

The Chemical Composition and Properties of Colostrum from Buffaloes

I. Chemical composition and some physical properties.

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MILK samples from individual buffaloes (5 animals) were collected during the first two weeks after parturition and analysed for acidity, pH, T.S., lactose, ash, chloride, protein fractions and refractive index and relative viscosity.

The results showed that the constituents of colostrum reached levels normal for milk in varying periods after parturitions and refractive index and relative viscosity.

Ash on the 2nd day,

T.S., S.N.F. and casein on the 3rd day,

Albumin and refractive index on the 4th day,

Lactose on the 5th day,

Total protein, globulin, β -lactoglobulin and chloride on the 7th day,

Acidity and pH on the 10th and 12th days respectively.

The milk obtained on the first days after parturition, usually referred to as colostrum, is markedly different from normal milk in every aspect (El-Negoumy, 1957) Ghosh & Anantkrishnan, 1964). The transition from colostrum to normal milk is usually accompanied by gradual or sudden changes in the constituents and properties of colostrum milk. The rate of these changes is largely dependent on the kind and individuality of the animal. Most of the studies on this subject are concerned with cow colostrum (McFutyre *et al.* 1952, Parrish *et al.* 1950, Patel & Patel 1958, 1959), while information on the colostrum of other mammals especially buffaloes is incomplete.

The present study is, therefore, concerned with the changes in some constituents of buffalo colostrum milk during 14 days postpartum and the period needed for each constituent to reach its level in normal milk.

Experimental Procedure

Individual samples of buffalo milk were collected from 5 animals of the herd of the Faculty of Agriculture, Ein Shams University within 24 hrs of parturition and then daily for a period of two weeks.

The samples were analysed for acidity, pH, chloride, fat, T.S. and ash contents as described by Ling (1956). The lactose content was determined colorimetrically by the phenol-sulphuric acid method (Barnet+Tawab, 1957), Nitrogen fractions namely total N, non-casein N, non-protein N, albumin N, B-lactoglobulin N and globulin N were determined according to Aschaffenburg & Drewry (1959). The refractive index of the samples was measured with the Abbe. dipping refractometer according to the A.O.A.C. method (1960) and the relative viscosity by the pipette method (Laboratory Manual, 1949).

Results and Discussion

Results in Tables 1, 6 showed that the extent of changes in the chemical composition and properties of colostrum milk on the first 14 days postpartum varied with each constituent.

TABLE 1. Changes in total solids, solids not fat and fat contents of individual buffaloes milk during the first 14 days post partum*.

Days after calving	Total solids		Solids not fat		Fat	
	Average	Range	Average	Range	Average	range
(0-24 hr)	23.70	17.02—31.12	18.00	9.52—24.12	5.70	3.2—7.5
2	19.76	17.18—22.97	13.48	9.68—18.47	6.28	4.5—7.5
3	15.41	13.31—17.51	10.37	7.94—13.52	5.04	4.0—7.0
4	15.85	13.77—17.80	11.31	9.94—14.20	4.54	3.5—6.2
5	15.22	13.13—17.94	11.16	9.33—14.64	4.06	3.3—4.6
6	14.82	12.47—16.89	11.07	8.69—13.89	3.78	3.0—5.0
7	14.83	12.44—17.00	10.75	8.44—12.50	4.08	3.4—5.0
8	14.68	13.05—17.27	9.70	9.48—13.57	4.98	3.6—4.5
9	14.45	13.89—15.12	10.35	9.60—11.12	4.10	3.5—4.5
10	14.33	13.42—15.26	10.21	9.62—10.86	4.12	3.5—4.5
11	14.17	13.31—15.40	9.67	8.31—10.40	4.50	3.6—5.0
12	14.21	13.43—15.00	10.13	9.41—10.76	4.08	3.5—5.4
13	14.02	13.20—14.56	9.96	9.70—10.24	4.06	3.5—4.6
14	14.08	13.20—14.56	9.86	9.40—10.26	4.22	3.5—5.1

(*) All values are expressed in percent.

