

Some Nutritional Studies on Colostrum and Milk of Cows and Buffaloes

M.A. Raafat, El Sayed Abou-Hussein,
A.K. Abou-Raya and Amal El-Shirbiny

Department of Animal Production, Faculty of Agriculture,
Cairo University, Giza, Egypt.

This study was conducted in order to study the chemical changes, the nutritive value, and the calorific value of colostrum during the postpartum period at relatively short intervals. Results show that the highest total solid was in colostrum after calving which was 28.25, 23.85, and 24.36 for local cows, Friezians and buffaloes respectively and tended to decrease till normal after seven days.

The highest protein percentage was in colostrum after calving which was 21.45%, 15.47%, and 1.35% for local cows, Friezians, and buffaloes respectively and decreased to normal after seven days.

Starch value and total digestible nutrients showed the highest values of 33.83 S.V. and 34.39 T.D.N. for local cows, after calving, while they were 37.71 S.V., and 37.06 T.D.N. for Friezians after six hours, and lastly for buffaloes after 24 hours being 34.26 S.V. and 33.36 T.D.N., where the protein percentages decreased to normal after a week.

In colostrum, the calorific value was the highest after calving for local cows of 175.75 cal/100 gm, after six hours for Friezians of 173.41 cal/100 gm. and after 24 hours for buffalo's of 154.06 cal/100 gm. The calorific value of buffaloes colostrum and milk after 24 hours was higher than those of Friezians and local cows. At the same time the calorific value of colostrum and milk of local cows was higher than that of Friezians.

Several workers (Sutton and Kaeser, 1946, Sutton and Kaeser 1947, Keaser and Sutton, 1948, pyne, 1953, and Wing, 1958), showed that feeding additional quantities of colostrum to calves increased weight gains and make better physical appearance.

Hramov (1940), reported that the nutritive value of 1 kg Siberian cow's colostrum was equal to 0.35 feed unit and it contained 45 g protein, 20% more than milk. He found that the digestion coefficients of protein, fat and nitrogen free extractives were 89.0, 93.1, and 98.7% respectively. Parrish *et al.*, (1953), studied the properties and digestibility of colostrum of the dairy cows

during the first eight days after birth. They divided the postnatal period into three successive sub-periods of 2, 2, and 4 days and they obtained the following digestion coefficients of colostrum nutrients : 91 to 95 for dry matter, 86 to 92 for protein, 96 to 98 for carbohydrates and 96% for fat. Abd El-Malik 1964, carried out the same experiments as Parrish *et al.*, (1953) but he divided the postnatal period into three successive periods of 2, 3 and 4 days. He obtained the following digestion coefficients for cow's colostrum 79, 92 and 91 for protein, 99, 98 and 98 for fat and 99, 92 and 98% for carbohydrate, while that of buffaloes were 96, 93 and 94 for protein, 98, 98 and 98 for fat and 99, 97 and 98% for carbohydrate.

Parrish *et al.* (1950), found that colostrum from the Holsteins and Gurnseys cows had an energy content about twice that of normal milk, a ratio similar to that calculated by Haurdiniere, 1944; but colostrum from Ayrshires and from perseys had an energy content only about 1.5 times that of the later milk. Perrin, 1958, examined the milk from the cow, sow, ewe, goat and human, for energy content by the use of the bomb calorimeter, the results determined directly were compared with those determined by chemical analysis, and good agreement was resulted. The energy content of cow's milk varied between 54 and 110 calories/100g milk depending mainly on fat content. It was suggested that the following equation could be used :

$$E = 9.11 F + Y(6.38 \times T.N.) + 3.95 L$$

where E = calories, F = fat, T.N. = total nitrogen and L = lactose. Y : is a constant according to species as follows: 5.12, 5.52, 5.54 and 5.54 for the sow, cow, ewe and goat respectively. These values were obtained from the protein conversion factor 5.86 given by Andersen, (1926) by correcting the average fraction of the total nitrogen of the milk found to be non-protein in nature. The present study was undertaken to study the changes in the feeding value and calorific value of colostrum during the postpartum period at relatively short intervals.

