

The Chemical Composition and Properties of Colostrum from Buffaloes

II. Heat Stability, Rennet and Ethanol Coagulation

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THE HEAT stability, and rennet and ethanol coagulation of colostrum from individual buffaloes were determined during the first two weeks after parturition.

The results showed that buffalo mammary secretion may be considered comparable to normal milk 4 days postpartum in respect to these properties. The interrelations between the heat stability, rennet and ethanol coagulation and the chemical composition and properties of colostrum are presented and discussed.

The heat stability, and ethanol and rennet coagulation of buffaloes milk have been reported (Abd El-Salam, 1965, 1966 and Abd El-Salam and El-Shibiny, 1966). In these studies, heat stability, and rennet and ethanol coagulation were found to be affected by the chemical composition of the milk.

During the first two weeks after calving, it has been shown that the chemical composition of colostrum and the rate at which its composition changes to that of normal milk varied with the kind of constituent (Rifaat *et al.* under pub.). However, the heat stability, and ethanol and rennet coagulation of the mammary secretion during this period and their relation to the chemical composition has not been investigated. This was the object of the present paper.

Material and Methods

The collection and preparation of the samples have been previously reported (Rifaat *et al.* under pub.)

The heat stability of the samples was measured by determining the time required to cause coagulation at 130°C as described by Abd El-Salam (1965). The stability of milk samples to ethanol was determined by finding the strength of alcohol solution which was needed to clot an equal volume of milk as described by Waite and Davies (1958) the method used for measuring the renneting time of milk was the same as described by Fahmi (1962).

Simple correlations between the heat stability, and ethanol and rennet coagulation and the chemical and physical properties of milk were calculated using data presented in part I of this series (Rifaat *et al.* under pub.).

Results and Discussion

Heat Stability

On the first and 2nd days after calving, colostrum showed its lowest heat stability with average coagulation times of 0.28 and 0.60 minutes respectively Table 1. The heat stability of colostrum then rapidly increased to 25

TABLE 1. Changes in heat stability, and rennet and ethanol coagulation of buffalo milk during the first 14 days postpartum

Days after calving	Heat stability		rennet coagulation		ethanol coagulation	
	Average*	Range*	Average*	Range*	Average‡	Range‡
(0—24 h)	0.28	0.25—0.33	198	125—356	60.0	60.0
2	0.60	0.30—0.82	165	91—296	60.0	60.0
3	11.45	1.25—22.66	108	68—214	60.4	60.0—62.0
4	25.00	2.00—36.00	101	67—205	60.4	60.0—62.0
5	31.80	29.25—36.33	96	60—186	61.6	60.0—64.0
6	34.53	29.00—38.33	82	62—129	62.0	60.0—66.0
7	35.93	30.00—40.00	82	66—113	64.0	62.0—66.0
8	36.66	31.30—42.50	90	77—128	64.4	64.0—66.0
9	35.70	30.00—42.00	85	63—120	64.8	64.0—66.0
10	36.75	31.25—41.25	80	63—114	66.0	64.0—68.0
11	36.73	30.25—42.30	84	63—120	68.8	68.0—72.0
12	37.57	30.20—43.30	83	67—100	68.0	66.0—70.0
13	38.80	33.25—42.25	93	73—139	70.0	68.0—72.0
14	39.20	33.00—44.17	87	65—120	70.0	68.0—72.0

* All values are expressed in minutes.

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‡ « « « « « percent.

min. On the 4th day and then gradually increased to 39.20 min. 14 days after parturition. The heat stability of the mammary secretion after the fourth day of calving was comparable to that of normal buffalo milk (Abd El-Salam, 1965).