TABLE 2. Changes in the lactose, ash and chloride contents of individual buffalo milk during the first 14 days post partum.*

Days after calving	Lactose		Ash		Chloride	
	Average	Range	Average	Range	Average	Range
(0-24 hr)	3.87	3.65-4.10	0.95	0.80-1.43	0.217	0.170-0.251
2	4.24	4.05-4.50	0.87	0.80-0.93	0.187	0.147-0.242
3	4.58	4.35-4.70	0.87	0.82-0.94	0.147	0.100-0.201
4	4.89	4.70-5.00	0.87	0.81-0.92	0.126	0.097-0.149
5	5.06	5.00-5.10	0.91	0.83-0.99	0.125	0.099-0.143
6	5.06	5.06-5.10	0.92	0.87-0.98	0.120	0.090-0.143
7	5.11	5.06-5.20	0.92	0.87-0.99	0.103	0.084-0.126
8	5.12	5.10-5.20	0.90	0.87-0.97	0.099	0.088-0.117
9	5.18	5.10-5.20	0.88	0.86-0.91	0.092	0.073-0.104
10	5.13	5.10-5.25	0.89	0.87-0.91	0.090	0.073-0.104
11	5.17	5.10-5.25	0.89	0.85-0.92	0.086	0.070-0.099
12	5.16	5.10-5.20	0.88	0.84-0.91	0.084	0.070-0.098
13	5.21	5.20-5.25	0.87	0.84-0.91	0.088	0.070-0.093
14	5.21	5.20-5.25	0.87	0.87-0.91	0.083	0.070-0.093

(*) All values are expressed in percent.

The averages contents of T.S. and S.N.F. on the first day of milking were high and amounted to 23.70 and 18.00 respectively. They then rapidly decreased reaching the normal levels for buffalo milk on the third day after calving namely 15.41 and 10.37 respectively. Similar changes were reported by Ghosh & Anantakrishnan (1964) and El-Negoumy (1957).

The fat was the most variable constituent during the colostrum period with a general tendency for the highest values to occurs on the 2nd day of milking. Similar variations were reported by Ghosh & Anantakrishnan (1964).

The high contents of total protein and protein fractions, especially globulin, were a characteristic feature of colostrum. However, the total protein content rapidly decreased from 14.50% on the first day, to its average value in normal milk of 4.73% on the 7th day after parturition. Globulin, with an average of 8.59% on the first day, reached its value for normal milk on the 7th day of calving with an average of 0.38%. Also, the albumin content decreased from 1.50% on the first day to attain its value for normal milk of 0.60% on the 4th day. β -lactoglobulin content started with an average of 0.84%, dropped rapidly to 0.48% on the 2nd day, and reached its normal value for milk of 0.30% on the 7th day of milking. These results, are higher than those reported by El-Negoumy (1957).

TABLE 3. Changes in total protein and non-protein nitrogen contents of individual buffalo milk during the first 14 days post partum.*

Days after calving	Total protein		Non-protein-nitrogen	
	Average	Range	Average	Range
(0-24 hr)	14.50	13.99-15.02	0.057	0.052-0.061
2	7.92	7.10-8.89	0.055	0.052-0.059
3	5.70	5.59-5.79	0.052	0.046-0.055
4	5.38	5.17-5.71	0.056	0.052-0.060
5	5.42	5.27-5.61	0.055	0.052-0.060
6	4.99	4.52-5.49	0.052	0.045-0.055
7	4.73	4.41-4.95	0.052	0.045-0.055
8	4.56	4.31-4.74	0.052	0.045-0.055
9	4.41	4.10-4.74	0.052	0.045-0.055
10	4.22	4.10-4.41	0.051	0.046-0.055
11	4.15	4.10-4.31	0.052	0.046-0.055
12	4.19	4.10-4.52	0.050	0.046-0.055
13	4.18	4.10-4.31	0.052	0.046-0.055
14	4.09	4.10-4.22	0.052	0.046-0.055

(* All values are expressed in percent.

