

Chemical Studies on The Colostrum

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Abstract:

42 Friesian cow's and Egyptian buffalo's colostrum samples were collected from six animals (three cows and three buffaloes) through seven days after parturition. These samples were analysed chemically. The gross composition and some minerals constituents were determined, tabulated and discussed. The average values of the determined chemical constituents except both of pH value and lactose decreased gradually (titratable acidity, specific gravity, fat, T.S, S.N.F, T.P., casein and ash). Also, the minerals compositions of these two types of colostrum (cow and buffalo): Ca, K, Na, P, Zn, Mg and Mn gradually decreased during the first seven days of lactation period.

Introduction

Colostrum is pre-milk substance that is produced immediately with the first days after birth. Colostrum is thick lemon yellow mammary secretion. It is considered as a vital food for the newborn of all mammals, due to its high contents of transfer immunity factors as immunoglobulins, in addition to its nutritive value

(Reiter, 1985; Prasad, 1997 and Thapa, 2005). Colostrum differs

considerably in composition and properties from normal milk (Johnson,1978;Walstra and Jennes, 1984).

The present investigation was carried out to determine the chemical properties and the mineral contents of the two types of colostrum (cow and buffalo) and its transition gradually to normal milk during the first seven days of lactation period.

Materials and Methods

Samples (42 samples) were taken daily from individual Egyptian buffaloes and Friesian cows (three animals of both of them) during the first week of lactation period. These individual samples were collected from different places of the city of Abnoub, Assiut governorate.

Titration acidity, pH value, specific gravity, lactose, fat, total solids (T.S.), solids not fat (S.N.F.), total protein (T.P.), casein and ash contents were determined as described by A.P.H.A (1992). The dry ashing techniques for mineral determination had been estimated (ppm) according to the method

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used by James (1995). A weight of 5.0 g of the obtained ash of fresh colostrum was dissolved in 5.0 ml concentrated HCL (36.6%), and the volume was completed to 50.0 ml by distilled water. The dilutions were applied to the Atomic Absorption Spectrophotometer to estimate the levels of investigated minerals.

Results and Discussion

The results presented in Tables (1) & (2) clearly indicate that the titratable acidity of the two types of colostrum (buffalo and cow) being observed in the first day of milking were as 0.56 and 0.44, respectively (as average values), and decreased gradually until reached to 0.19 and 0.18 in the sixth day of parturition. Concerning the pH values of the colostrum samples, data in the same Tables reveal

that these values increased for the buffalo and cow's colostrum from 6.07 and 6.04 at the first day of parturition to 6.62 and 6.53 at the seventh day, respectively. These results were similar to that reported by Ferreio et al., (1980); Faul and Hughes (1987) and Arain et al., (2008).

From the foregoing results it could be observed that the variation in the acidity and pH of buffalo and cow's colostrum during first days postpartum milking took an opposite trends as expected. However, of both acidity and pH values gradually changed to less or more their levels in normal milk after the sixth postpartum milking. Similar trend in change of acidity and pH values were observed by Haggag et al., (1991) and Tsioulpas et al., (2007).

Table (1) Chemical properties of Egyptian buffalo's colostrum

Analysis	Days						
	1	2	3	4	5	6	7
Acidity %	0.56	0.45	0.38	0.33	0.27	0.19	0.10
pH	6.07	6.13	6.18	6.25	6.36	6.54	6.62
Specific gravity	1.067	1.054	1.046	1.036	1.034	1.033	1.030
Lactose %	3.06	3.13	3.24	3.26	3.91	4.10	4.50
Fat %	6.40	5.60	5.40	5.30	5.20	5.20	5.10
T.S %	24.48	21.76	17.81	15.54	15.40	14.53	13.67
S.N.F %	18.04	16.36	12.66	10.60	10.24	9.20	8.46
T.P %	15.57	12.81	8.72	7.36	5.82	4.30	3.18
Casein %	4.80	4.21	3.78	3.53	3.11	2.63	2.45
Ash %	1.58	0.95	0.87	0.81	0.81	0.80	0.78

Table (2) Chemical properties of Friesian cow's colostrum.

