. The overall means were compared using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

1- Weight of colostrum yield

Least squares means of the first milking weight (FMW) are shown in Table (1). Buffalo cows at first lactation produced the lowest FMW (1.45 ± 0.54 kg) compared with older cows. The value of FMW increased linearly (P<0.01) with the advancement of lactation number until the highest value (4.70 ± 0.54 kg) at sixth

lactation or more. Mean of FMW was higher in first year (2004) but without significant differences. The FMW was correlated negatively with colostral IgG and IgA (r= -0.242 and -0.121, respectively). The results are in agreement with Pritchett *et al.* (1991) and Tomkins and Jaster (1991).

Table 1. Least squares means of weight of first milking (FMW) of buffaloes at different parities

Items	Parity						SEM	Mean of Year
	1	**2**	**3**	**4**	**5**	**6+**		
Year: 2004	1.50	2.50	4.25	3.80	6.00	4.70	0.83	3.80
2005	1.39	3.12	2.25	4.25	3.81	4.70	0.65	3.25
Mean of Parity	1.45[C]	2.81[B]	3.25[AB]	4.03[AB]	4.20[AB]	4.70[A]		

[A,B,C] Means with different superscripts within the same raw of parity is significantly different at (P<0.01).

2- Chemical composition of colostrum

Least square means of colostral chemical composition are presented in Table (2). Fat percentage of colostrum increased significantly (P<0.01) with advanced lactation number of cows. The highest value of fat was in 5th lactation. A similar trend was found with lactose. Fat and lactose elevated (P<0.01) significantly with milking intervals. Protein and consequently solids not fat (SNF) decreased (P<0.01) as lactation number of cows increased. The highest values were in first lactation cows (10.09 % and 14.0 % for protein and SNF, respectively). They declined (P<0.01) linearly with milking intervals to amounts typical for mature milk after three days postpartum. Total solids (TS) did not differ significantly among lactations, however TS decreased (P<0.01) linearly with milking intervals. The components of colostrum (without fat) were significantly higher (P<0.01) in second year (2005 *vs.* 2004). This may be related to prepartum feeding as buffalo cows were fed additional 5-7 kg corn silage during the 2nd year. It was found that protein and TS levels were higher (P<0.01 and P<0.05) in first lactation during 2nd year than those in 1st year (Fig.1 and 2). A similar trend was found in fat and lactose but the highest level of fat was in 2nd lactation and lactose was in 2nd, 3rd and 4th lactation (Fig. 3 and 4). The results are in agreement with Salama *et al.* (1997), who found that colostral protein and TS were higher in the first lactation buffaloes compared with multiparous cows, however fat % was lower in first lactation (5.6%) and increased with increasing lactation number. Whereas, Kume and Tanabe (1993) found the highest (P<0.05) colostral protein was in 3rd and lowest was in 1st lactation number but colostral TS did not differ among parities. Quigley and Martin (1994) mentioned that colostral protein and fat contents were lower in 2nd lactation cows.

Likewise, the highest level of lactose was in 5th and 6th milking during 2nd year (Fig. 5). On the other hand, the highest levels of protein and consequently SNF were in 1st and 2nd milking (Fig. 6). A similar trend was found in buffaloes by Ghionna *et al.* (1987); Maria *et al.* (1990) and Singh *et al.* (1993) who reported that colostral protein and TS decreased in buffaloes (P<0.05) at 4th milking postpartum. Oyeniyi and Hunter (1978) and Kume and Tanabe (1993) found TS and protein in colostrum of Holestein cows decreased (P<0.01) linearly with milking intervals. Ronge and Blum (1988) and Grutter and Blum (1991) reported that colostral compound except

for lactose are particularly abundant in the 1st colostrum, but they rapidly decreased within approximately 8 days to amounts typical for normal milk.

