J. Agric. Sci. Mansoura Univ., 34 (4): 2997 - 3007, 2009

THERMAL STABILITY AND PHYSICO-CHEMICAL CHARACTERISTICS OF EGYPTIAN BUFFALO'S COLOSTRUM

El-Loly, M.M.*; M. M. El-Sheikh and A. H. Zaghloul
Department of Dairy Science, National Research Centre, Cairo, Egypt
: Corresponding author:** ***mm_elloly@hotmail.com

ABSTRACT

The thermal stability and physico-chemical properties of individual buffaloes' colostrum (5 animals) were followed during three days after postpartum.

The heat stability of the first postpartum milk can be visually defined in terms of the time required to induce coagulation at boiling temperature. Gradually marked variations of heat coagulation time were detected up to 60 h postpartum milking when heated at boiling temperature. The thermal stability of individual buffalo's colostrum gradually increased with progressive postpartum milking, namely, at 1 h (0.55 min.), 6 h (3.53 min.), 12 h (7.10 min), 24 h (12.30 min), 36 h (18.10 min), 48 h (21.05 min) and 60 h (24.13 min). But at 72 h postpartum, no visual change (coagulation) was observed during heating at boiling temperature for one hour. It can be seen that first postpartum milk was very unstable to heat treatment with coagulation at boiling temperature.

Hydrometer is a simple, rapid and of low cost method to evaluate the quality of colostrum. Colostral immunoglobulins concentrations measured from one partial to third consecutive complete milking at 12 h intervals postpartum decreased at different rates over time or number of milking.

The colostrum is thicker, stickier and slightly yellowish compared to normal milk, the specific gravity was higher than that of normal milk and the pH is lower.

The total solids, total protein, fat and ash contents were highest after parturition and then decreased rapidly to reach values of normal milk almost after three days of parturition, where the protein content was the most variable constituent. While the changes in the lactose content followed an opposite trend.

Keywords: Buffalo, colostrum, composition, thermal stability, hydrometer, immunoglobulins.

INTRODUCTION

Buffalo's milk is a backbone of the dairy industry in several regions of the world. The world population of buffaloes is more than 150 million animals. Buffalo milk represents in south and East Asia (India, Pakistan and China), Egypt, Bulgaria and some area of southern Italy (Stefano, 1998).

Buffalo's milk is ranked second in the world after cow's milk, being more than 12% of the world's milk production. Buffaloes were known during the pharonic times, it is currently believed that the Egyptian buffaloes originated from the wild Indian water buffaloes and rapidly became the principle milk producing animal in Egypt. In 2002 the number of buffaloes in Egypt was estimated to be 3.72 million animals (MARL, 2002). They belong to one breed and two types, Behairy and Seidie, which vary in their general characteristics and milk production. At present, buffaloes contribute more than 65% of the milk production and 35% of red meat production in Egypt (Mourad, 1997).

Colostrum is the first natural food produced by female mammals towards the end of pregnancy and possibly during the first 24-72 h after giving birth (Campbell & Petersen 1963; Brambell, 1969 and Butler, 1974). Chemically, colostrum is a very complex fluid, usually lemon-yellow, rich in nutrients profile (proteins, carbohydrates, lipids, vitamins and minerals), in addition, it contains oligosaccharides, growth factors, anti-microbial compounds, and immune-regulating constituents that are either not present in milk or present in substantially lower concentrations (Gopal and Gill 2000). Inadequate or improper colostrum feeding and management cause a significant portion of the calf morbidity and mortality on dairy farms. The importance of adequate colostrum of suitable quality in the critical first 24 h of life is well documented (McGuire *et al.,* 1976; Bush and Staley, 1980; Matte *et al.,* 1982).

Colostrum is abnormal milk, unsuitable and unprocessable milk which differs considerably in composition and properties from normal milk (Johnson, 1978; Walstra and Jennes, 1984). Therefore, it is not marketable product, the unique importance of colostrum is to serve as a feed for offspring to provide a much higher nutrition to the new born calf. During transition from colostrum to normal milk, gradual or sometimes sudden changes may occur in composition and properties (Prasad, 1997).

In addition, the inclusion of colostrum in normal milk affects the market milk industry due to denaturation of immunoglobulin and tends to gel during heating at home level or processing at dairy plant (Haggag *et al.,* 1991[b]; Harding, 1995). The differences in physico-chemical make behave differently when the milk is processed for the manufacturing of different products (Sindhu, 1996).

Fleenor and Stott (1980) first developed a colostrometer test that incorporated the relationship between immunoglobulin concentration in bovine colostrum and the specific gravity of fresh whole colostrum into a conventional hydrometer.

Therefore, the aim of this study was to evaluate the thermal stability, some physico-chemical characteristics of buffalo's colostrum during transition to normal milk and to measure its quality.