Experimental and Methods

Samples of colostrum were obtained from 5 buffaloes, 5 local cows and 3 Friesian cows, within 168 hrs. (7 days) after calving. Eleven samples were operated beginning from immediately after parturition then at 6 hr intervals for the first 24 hr after calving, then at 1 hr intervals for the next 24 hr then at 24 hr intervals for the next 72 hr. after calving, and again after a lapse of 48 hr. The animals experimented on were those from the herd of the Animal Nutrition Experimental Station, Faculty of Agric., University of Cairo. The animals were fed adequately according to the experimental station system of feeding for maintenance and production.

The samples were examined to obtain the chemical composition of colostrum and milk. The feeding value and calorific value of colostrum and milk were calculated from their chemical composition.

Ø Calorie = Kilocalorie.

Calculation of Starch Value (S.V.) Total Digestible Nutrients (T.D.N.) and Nutritive Ratio (N.R.)

The following digestion coefficient were used (Abd El-Malik, 1961) during 3 successive periods for cows and buffaloes :

Periods	Cow			Buffalo		
	Protein	Fat	Lactose	Protein	Fat	Lactose
0— 48 hr	97	99	99	96	98	99
72—120 hr	92	98	98	93	98	97
144—192 hr	91	98	98	94	98	98

The calorific value of the samples were calculated using the Perrin's (1958) equation.

The chemical analysis of the samples was conducted according to A.O.A.C 1955.

Results and Discussion

Tables 1,2 and 3 summarise the results obtained for S.V., T.D.N., D.P., and calorific value, while Fig. 1 and 2 represent these results.

The feeding values (S.V. and T.D.N.)

They were distinctly the highest immediately after calving in local cows (33.84 S.V. and 34.39 T.D.N.), after 6 hr in Friezian cows (37.71 S.V. and 37.06 T.D.N.) and after 24 hr in buffaloes colostrum (34.26 S.V. and 33.36 T.D.N.). In the successive milkings a noticeable drop occurred after 18 hr 36 hr and 120 hr milking in Friezian, local cows and buffaloes respectively. Afterwards a slight decrease occurred reaching approximately the normal feeding value after one day postpartum in Friezian cows (17.42 S.V. and 17.22 T.D.N.), two days postpartum in local cows (18.09 S.V. and 17.67 T.D.N.), and five days postpartum in buffaloes (24.71 S.V. and 23.94 T.D.N.). The feeding value of buffaloes colostrum and milk was higher than that in cows while that of local cows was slightly higher than in Friezian cows (Fig. 1).

The feeding value on dry matter basis, generally increased with advancing milkings. It was 110.79 S.V. and 112.83 T.D.N. in local cows and 120.78 S.V. and 120.93 T.D.N. in Friezian cows and 113.87 S.V. and 115.13 T.D.N. in buffaloes, colostrum immediately after calving, while it was 135.02 S.V. and 131.38 in local cows, 125.17 S.V. and 122.62 T.D.N. in Friezian cows and 151.20 S.V. and 146.03 T.D.N. in buffaloes after a week of parturition. The irregular values of S.V. an T.D.N. may be due to the irregular fat content during the successive milkings.

TABLE I.—The average feeding value of local cow's colostrum and milk

Time after calving (hr)	Total solids %	Fat %	Total protein %	Lactose %	Feeding value					
					T.D.N.		S.V.		D.P. %	
					Fresh	Dry	Fresh	Dry	Fresh	Dry
immediately	22.25	4.88	31.45	1.89	34.39	112.83	33.84	110.79	22.03	73.74
6	26.35	6.12	18.80	1.64	33.56	120.70	33.41	120.04	18.75	68.01
12	24.32	5.72	17.17	1.58	30.64	122.22	30.54	121.83	16.80	66.97
18	21.93	4.50	15.19	1.97	26.35	117.42	26.16	116.46	15.08	67.62
24	18.93	4.00	11.57	3.25	24.20	116.55	24.11	116.12	11.99	57.22
36	15.27	4.48	7.72	2.79	18.81	129.01	19.14	131.12	6.32	44.07
48	13.43	4.32	5.35	3.41	17.67	130.36	18.09	133.21	4.48	34.61
72	12.53	4.12	4.78	3.45	16.65	123.80	17.04	126.15	4.34	35.59
96	12.54	3.92	4.57	3.82	16.41	124.18	16.77	126.66	4.22	33.44
120	12.35	4.28	4.51	3.30	16.71	130.13	17.12	133.42	4.20	32.89
168	12.77	4.52	4.04	3.46	17.32	131.38	17.18	135.02	3.76	28.73