Table 2. The main effects of parity of buffaloes, milking time and year on chemical composition of colostrum

Main Effects	Fat	Protein	Lactose	T.S	SNF
Parity: 1	5.65[b]	10.09[a]	3.07[b]	19.66	14.0[a]
2	6.19[a]	8.87[b]	2.86[b]	18.73	12.54[b]
3	6.81[a]	8.19[bc]	3.38[a]	19.20	12.40[bc]
4	7.18[a]	8.22[bc]	3.18[ab]	19.43	12.24[bc]
5	7.70[a]	8.15[bc]	3.16[ab]	19.8	12.09[bc]
6+	7.48[a]	8.13[c]	3.09[ab]	19.54	12.06[c]
SEM	0.31	0.33	0.07	0.44	0.34
Milking No.: 1	5.38[c]	11.79[a]	2.85[e]	21.01[a]	15.63[a]
2	6.98[b]	10.10[b]	2.92[de]	20.86[a]	13.88[b]
3	7.26[b]	8.53[c]	3.05[cd]	19.66[b]	12.40[c]
4	7.89[a]	7.56[d]	3.20[bc]	19.46[b]	11.57[d]
5	6.62[b]	7.05[de]	3.32[ab]	17.73[c]	11.11[d]
6+	6.89[b]	6.60[e]	3.41[a]	17.63[c]	10.74[d]
SEM	0.31	0.33	0.07	0.44	0.34
Year: 2004	6.65	8.16	3.00	18.6	11.95
2005	7.02	9.06[**]	3.24[**]	20.18[**]	13.16[**]
SEM	0.175	0.185	0.045	0.25	0.20

[a, b, c, d, e] Means with differing superscripts within the same column of parity or milking No. are significantly different at (P<0.01).
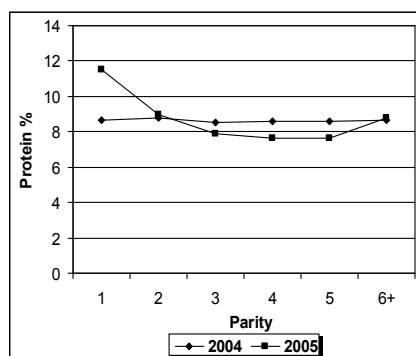** P<0.01

Fig. 1. Colostral protein % in different parities during two years
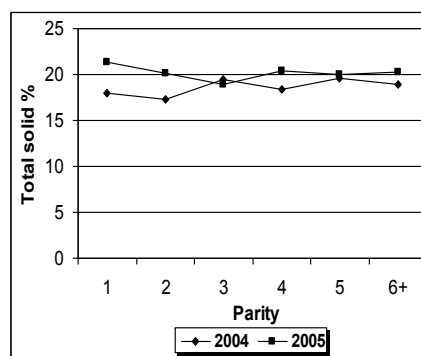

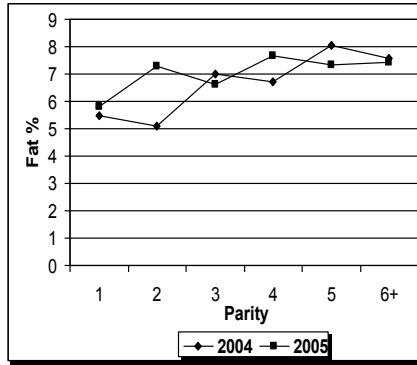**Fig. 2. Colostral total solid % in different parities during two years**

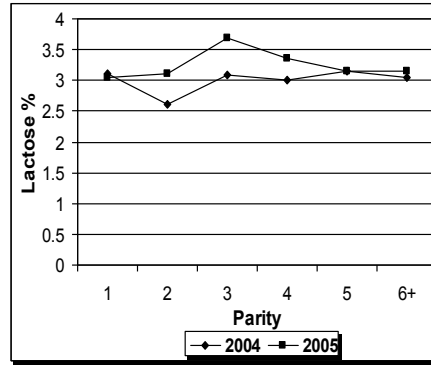**Fig. 3. Colostral fat % in different parities during two years**