MATERIALS AND METHODS

Colostrum samples were collected from five healthy lactating dairy buffaloes in a private farm at West Omrania, Giza governorate, Egypt, during the period from January to April 2008, at 1, 6 h and at 12 h intervals, and after 12 to 72 h after parturition. Immediately after complete milking of individual animals, the milk was thoroughly mixed and about 100 ml was taken in a clean stopper sample bottle in an ice box and transferred to the dairy laboratory, National Research Centre and kept frozen at -20°C until analysed. The average of duplicate replicates was taken for each sample.

Ten ml of each Buffalo's colostrum samples in stopper glass tubes were heated in a water bath at boiling temperature to visually define in terms of the time required to induce coagulation.

Colostrum quality was measured using hydrometer calibrated in immunoglobulin concentration at intervals 5 mg/ml from 0 to 50 mg/ml, and in increments of 0.002 with a range of 1.000 to 1.080 at 20°C according to Fleenor and Stott (1980).

Physico-chemical parameters were measured as follows: pH by a digital pH meter, (HANNA Instruments, pH 211, Microprocessor) and specific gravity at 20 °C gravimetrically using a hydrometer. Milk samples were analysed for titratable acidity, total solids (TS), fat, solids not fat (SNF), total protein (TP) and ash contents according the methods of Ling, (1963). While lactose content was determined colorimetrically using the phenol-sulphoric acid method according to Barentt and Abd El-Tawab, (1957).

RESULTS AND DISCUSSION

The thermal stability and physico-chemical composition of individual buffalo's colostrum (5 animals) were followed during three days after postpartum. From Fig. (1), it could be seen gradual and marked variations of heat coagulation time were detected up to 60 h postpartum milking when heated at boiling temperature. The thermal stability of individual buffalo's colostrum was gradually increased with successive postpartum milking, namely, at 1 h (0.55 min.), 6 h (3.53 min.), 12 h (7.10 min), 24 h (12.30 min), 36 h (18.10 min), 48 h (21.05 min) and 60 h (24.13 min). But after 72 h postpartum, no visual change (coagulation) during heating at boiling temperature for one hour was observed. Coagulation properties were strongly affected by milking number. Milk did not clot during heating (boiling) after three milking. It could be seen that our samples reached the normal milk after around third milking day postpartum.

Boiling of our samples showed that the milk from the first milking after calving behaved differently from the mature milk, this coagulation might be attributed to the high concentration of total protein, especially, immunoglobulins content that low heat stability (denaturation). This finding is in line to those of Parry, (1974); Walstra and Jennes (1984), who decided that this might be due to the low heat stability of the immunoglobulins or to the low pH in these samples. Thus, the first postpartum milk was more sensitive and very unstable to heat treatment with coagulation at boiling temperature.

In visual appearance, color of the samples changed with time from parturition, it is thicker, stickier, golden and slightly yellowish compared to normal milk. Similar observation was reported by Edelsten, (1988). These properties were slightly decreased and stabilized after the second milking, while, yellowness decreased with progressive lactation time, it became slightly lighter, which increased over the first three milking, then it take opaque-white in normal milk, thus, the colour is a useful tool to identify abnormal milk. However the color and appearance of the colostrum or milk are not indicative of the good quality (high in antibodies), which play an important role in transferring passive immunity to the young calf, this transfer mechanism starts to decline approximately 12 to 23 h after birth and ceases on average at 24 h (Stott *et al.,* 1979), and play an important role at the localized intestinal level. Robinson *et al.,* (1988) reported that the importance of achieving adequate levels of colostral immunoglobulins to protect the neonate from enteric disease and septicemia has long been recognized.

Fig. (1): Changes in thermal stability of buffalo's colostrum during three days postpartum at boiling temperature.

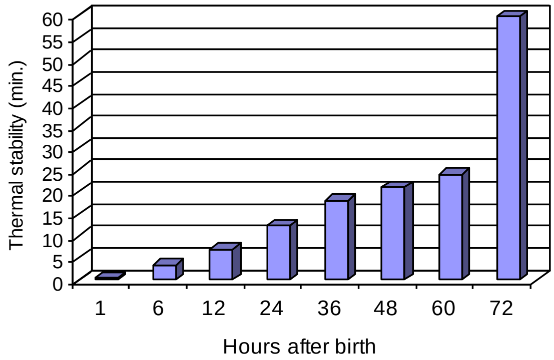
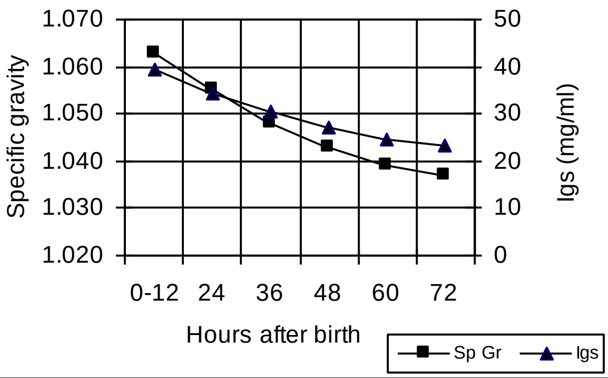


Fig. (2): Effect of lactation time on specific gravity values and its relation to immunoglobulins (Igs) concentrations.