The interrelationships between heat stability and the chemical and physical properties of colostrum are shown in Table 2. Thus, in the early mammary secretion, definite relationships existed between heat stability,

TABLE 2. The correlations between the heat stability and the chemical and physical properties of buffalo colostrum

Constituent	Correlation Coefficient	Significance	
		0.01	0.05
pH	+ 0.68	sig.	sig.
Acidity	- 0.64	sig.	sig.
Refractive index	- 0.89	sig.	sig.
Ethanol coagulation	+ 0.73	sig.	sig.
Relative viscosity	- 0.71	sig.	sig.
Rennet coagulation	- 0.90	sig.	sig.
Fat	- 0.76	sig.	sig.
Lactose	+ 0.94	sig.	sig.
Chloride	- 0.95	sig.	sig.
Ash	- 0.15	not sig.	not sig.
Total solids	- 0.86	sig.	sig.
Total protein	- 0.80	sig.	sig.
Casein	- 0.83	sig.	sig.
Albumin	- 0.83	sig.	sig.
Globulin	- 0.69	sig.	sig.
Non-protein nitrogen	- 0.74	sig.	sig.
B-lactoglobulin	- 0.85	sig.	sig.
Solids-not-fat	- 0.76	sig.	sig.

sig. : significant.

not sig. : not significant

and pH, fat, lactose and chloride content and coagulation. These results are not in agreement with those reported for buffaloes' milk (Abd El-Salam, 1965) and cows milk (White and Davies, 1958). The total solids, solids-not-fat, total protein and protein fractions were also significantly related to coagulation time. Abd El-Salam (1965) reported that whey proteins were significantly correlated to heat stability. These results suggest that the abnormal increase in total solids particularly whey proteins in colostrum facilitate the aggregation of the case in particles by heat treatment.

Rennet coagulation

The changes in the rennet coagulation time of colostrum during the 14 days immediately after calving are presented in Table 1. On the first day the renneting time averaged 198 sec then it rapidly decreased to 101 sec on the 4th day and then gradually decreased on the following days until it reached an average of 87 sec., 14 days after parturition.

Comparing these figures with those reported for buffalo's milk, the renneting time on the 4th day after parturition (101 sec.) was almost the same as that of normal buffalo milk (103 sec.) as reported by Abd El-Salam and El-Shibiny (1966).

When the relations between milk constituents and rennet coagulation were determined, definite and close relationships were found between renneting time and acidity, pH, total solids, lactose, chloride, total protein, solids-not fat and protein fractions Table 3. The whey proteins particularly globulins have a retarding effect on rennet action (Jenness and Patton, 1959). Therefore, a close relation between the whey protein content and renneting time could be expected and this was found to be true for the present results.

The relation between pH and acidity and rennet coagulation were also observed in normal buffalo milk (Abd El-Salam and El-Shibiny, 1966).

Ethanol coagulation

It is clear from the results presented in Table 1, that colostrum on the 1st and 2nd days after parturition showed the lowest stability towards ethanol and that stability then gradually increased. Thus, on the first day after calving, 60% ethanol was sufficient to coagulate milk while on the 14th day, 70% ethanol was required to produce coagulation.

The relations between pH and acidity, and ethanol coagulation were highly significant, Table 4. Similar relations were not observed in normal buffalo milk (Abd El-Salam, 1966). The results presented in Table 4, also show that, the protein fractions, casein and B-lactoglobulin had a definite relation with ethanol coagulation. Lactose, chloride and non-protein nitrogen also had significant correlations with ethanol coagulation.

The results also suggest that factors involved in ethanol coagulation differ from those involved in heat stability and rennet coagulation, and that these factors also differ greatly from those observed in normal milk.

The relation between Heat Stability, and Rennet and Ethanol Coagulation

The results presented in Table 2, show that the heat stability of colostrum was significantly correlated to rennet and ethanol coagulation. However, the heat stability was more closely related to rennet coagulation than to ethanol coagulation. Similar results were reported (Abd El-Salam 1966) for normal buffalo milk. Ethanol coagulation, however, was not correlated to rennet coagulation during the first 14 days after parturition, Table 3.