TABLE 2. The average feeding value of Friesian cow's colostrum and milk

Time after calving (hr)	Total solids %	Fat %	Total protein %	Lactose %	Feeding value					
					I.D.N.		S.V.		D.P. %	
					Fresh	Dry	Fresh	Dry	Fresh	Dry
immediately	23.85	5.37	15.47	2.01	28.96	120.93	28.90	120.78	15.01	61.67
6	26.98	9.33	14.23	2.49	37.06	134.49	37.71	136.61	13.80	50.92
12	21.43	6.90	10.61	2.93	28.56	132.42	29.04	134.57	10.29	37.76
18	15.25	4.17	7.25	2.88	19.17	125.21	19.41	126.78	7.04	45.48
24	13.89	3.63	6.50	2.85	17.22	123.85	17.42	125.26	6.30	45.43
36	13.42	4.68	4.76	3.12	18.14	133.03	18.61	136.22	4.62	34.77
48	10.23	2.63	4.66	2.05	12.42	121.48	12.56	122.91	4.52	44.80
72	11.03	2.87	4.50	2.72	13.13	119.06	13.33	120.89	4.14	37.79
96	13.56	5.00	4.29	3.41	18.31	133.34	18.86	137.13	3.95	29.85
120	12.14	3.63	3.95	3.72	15.30	125.65	15.65	128.51	3.64	29.83
168	11.50	3.33	3.89	3.44	14.26	122.62	14.57	125.17	3.54	30.71

TABLE 3. The average feeding value of buffalo's colostrum and milk

Time after calving (hr)	Total solids %	Fat %	Total protein %	Lactoes %	Feeding value					
					T.D.N.		S.V.		D.P. %	
					Fresh	Dry	Fresh	Dry	Fresh	Dry
immediately	24.36	4.40	17.35	2.09	28.04	115.13	27.73	113.87	16.66	68.26
6	22.89	3.78	16.79	1.43	25.87	113.07	25.49	111.45	16.13	70.13
12	21.68	3.24	15.59	1.88	23.97	111.12	23.58	109.34	14.96	69.01
18	22.42	6.90	12.60	2.07	29.35	127.33	29.71	130.68	12.10	54.73
24	22.99	9.64	10.62	1.92	33.36	142.93	34.26	146.58	10.20	44.90
36	21.12	10.29	8.45	1.61	32.39	151.87	33.52	157.02	8.10	38.87
48	18.67	9.20	6.78	1.88	28.65	151.07	29.70	156.33	6.51	36.61
72	18.23	8.80	5.91	2.62	27.45	150.03	28.50	155.71	5.50	30.55
96	17.29	7.80	5.89	2.71	25.31	146.10	26.20	151.25	5.48	31.66
120	16.94	6.97	5.75	3.33	23.94	141.21	24.71	145.75	5.34	31.68
168	16.71	7.38	5.27	3.21	24.37	146.03	25.22	151.20	4.95	29.74