The changes in the casein were less pronounced than those for whey proteins. The casein slightly increased from an average of 3.84 % in the first milking to 4.34% on the 2nd day and decreased to 3.98% on the 3rd day, a figure which falls in the range given from normal buffalo milk by Ghosh & Anantakrishnan (1964).

Changes in non-protein-nitrogen contents were slight during the colostrum period with values varying from 0.057 to 0.050% and with no clear trend. These results confirm the finding of Ghosh & Anantakrishnan (1964) but contradict those of El-Negoumy (1957). El-Negoumy found a gradual decrease in N.P.N. during the colostrum period.

TABLE 4. Changes in protein fractions of individual buffalo milk during the first 14 days post partum.*

Days after calving	Casein		Albumin		Globulin		B-lactoglobulin	
	Average	Range	Average	Range	Average	Range	Average	Range
(0-24 hr)	3.84	3.39-4.19	1.50	1.46-1.63	8.59	8.43-8.70	0.84	0.64-0.97
2	4.34	4.08-4.64	0.96	0.81-1.13	1.75	1.69-1.83	0.48	0.43-0.50
3	3.98	3.88-4.25	0.66	0.61-0.80	0.75	0.69-0.90	0.45	0.35-0.50
4	3.88	3.71-4.02	0.60	0.42-0.71	0.47	0.35-0.68	0.40	0.35-0.47
5	3.91	3.81-4.08	0.61	0.51-0.73	0.47	0.34-0.57	0.43	0.37-0.45
6	3.62	3.44-3.99	0.59	0.49-0.75	0.53	0.36-0.81	0.39	0.35-0.44
7	3.70	3.43-3.60	0.58	0.51-0.67	0.38	0.28-0.53	0.30	0.28-0.32
8	3.39	3.22-3.55	0.62	0.53-0.90	0.34	0.26-0.52	0.29	0.27-0.34
9	3.27	3.02-3.50	0.50	0.43-0.63	0.35	0.27-0.52	0.26	0.22-0.34
10	3.14	3.03-3.22	0.49	0.45-0.56	0.35	0.26-0.45	0.23	0.22-0.28
11	3.10	3.03-3.15	0.51	0.47-0.55	0.30	0.21-0.36	0.23	0.21-0.26
12	3.15	3.07-3.43	0.52	0.48-0.61	0.26	0.20-0.33	0.24	0.22-0.3
13	3.11	3.07-3.36	0.49	0.47-0.50	0.26	0.23-0.31	0.23	0.21-0.24
14	3.07	3.01-3.11	0.49	0.47-0.50	0.28	0.23-0.35	0.22	0.19-0.2

(*) All values are expressed in percent.

The lactose content of the first drawn milk was low with an average of 3.87% and then gradually increased reaching its normal level for milk of 5.06% on the 5th day after calving. These results are in accordance with previous findings (El-Negoumy, 1957).

The variations in the ash content during the colostrum period were slight and agreed with those for cows colostrum (Parrish *et al.* 1950, Patel & Patel, 1958). Values declined from 0.95% in the 1st milking to 0.87% on the 2nd day, a figure comparable to that of normal milk.

TABLE 5. Changes in the pH and acidity content of individual buffalo milk during the first 14 days post partum*.