Analysis	Days						
	1	2	3	4	5	6	7
Acidity %	0.44	0.36	0.25	0.22	0.20	0.18	0.16
pH	6.04	6.15	6.33	6.35	6.44	6.51	6.53
Specific gravity	1.057	1.048	1.037	1.033	1.029	1.029	1.028
Lactose %	2.83	3.18	3.37	3.41	3.59	4.11	4.40
Fat %	5.0	4.5	4.3	3.8	3.6	3.5	3.5
T.S %	20.08	17.26	14.57	13.10	11.94	11.66	11.75
S.N.F %	15.08	13.08	10.27	9.30	8.34	8.16	8.25
T.P %	11.14	8.75	5.96	5.03	3.98	3.34	3.05
Casein %	5.13	4.69	4.31	4.14	3.39	2.86	2.37
Ash %	1.35	1.15	0.94	0.86	0.77	0.72	0.73

The values of specific gravity (Tables 1 & 2) for the two types of colostrum decreased through the seven days after parturition from 1.067 at the first day to 1.030 at the seventh day (buffalo), and from 1.057 to 1.028 in the same period (cow). These results indicate a general resemblance with the results reported by Haggag et al., (1991); Prasad, (1997) and Arain et al., (2008).

Lactose content of buffalo's and cow's colostrum in first postpartum milking was 3.06 % and 2.87 %, respectively. The concentration of lactose increased gradually during the days of colostrum up to 4.50 % and 4.40 %, respectively (Tables 1 & 2). These results were in line with the results mentioned by Sukumar,(1980); Nickerson, (1995); Prasad, (1997) and Arain et al., (2008).

The data obtained on the various colostrum constituents namely: fat, solids not fat and total solids are given in Tables 1

& 2 also. As shown in Table (1), the average contents of fat, solids not fat (S.N.F.) and total solids (T.S.) of the buffalo colostrum ranged between 6.40 % to 5.10 %, 18.04 % to 8.46 % and 24.48 % to 13.67 %, respectively, from the first to the seventh day postpartum. The same thing was observed in the cow colostrum (Table 2), where the corresponding values of fat, S.N.F. and T.S. ranged between 5.00 % to 3.50 %, 15.08 % to 8.25 % and 20.08 % to 11.75%, respectively, in the same period. From these results, it was noticed that the values of fat, S.N.F. and T.S. of the buffalo's colostrum were higher than those of the cow's colostrum. Also, it was also observed that the average contents of fat, S.N.F. and T.S. decreased gradually from the first day to the seventh day postpartum. These results were in agreement with Malhi, (2000).

Concerning the content of total protein (T.P.) of the first milking colostrum, it observed

that it is high in both of buffaloes and cows (15.57 % and 11.14%, respectively), (Tables 1 & 2) which agreed with Arain et al., (2008). This could be due to higher concentration of globulin that serves as the carrier of antibodies for suckling calf against disease producing organism (Nickerson, 1995). Moreover, the total protein content of colostrum significantly declined during its transition to normal milk, where its values reached in seventh milking to 3.18 % and 3.05 % respectively.

Regarding the casein content in the colostrum, it was found that its value in the first postpartum milking was 4.80 % and 5.13 % for both of the buffalo and cow colostrum, respectively, which dropped during the period of milking colostrum until it reached to 2.45 % and 2.37 % in the seventh milking respectively. Similar trend changes in casein content of colostrum were reported by Nickerson, (1995); Prasad, (1997) and Arain et al., (2008).

As for the ash content of first milking colostrum of the buffalo and cow colostrum, it was noticed that it was high (1.58 % and 1.39 %, respectively), then decreased in other postpartum milking days until reached in the seventh day to 0.78 % and 0.73

% respectively. This result was in agreement with the results of Nickerson, (1995); Prasad, (1997); Nawar, (2006) and Arain et al., (2008).

Tables (3) and (4) show the mineral composition of the buffalo and cow's colostrum during the first seven days postpartum. From these results, it could be noticed that the concentration of total calcium (Ca) was high in both of the two types of colostrum, but it was higher of the buffalo's colostrum than this obtained of the cow's colostrum. It was also observed that the Ca content of buffalo colostrum was extremely high at the first day of milking (6.09 ppm), while it was 4.88 ppm in the cow's colostrum. These values of the Ca content declined sharply to reach 1.31 ppm in the seventh day postpartum in the buffalo colostrum, whereas this value in the cow's colostrum decreased gradually to reach to 2.80 ppm in the seventh day. It was also noticed that the values of Ca were high in the end of the colostrum period for the cows, comparing with the buffaloes. The high concentration of Ca content which observed in the first day postpartum is probably due to the high amounts of casein which acts as a Ca carrier in milk (Holt, 2004).