TABLE 3. The correlations between rennet coagulation and the chemical and physical properties of buffalo colostrum

Constituent	Correlation coefficient	Significance	
		0.01	0.05
pH	- 0.63	sig.	sig.
Acidity	+ 0.79	sig.	sig.
Refractive index	+ 0.93	sig.	sig.
Ethanol coagulation	- 0.18	not sig.	not sig.
Relative viscosity	+ 0.90	sig.	sig.
Fat	+ 0.77	sig.	sig.
Lactose	- 0.96	sig.	sig.
Chloride	+ 0.99	sig.	sig.
Ash	+ 0.24	not sig.	not sig.
Total solids	+ 0.98	sig.	sig.
Total protein	+ 0.91	sig.	sig.
Casein	+ 0.70	sig.	sig.
Albumin	+ 0.96	sig.	sig.
Globulin	+ 0.88	sig.	sig.
Non-protein nitrogen	+ 0.75	sig.	sig.
B-lactoglobulin	+ 0.89	sig.	sig.
Solids not fat	+ 0.93	sig.	sig.

sig. : significant.

not sig. : not significant.

TABLE 4. The correlations between ethanol coagulation and the chemical physical properties of buffalo colostrum

Constituent	Correlation coefficient	Significance	
		0.01	0.05
pH	+ 0.91	sig.	sig.
Acidity	- 0.93	sig.	sig.
Refractive index	- 0.001	not sig.	not sig.
Relative viscosity	- 0.04	not sig.	not sig.
Fat	- 0.16	not sig.	not sig.
Lactose	+ 0.77	sig.	sig.
Chloride	- 0.80	sig.	sig.
Ash	- 0.34	not sig.	not sig.
Total solids	- 0.70	sig.	sig.
Total protein	- 0.21	not sig.	not sig.
Casein	- 0.88	sig.	sig.
Albumin	- 0.59	not sig.	not sig.
Globulin	- 0.43	not sig.	not sig.
Non-protein-nitrogen	- 0.99	sig.	sig.
B-lactoglobulin	- 0.77	not sig.	not sig.
Solids-not-fat	- 0.59	not sig.	sig.

sig. : significant

not sig. : not significant.

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التركيب الكيماوى وخواص سرسوب اللبن الجاموسى ثانيا - الثبات الحرارى والتجبن بالمنفحة والكحول

محمد الحسينى عبد السلام ، ابراهيم الدسوقى رفعت ،
عثمان عبد الفنى حسن و حمزة العلمى ،
المركز القومى للبحوث - زراعة عين شمس .

درس الثبات الحرارى والتجبن بالمنفحة والكحول للبن الناتج من خمسة
من فزادى الجاموس خلال 14 يوما بعد الولادة ويمكن تلخيص النتائج
المتحصل عليها فيما يلى :

1 - ان الثبات الحرارى للبن فى اليوم الاول بعد الولادة يكون
ضعيفا ويزيد تدريجيا حتى يصل الى مستواه فى اللبن الطبيعى بعد
اربعة ايام من الولادة .

2 - ان زمن التجبن بالمنفحة يكون مرتفعا بعد الولادة مباشرة ويأخذ
فى التناقص تدريجيا حتى يصل الى الزمن المعروف لتجبن اللبن
الجاموسى الطبيعى بالمنفحة بعد اربعة ايام من الولادة .

3 - فى اليوم الاول بعد الولادة يكفى تركيز 60% من الكحول
لتجبن اللبن ويزيد التركيز اللازم لتجبن اللبن تدريجيا حتى يصل
الى 70% بعد 14 يوما من الولادة . ويمكن اعتبار اللبن طبيعيا بالنسبة
لهذه الخاصية بعد اربعة ايام من الولادة .

4 - ربطت هذه الخواص بعلاقات احصائية بالمكونات المختلفة للبن
ونوقشت فى ضوء تأثير كل مكون على تلك الخواص .