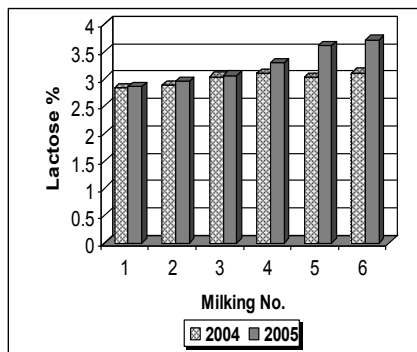**Fig. 4. Colostral lactose % in different parities during two years**

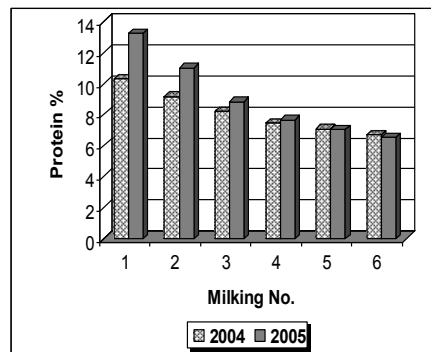**Fig. 5. Colostral lactose % in milking intervals during two years**

Fig. 6. Colostral protein % in milking intervals during two years

3- Colostral Immunoglobulins

Colostral IgG concentrations of buffaloes decreased (P<0.01) significantly with the advancement of lactation number (Table 3). The highest level was in the first and second parities (5.28 and 5.44 g/dl) compared with the 5th and 6th lactational cows (4.51 and 3.99 g/dl). Also, the highest value of IgG was in the first milking (6.31 g/dl) and declined (P<0.01) gradually with time intervals. There were no significant effect of the interaction between parity and milking number. Similarly, colostral IgM and IgA concentrations (Tables 4 and 5) were the highest in the primiparous cows (0.88 and 0.33 g/dl, respectively) and declined significantly in the multiparous cows (0.72 and 0.28 g/dl, respectively). Furthermore, IgM and IgA were decreased (P<0.01) with milking number. These results agree with several studies. Mach and Pahud (1971) reported that the range of Ig of bovine mammary secretions was 5.2-8.7 g/dl of IgG; 0.37 – 0.61 g/dl of IgM and 0.32 – 0.62 g/dl of IgA. As well as, Quigley and Martin (1994) found that mean concentration of colostral IgG, IgM and IgA of Jersey cows were 6.6; 0.24 and 0.17 g/dl, respectively. Klobasa *et al.* (1998)

obtained similar range on Holstein cows. Salama *et al.* (1997) found that colostral Ig concentration was higher in the first lactation buffaloes compared with multiparous. On the other hand, previous studies conducted on other species referred to colostral IgG_1 concentration was greater in multiparous cows (Devery-Pocius and Larson, 1983; Pritchett *et al.*, 1991 and Levieux and Ollier, 1999). Also, Quigley and Martin (1994) found that colostral IgM increased linearly as lactation number increased, however IgG and IgA were not affected significantly by lactation number of Jersey cows. Likewise, Mechor *et al.* (1992) found that lactation number had no significant effect on Ig content of colostrum. Oyeniyi and Hunter (1978), Kelly (2003) and Abd El-Hady *et al.* (2005) observed that colostral IgG concentration declined significantly (P<0.01) with milking number.

Table 3. Colostral IgG (g/dl) of buffalo cows as affected by parity and milking Number

Items	Milking No.						SEM	Mean of parity
	1	2	3	4	5	6		
Parity: 1	6.84	6.12	5.13	4.60	4.48	4.54	0.46	5.28[AB]
2	6.51	5.31	5.60	5.02	4.87	5.32	0.62	5.44[A]
3	6.54	6.63	5.05	4.11	3.28	3.51	0.40	4.85[ABC]
4	6.40	5.28	5.52	4.73	3.45	3.37	0.36	4.79[BC]
5	6.02	5.55	4.69	3.36	3.62	3.83	0.61	4.51[C]
6+	5.54	5.17	4.18	3.33	2.33	3.43	0.49	3.99[D]
Mean of milking	6.31[A]	5.68[B]	5.03[C]	4.19[D]	3.67[E]	3.99[ED]	0.20	

[A,B,C,D,E] Means with differing superscripts within parity or milking No. are significantly different at (P<0.01).