Table (3) Mineral contents of Egyptian buffalo's colostrum (ppm)

Constituents	Days						
	1	2	3	4	5	6	7
Ca	6.09	4.65	3.92	3.07	2.64	1.36	1.31
K	2.89	2.75	2.37	2.25	1.96	1.90	1.84
Na	1.29	1.16	0.94	0.85	0.75	0.64	0.35
P	0.75	0.59	0.56	0.53	0.54	0.53	0.51
Zn	1.34	1.19	1.10	1.09	0.95	0.87	0.66
Mg	0.54	0.42	0.41	0.40	0.40	0.38	0.32
Mn	0.113	0.047	0.031	0.024	0.021	0.020	0.020

Table (4) Mineral contents of Friesian cow's colostrum (ppm)

Constituents	Days						
	1	2	3	4	5	6	7
Ca	4.88	4.33	3.09	2.98	2.93	2.85	2.80
K	3.92	3.70	3.63	3.46	3.41	3.40	3.30
Na	1.89	1.63	1.58	1.58	1.55	1.40	1.08
P	1.30	1.09	0.84	0.78	0.75	0.70	0.64
Zn	0.89	0.64	0.60	0.61	0.58	0.57	0.51
Mg	0.54	0.44	0.39	0.36	0.29	0.23	0.22
Mn	0.026	0.023	0.021	0.022	0.018	0.017	0.015

The average content of the potassium (K) came in the next arrangement after the calcium through the period of the colostrum (Tables 3 & 4). At the beginning of colostrum (the first day) , it was observed a high content of K for both of buffalo's and cow's (2.89 ppm and 3.92 ppm, respectively), then decreased gradually until reached to 1.84 ppm and 3.30 ppm, respectively, at the seventh day of colostrum. It could also be noticed that cow's colostrum had a higher values of K, comparing with the buffalo's. The average content of the sodium (Na) took the same trend of potassium, where it could be observed that cow's colostrum had a higher

contents of Na compared with the buffalo's one along the seven days of colostrum. At the first day, the values of Na were 1.29 and 1.89 ppm, whereas at the seventh day these values were 0.35 and 1.08 ppm, respectively. From the results (Tables 3 & 4), it was observed that the values of Na decreased gradually during the days of colostrum and noticed also that the rate of this decreasing was greater in the buffalo's colostrum than the decreasing in the cow's one (Tsioulpas et al., 2007).

Regarding the average content of phosphorus (P) it was cleared that its value was high in the first day of buffalo's colostrum (0.75 ppm, Table 3),

then decreased gradually until the end of colostrum (Table 3), while this content was higher in the cow's one (Table 4) and decreased also from 1.30 ppm in the first day to 0.64 ppm in the seventh of colostrum.

The average contents of zinc (Zn) of buffalo's and cow's colostrum are presented in Tables (3) and (4). It was noticed that its value were higher along the days of colostrum for buffaloes than that for cows (in the first day of colostrum, the values of Zn were 1.34 ppm and 0.89 ppm respectively). In the two types of colostrum, it was observed a gradually decrease in the values until reached to 0.66 and 0.51 ppm respectively. This is clear that there is an opposite relation between the two mineral elements P and Zn.

The magnesium (Mg) contents of both of buffalo's and cow's colostrum were nearly the same in the first days of colostrum (0.54, 0.42, 0.41 ppm for the buffaloes and 0.54, 0.44, 0.39 ppm for the cows respectively). All the values of Mg during the period of the colostrum were decreased gradually until reached to 0.32 and 0.22 ppm respectively.

In relation to the content of manganese (Mn), it was noticed that this content was very scanty along the days of colostrum for both of the two types of it, where its values in the first 3 days were 0.113, 0.047, 0.031 ppm for the buffalo's colostrum, whereas these contents were 0.026, 0.023,

0.021 ppm for the cow's colostrum. These results show that the contents of Mn were higher in the buffalo's colostrum comparing with the cow's one (Tables 3 & 4). It also show commonly that the values of Mn were the smallest compared with the other mineral elements studied in this investigation.

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دراسات كيماءوية على السرسوب

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على مدار سبعة ايام بعد الولادة تم تجميع اثنان واربعون عينة من سرسوب ستة حيوانات (ثلاثة من الابقار، ومثلهم من الجاموس)، وقد جرى تحليل هذه العينات كيماءويا حيث وجد ان متوسط قيم مكونات السرسوب المختلفة كانت في تناقص تدريجي طوال هذه الايام السبعة (الحموضة، الكثافة النوعية، الدهن، الجوامد الكلية، الجوامد اللادهنية، البروتين الكلي، الرماد) وذلك على عكس قيم الرقم الهيدروجيني (pH) وكذلك الكازين التي كانت تزداد مع تقدم ايام حليب السرسوب، وذلك لكلا نوعي السرسوب البقري (فريزيان) وايضا الجاموسي.

كذلك تم في هذا البحث تقدير محتوى كلا من النوعين السابق ذكرهما من السرسوب وذلك من بعض العناصر المعدنية وهي: الكالسيوم، البوتاسيوم، الصوديوم، الفوسفور، الزنك، الماغنسيوم، المنجنيز، حيث لوحظ ان قيمهم تتناقص ايضا تدريجيا خلال فترة حليب السرسوب.