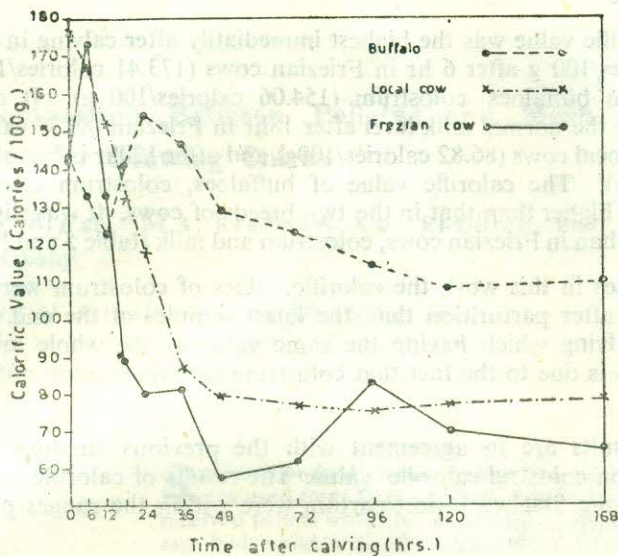


Fig.2. Changes in the calorific value of cow's and buffaloes' colostrum and milk.

Digestible Protein (D.P.)

The digestible protein decreased very rapidly from 22.03%, 15.01% and 16.66% immediately after calving to become 3.76%, 3.54% and 4.95% after 168 hr. milking local, Friesian cows and buffaloes respectively. The colostrum of local cows as fed contained higher D.P. than that in buffaloes, while that in Friesian was the lowest. In the latest milking, it was higher in buffaloes milk than in cows.

On dry matter basis, the digestible protein decreased as time advanced. The average immediately after calving was 73.74%, 61.67% and 68.26%, while after 168 hr it was 28.73, 30.71 and 29.74% in local, Friesian cows and buffaloes respectively.

Nutritive Ratio (N.R.)

The nutritive ratio was the lowest in the beginning than in the latest samples of milk at the end of the first week of parturition as it is shown in Table 4.

The results in this study on the feeding value (T.D.N., S.V. and D.P.) on cow's and buffaloes colostrum are in close agreement with the results obtained by Abd El-Malik, 1964, on Egyptian cows and buffaloes' colostrum and milk. The results indicated that colostrum in the first day has a feeding value higher than whole milk and, slightly higher or equal to normal milk afterwards.

Calorific value

The calorific value was the highest immediately after calving in local cows (175.75 calories/100 g after 6 hr in Friesian cows (173.41 calories/100 g), and after 24 hr in buffaloes' colostrum (154.06 calories/100 g). It dropped to approximately the normal milk level after 18hr in Friesian (89.37 calories/100g) after 36hr in local cows (86.82 calories/100g) and after 120hr in buffaloes (108.37 calories/100 g). The calorific value of buffaloes, colostrum after 24 hours and milk was higher than that in the two breeds of cows. It was slightly higher in local cows than in Friesian cows, colostrum and milk (table 5 and Fig. 2).

In all cases in this work the calorific values of colostrum were higher in first milkings after parturition than the latest samples at the end of the first week after calving which having the same value as the whole milk of each species. This is due to the fact that colostrum contained more nutrients than did milk.

These results are in agreement with the previous findings by Parrish *et al.* (1950) on colostrum calorific value. The results of calorific value of milk at the end of the first week post-partum were within the ranges published by Perrin, (1958), on milk.

TABLE 4. Changes in Nutritive Ratio (N.R.) in colostrum and milk (Average as fresh)

Time after calving (hr)	Buffaloes	Cows	
		Local	Friesian
Immediately . . .	0.68	0.56	0.93
6	0.60	0.79	1.69
12	0.60	0.82	1.78
18	1.43	0.75	1.73
24	2.27	1.02	1.73
36	3.00	1.98	2.93
48	3.40	2.94	1.75
72	3.99	2.84	2.17
96	3.62	2.89	3.64
120	3.48	2.98	3.20
168	3.92	3.61	3.03

TABLE 5. The average calorific value of colostrum and milk of local cows and buffaloes

Time after calving hr	local cows Calorific value calories/ 100 g	Frezian cows Calorific value calories/ 100 g	Buffaloes Calorific value calories/ 100 g
Immediately	175.75	142.25	142.56
6	167.16	173.41	132.77
12	152.08	133.00	122.99
18	131.80	89.37	140.57
24	117.84	80.23	154.06
36	86.82	81.28	146.75
48	79.10	57.83	128.64
72	76.59	61.70	123.18
96	75.32	82.70	114.29
120	76.56	69.61	108.37
168	78.48	65.39	108.96