Table 4. Colostral IgM (g/dl) of buffalo cows as affected by parity and milking number

Items	Milking No.						SEM	Mean of parity
	1	2	3	4	5	6		
Parity: 1	0.98	0.98	1.00	0.62	0.83	0.88	0.11	0.88[a]
2	0.95	0.79	0.90	0.77	0.87	0.93	0.14	0.87[a]
3	0.99	0.98	0.73	0.64	0.61	0.50	0.09	0.74[ab]
4	0.96	0.80	0.87	0.72	0.57	0.58	0.08	0.75[ab]
5	1.12	0.89	0.69	0.68	0.67	0.40	0.14	0.74[b]
6+	0.77	0.93	0.75	0.74	0.58	0.57	0.11	0.72[b]
Mean of milking	0.96[A]	0.89[AB]	0.82[B]	0.69[C]	0.69[C]	0.64[C]	0.05	

[a, b, c] Means with differing superscripts within the same column of parity are significantly different at (P<0.05)
[A, B, C] Means with differing superscripts within the same row of milking No. are significantly different at (P<0.01)

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Table 5. Colostral IgA (g/dl) of buffalo cows as affected by parity and milking number

Items	Milking No.						SEM	Mean of parity
	1	**2**	**3**	**4**	**5**	**6**		
Parity: 1	0.44	0.36	0.34	0.30	0.30	0.27	0.03	0.33[A]
2	0.43	0.30	0.35	0.24	0.31	0.32	0.04	0.33[A]
3	0.39	0.36	0.31	0.27	0.25	0.20	0.02	0.30[AB]
4	0.41	0.33	0.35	0.30	0.25	0.25	0.02	0.32[AB]
5	0.41	0.33	0.28	0.19	0.25	0.21	0.04	0.28[B]
6+	0.35	0.36	0.28	0.22	0.26	0.21	0.03	0.28[B]
Mean of milking	0.40[A]	0.34[B]	0.32[B]	0.25[C]	0.27[C]	0.24[C]	0.01	

[A, B, C] Means with differing superscripts within parity or milking No. are significantly different at (P<0.01).

4- Plasma Immunoglobulins

As shown in Table (6), a slight effect of parity on plasma IgG and IgA of cows but without significant differences. Plasma IgG and IgA tended to increase with the increasing of parity. The lowest value of IgM concentration was in 2nd lactation cows and tended to increase (P<0.01) with the advancement of lactation number. Plasma IgG and IgM were elevated linearly (P<0.01) with time intervals until calving, however plasma IgA tended to increase with time but without significant differences.

Passive immunity transfer to neonatal buffalo calves as affected by parity of their dams also were studied (Table 7). It was found that the highest levels of plasma IgG (P<0.1) and IgM (P=0.15) were in the neonates from the 3rd and 4th lactation dams. The lowest values were of 1st and 2nd lactations, although their colostrum had higher IgG and IgM concentrations. This may be explained by the lower colostral yield of these cows as compared with multiparous, so that the colostral intake by neonates was lower. A similar curve was observed with plasma IgA which had higher (P<0.05) level in calves from 5th parity dams. Quigley *et al.* (2001) reported that plasma IgG concentration in calves fed $\geq$ 122 g of IgG was $\geq$ 1.0 g/dl indicating successful transfer of passive immunity. They also concluded the amount of IgG that fed to calves should not be less than 100 g/dose to transfer adequate amount of passive immunity. The present results indicated that mean of colostral IgG concentration in 1st milking was 6.51 g/dl and the mean of plasma IgG concentration of neonates was 2.08 g/dl that indicating successful passive immunity transfer. Plasma IgG of calves was elevated to the maximum level at 14th day of age and then tended (P<0.1) to decrease. Whereas, IgM and IgA were not affected by age of calf. Similar trend to the effect of age of calf was found by Rajala and Castren (1995).