Days after calving	pH		Acidity (*)	
	Average	Range	Average	Range
(0-24 hr)	6.02	5.90-6.20	0.32	0.27-0.40
2	6.07	5.90-6.20	0.29	0.25-0.30
3	6.12	6.05-6.30	0.27	0.24-0.27
4	6.16	6.05-6.30	0.26	0.24-0.27
5	6.18	6.10-6.30	0.25	0.24-0.26
6	6.19	6.10-6.30	0.24	0.22-0.26
7	6.27	6.10-6.35	0.23	0.21-0.25
8	6.33	6.30-6.35	0.24	0.23-0.29
9	6.36	6.20-6.45	0.22	0.19-0.27
10	6.38	6.10-6.50	0.21	0.17-0.27
11	6.44	6.30-6.50	0.20	0.18-0.24
12	6.50	6.45-6.55	0.19	0.16-0.22
13	6.55	6.50-6.60	0.18	0.16-0.20
14	6.56	6.50-6.60	0.17	0.16-0.18

(*) All values are expressed in percent.

Unlike the previous constituents the high level of chloride persisted for a longer time before it reached its normal level after 7 days. Thus, the chloride content of the first drawn milk had an average value of 0.217% and gradually decreased reaching its normal level of 0.103% in milk on the 7th day after parturition. El-Negoumy (1957) and Ghosh & Anantakrishnan (1964) reported that chloride content reached its normal level in the 7th milking.

Variations in the acidity and pH of buffalo colostrum during 14 days postpartum took opposite trends as expected, with the former decreasing and the latter increasing. However, the variations in acidity were more pronounced. Both acidity and pH reached their normal levels in buffalo milk after 10 and 12 days respectively. El-Negoumy (1957), showed that the variations in acidity and pH were gradual and attained their normal levels in the 8th milking.

TABLE 6. Changes in the refractive index and relative viscosity of individual buffalo milk during the first 14 days post partum.

Days after calving	Refractive index		Relative viscosity	
	Average	Range	Average	Range
(0-24 hr)	1.34529	1.34515—1.34540	1.3877	1.0612—2.0408
2	1.34522	1.34520—1.34525	1.1020	1.0408—1.1428
3	1.34484	1.34463—1.34510	1.0448	1.0408—1.612
4	1.34474	1.34470—1.34496	1.0408	1.0204—1.0612
5	1.34471	1.34455—1.34488	1.0204	1.0204
6	1.34478	1.34465—1.34490	1.0204	1.0204
7	1.34473	1.34450—1.34492	1.0286	1.0204—1.0612
8	1.34477	1.34462—1.34495	1.0286	1.0204—1.0612
9	1.34468	1.34450—1.34488	1.0245	1.0204—1.0408
10	1.34472	1.34450—1.34490	1.0286	1.0204—1.0612
11	1.34468	1.34452—1.34481	1.0245	1.0204—1.0408
12	1.34463	1.34450—1.34473	1.0205	1.0204—1.0208
13	1.34459	1.34450—1.34470	1.0205	1.0204—1.0208
14	1.34459	1.34450—1.34474	1.0205	1.0204—1.0208

The changes in the refractive index in the early days after parturition were rapid but values reached a constant level after 4 days with an average of 1.34463. The relative viscosity showed similar variations to refractive index being high in the first day and decreasing to an almost constant value 4 days after calving.

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التركيب الكيماوى وخواص سرسوب اللبن الجاموسى

أولا - التركيب الكيماوى وبعض الخواص الطبيعية .

أبراهيم الدسوقى رفعت ، عثمان عبد الفنى ، حمزه الصلمى

ومحمد الحسينى عبد السلام .

المركز القومى للبحوث - زراعة عين شمس

جمعت عينات من اللبن الناتج من خمسة من فرادى الجاموس خلال أربعة عشر يوما بعد الولادة وقدر فى هذه العينات نسبة الجوامد الكلية والحموضة والدهن واللاكتوز والرماد والكلوريد والبروتين الكلى وشقوقه وكذلك رقم الـ pH ومعامل الانكسار واللزوجة النسبية .

وقد دلت النتائج على أن المكونات المختلفة تصل إلى مستواها الطبيعى فى اللبن بعد فترات مختلفة بعد الولادة كالآتى :

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• الحموضة ورقم الـ pH فى اليوم العاشر والثانى عشر على التوالى -