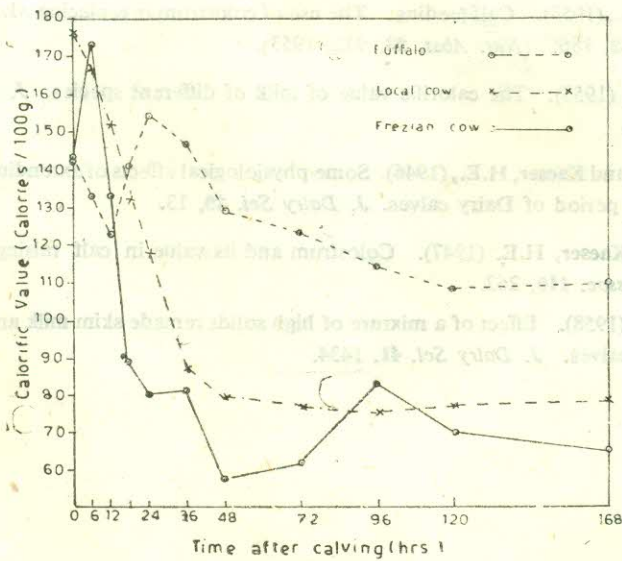


Fig. 2. Changes in the calorific value of cow's and buffaloes colostrum and milk

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دراسة مقارنة للقيمة الغذائية لسرسوب ولبن الأبقار المحلية والفريزيان والجاموس

محمد على رافت ، السيد رفعت ابوحسين ، أحمد كمال ابو ربة وآمال الشربيني

كلية الزراعة ، جامعة القاهرة

برز الاهتمام بدراسة القيمة الغذائية للسرسوب ومقارنة ذلك باللبن الكامل من الأبقار والجاموس وذلك نظرا لما له من أهمية كبيرة عند تغذية العجول الحديثة الولادة خلال الأسبوع الأول من الرضاعة . وما لذلك من أثر كبير على حالة العجول الطبيعية والصحية والمظهرية .

كما تبين أن القيمة الحرارية للسرسوب واللبن الكامل له أهمية كبيرة عند تغذية العجول الصغيرة بل وله أثر كبير أيضا عند تغذية الاطفال الرضع على سرسوب أمهاتهم وهذا الاثر ينعكس على حالة الحيوانات الصغيرة من حيث التربية والمحافظة على صفات الامهات الجيدة والتي تعمل على رفع القيمة الانتاجية للبن العجلات الاناث في مواسم ولاداتها المقبلة .

ومن الدراسة السابقة تبين أن اضافة كميات زائدة من السرسوب للعجول الصغيرة كان له أثر في زيادة أوزان العجول عن تلك التي لم تزودكمية السرسوب التي تناولتها عن المعتاد وقد وجد في بعض الدراسات الاخرى أن السرسوب يحتوي على قيمة حرارية تبلغ ١٥٠ - ٥٢٠ حره قدر القيمة الحرارية التي في اللبن الكامل .

وهذه الدراسة توضح لنا النتائج الهامة الآتية :

١ - كانت نسبة المادة الجافة في السرسوب مرتفعة جدا فبلغت ٢٥٪ ٢٨٪ ، ٢٣٪ ٢٤ ، ٣٦٪ ٢٤ . لكل من الأبقار البلدى والفريزيان والجاموس على التوالي عند الولادة ثم انخفضت بعد ثلاثة أيام من الولادة الى ١٢.٥٣ ، ١١.٠٣ ، ١٨.٢٣٪ للبلدى والفريزيان والجاموس على التوالي . بينما بدأت نسبة الدهن منخفضة في السرسوب ثم ارتفعت بعد ذلك في اللبن الكامل .

٢ - كانت اعلا نسبة بروتين في السرسوب عند الولادة فبلغت ٢١.٤٥٪ ، ١٥.٤٧٪ ، ١٧.٣٥٪ للبلدية والفريزيان والجاموس على التوالي ووصلت أقل نسبة في اللبن الكامل بعد أسبوع من الولادة .