Table 6. Least squares means of plasma immunoglobulins (g/dl) of buffalo cows at prepartum period

Items	Plasma immunoglobulins of cows		
	IgG	IgM	IgA
Parity: 1	2.48	0.35[ab]	0.086
2	2.38	0.29[b]	0.088
3	2.59	0.39[a]	0.106
4	2.66	0.36[ab]	0.098
5	2.81	0.35[ab]	0.095
6+	2.49	0.41[a]	0.14
SEM	0.18	0.025	0.02
Time Prepartum (day):			
-30	2.03[C]	0.29[B]	0.095
-15	2.49[B]	0.37[A]	0.097
0	3.18[A]	0.42[A]	0.114
SEM	0.13	0.02	0.015

[a, b, c] Means with differing superscripts within the same column of parity are significantly different at ($P<0.1$).
[A, B,C] Means with differing superscripts within the same column of time are significantly different at ($P<0.01$).

Table 7. Least squares means of plasma immunoglobulins (g/dl) of newborn calves

Items	Plasma immunoglobulins of calves		
	IgG	IgM	IgA
Parity: 1	1.79	0.27	0.064[b]
2	1.94	0.26	0.058[b]
3	2.29	0.29	0.129[ab]
4	2.32	0.27	0.088[b]
5	2.11	0.31	0.195[a]
6+	2.04	0.23	0.075[b]
SEM	0.16	0.021	0.025
Age of calf (day):			
7	1.94	0.29	0.127
14	2.30	0.25	0.084
28	2.01	0.27	0.094
SEM	0.12	0.015	0.018

[a, b] Means with differing superscripts within the same column of parity are significantly different at ($P<0.05$).

5- Correlation coefficients

Chemical composition of colostrum has been studied in association with colostral immunoglobulins through correlation coefficients (r). Concentration of IgG, IgM and IgA were highly correlated with protein and SNF % (Table 8). However, Ig fractions were negatively correlated with lactose and fat %. In addition, negative correlations were found between FMW and IgG or IgA. Highly significant correlations were noted among IgG, IgM and IgA. Colostral protein was negatively correlated ($P<0.01$) with both fat and lactose (r= -0.25 and -0.52, respectively).

These findings are in agreement with Ghionna *et al.* (1987); Mechor *et al.* (1992) and Salama *et al.* (1997) who reported that colostral Ig was highly positively correlated with protein and negatively with fat (r= -0.21). As well, Pritchett *et al.* (1991) ,agreement with our results, noted a negative correlation (r= -0.29) between IgG and FMW. Mechor *et al.* (1992) and Quigley and Martin (1994) found similar trend where they reported significant correlation between IgG, IgM and IgA, also between IgG and both protein and TS.

Table 8. Correlation coefficients between colostral components of buffalo cows.

Items	Fat	Protein	Lactose	TS	SNF	FMW[1]	IgG	IgM
Protein	-0.250**							
Lactose	0.071	-0.523**						
T.S	0.668**	0.534**	-0.194*					
SNF	-0.212*	0.974**	-0.333**	0.585**				
IgG	-0.219*	0.493**	-0.335**	0.168	0.459**	-0.242		
IgM	-0.169	0.319**	-0.186*	0.097	0.311**	0.089	0.637**	
IgA	-0.282**	0.464**	-0.399**	0.078	0.410**	-0.121	0.713**	0.623**

[1] FMW: weight of first milking

* P<0.05 ; ** P<0.01

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السـرسوب فـى الجـاموس: التركيـب الكيمـاوى والمحتـوى مـن الأجـسام المناعيـة وعلاقتـه بالحالة المناعية فى العجول حديثة الولادة

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تم جمع عينات سرسوب من ٩٨ جاموسة فى المواسم الانتاجية من الأول الى السادس فأكثر ، كذلك تم جمع عينات دم من ٣٤ جاموسة ومن أبنائها بغرض دراسة تأثير الموسم الانتاجى على (١) الأجسام المناعية والتركيب الكيماوى للسرسوب (٢) المناعة المنقولة للعجول حديثة الولادة وعلاقتها بمستوى الأجسام المناعية فى أمهاتها وفى السرسوب. تم جمع عينات السرسوب كميا من اول ستة حلبات بعد الولادة من كل جاموسة أثناء عامين متتاليين (٢٠٠٤ ، ٢٠٠٥) تم تقدير التركيب الكيماوى للسرسوب (دهن ، بروتين ، لاكتوز، المكونات الصلبة اللادهنية والمواد الصلبة الكلية) وذلك فى جميع العينات على مدار العامين، فى حين أنه تم تقدير الأجسام المناعية (IgG, IgM, IgA) فى عينات العام الأول (٢٠٠٤). تم أخذ عينات دم من ٣٤ جاموسة أثناء الشهر الأخير من الحمل وكذلك من الأبناء الناتجة أثناء الشهر الأول من العمر وذلك لتقدير المناعة المنقولة.

وقد تلخصت أهم النتائج فى الآتى: ازداد وزن أول حلبة من السرسوب زيادة طردية (P<0.01) مع التقدم فى الموسم الانتاجى حيث كان متوسط وزن الحلبة الأولى فى حيوانات الموسم الانتاجى الأول ١.٤٥ كجم بالمقارنـة مـع ٤.٧٠ كجم فى حيوانات الموسم السادس فأكثر. وكانت أعلى تركيزات للأجسام المناعية فى حيوانات الموسم الأول والثانى فى حين أن أقل تركيزات وجد فى حيوانات الموسم السادس. وكان متوسط الأجسام المناعية فى الحلبات الستة الأولى كالآتى: IgG كان ٦.٣١، ٥.٦٨، ٥.٠٣، ٤.١٩، ٣.٦٧، ٣.٩٩ جم/١٠٠سم٣، وكان IgM ٠.٩٦، ٠.٨٩، ٠.٨٢، ٠.٦٩، ٠.٦٤، ٠.٦٤ جم/١٠٠ سم٣، وكان IgA ٠.٤، ٠.٣٤، ٠.٣٢، ٠.٢٥، ٠.٢٧، ٠.٢٤ جم/١٠٠مل. أما التركيب الكيماوى للسرسوب قد تأثر معنويا بالمواسم الانتاجية للجاموس. حيث كان بروتين السرسوب وكذلك المواد الصلبة الادهنية أعلى (P<0.01) فى حيوانات الموسم الأول بالمقارنـة بالحيوانـات عديدة المواسم. فى حين ان الدهن واللاكتوز كـان أقـل (P<0.01) فى حيوانـات الموسم الأول منه فى الحيوانات الأكبر عمرا ، وكان أعلى نسبة بروتين، مواد صلبة كلية ومواد صلبة لادهنية فى أول حلبة ثم تراجعت معنويا فى الحلبات التالية، فى حين ان الدهن واللاكتوز قد ازداد تدريجيا (P<0.01) فى الحلبات التالية عنه فى الحلبة الأولى. أما بالنسبة لتركيزات الأجسام المناعية فى بلازما دم الأمهات فقد ازدادت بزيادة مدة الحمل حتى وصلت الى أقصى تركيزاتها عند الولادة وكذلك مستوى الأجسام المناعية فى الأبناء فقد ازداد بالتقدم فى العمر من اليوم السابع وحتى اليوم ٢٨ من العمر. فى حين ان مستوى الأجسام المناعية فى الأمهات وكذلك المناعة المنقولة لأبنائها لم تتأثر بالموسم الانتاجى للأمهات. وقد كان معامل

الارتباط بين الأجسام المناعية فى السرسوب وكلا من البروتين والمواد الصلبة اللادهنية مرتفع معنويا وكذلك بين الأجسام المناعية وبعضها.

يستخلص من هذه الدراسة أن كلا من الموسم الانتاجى للجاموس ورقم الحلبة (أو الوقت بعد الولادة) تعد من أكبر العوامل تأثيرا على المناعة والتركيب الكيماوى فى السرسوب الجاموسى.