Hydrometer enables the dairyman to establish the quality of colostrum that should be used to select colostrum that has an adequate immunoglobulin concentration (high quality) for feeding the newborn calf, which are absorbed intact from colostrum to blood during the first day after suckling to effect reliable transfer of passive immunity or for a colostrum bank, and extra colostrum can be saved and frozen for use later, because it is produce usually far more than a calf can consume.The commercially available hydrometer readings of colostral immunoglobulin concentrations had averages 39.45, 34.05, 30.30, 26.95, 24.20 and 23.20 mg/ml at 0-12, 24, 36, 48, 60 and 72 h postpartum, respectively (Fig. 2). These values were the same trend but higher than those reported by Mahran *et al.,* (1997), who determined it by Single Radial Immunodiffusion (SRID) technique. Also, similar data were observed in bovine colostrum by Pritchett *et al.,*(1994) the mean globulins reading was 82.1 mg/ml and mean immunoglobulins by SRID was 48.1 mg/ml. For these results, hydrometer was considered to be the diagnostic test value, while SRID was considered to be the true value.

It could be concluded that the immunoglobulins were highest in the colostrum, then gradually decreased in the first three days after parturition. This parallels the transition from colostrum to normal milk. Similar trend in bovine colostrum was detected by Oyeniyi and Hunter (1978); Stott *et al.,* (1981). Specific gravity of buffalo's colostrum ranged from 1.035 to 1.065 with an average of 1.048. Density is dependent on temperature at the time of measurement and composition of material, especially fat content (Ganguli, 1974). Density of milk declined during the first to three milking (Fig. 3a). Also, Haggag *et al.,* (1991[a]) found that specific gravity of buffalo colostrum decreased from 1.040 to 1.032 within 48 h postpartum, which is lower than in the present study. In addition, Birgitte *et al.,* (2004) mentioned that the mean value of specific gravity for cow was 1.038 at third milking postpartum, which in corresponding to our results (1.037).

Moreover, El-Agamy *et al.,* (1998) found that the mean value of specific gravity for normal buffalo milk was 1.035, which is in agreement with our results at third day.

The pH value of buffalo colostrum increased from 6.28 to 6.47 with an average of 6.38 during the first three days postpartum. These changes in this parameter are presented in Fig. (3b). Haggag *et al.,* (1991[a]) found that the pH of colostrum was 6.43 ± 0.02 in comparison with 6.57 ± 0.04 for normal milk, which is slightly higher than our results (6.38). Also, Birgitte *et al.,* (2004) mentioned that the mean value of pH for cow was 6.42 at third milking postpartum, which is corresponding to our results (6.42). Moreover, El-Agamy *et al.* (1998) found that the mean value of pH for normal buffalo milk was 6.70.

It could be observed that the acidity of milk during colostral period ranged between 0.20 and 0.40 with mean of 0.29 (Fig. 3c). These data of acidity percentages were higher (but lower for pH) than that reported by Hofi *et al.,* (1966), who observed that the mean value of acidity and pH for herd samples of buffalo milk to be 0.175 % and 6.58 compared to 0.172 % and 6.53 for milk from cattle, respectively. Also, Haggag *et al.,* (1991[a]) found that the acidity of colostrum was 0.20% ± 0.01 in comparison with 0.15% ± 0.006 for normal milk, which is lower than our results (0.29). Moreover, El-Agamy *et al.,* (1998) fond that the mean value of acidity for normal buffalo milk was 0.18. It is clear that the pH values took an opposite trends of acidity percentages. Table (1) shown the chemical characteristics of buffalo's colostrum during three days of parturition. The total solids in colostrum consist essentially of protein, carbohydrate (mainly lactose), fat and minerals (ash) (Roy, 1970). These nutrients are needed for the survival of the newborn until it is weaned. Total solids decreased rapidly in the colostral milk during the transition period. Content of solids in first milking colostrum of buffalo was appreciably higher (30.40 %) than that from the third milking of postpartum (15.15 %). Rates of change were similar to those observed by Rifaat *et al*., (1972); El-Loly, (2005); El-Loly and Salim (2008). The greatest differences in the total solids content of colostrum contrast to normal milk could be the result of elevated content of antibodies of colostrum (Nickerson, 1995).

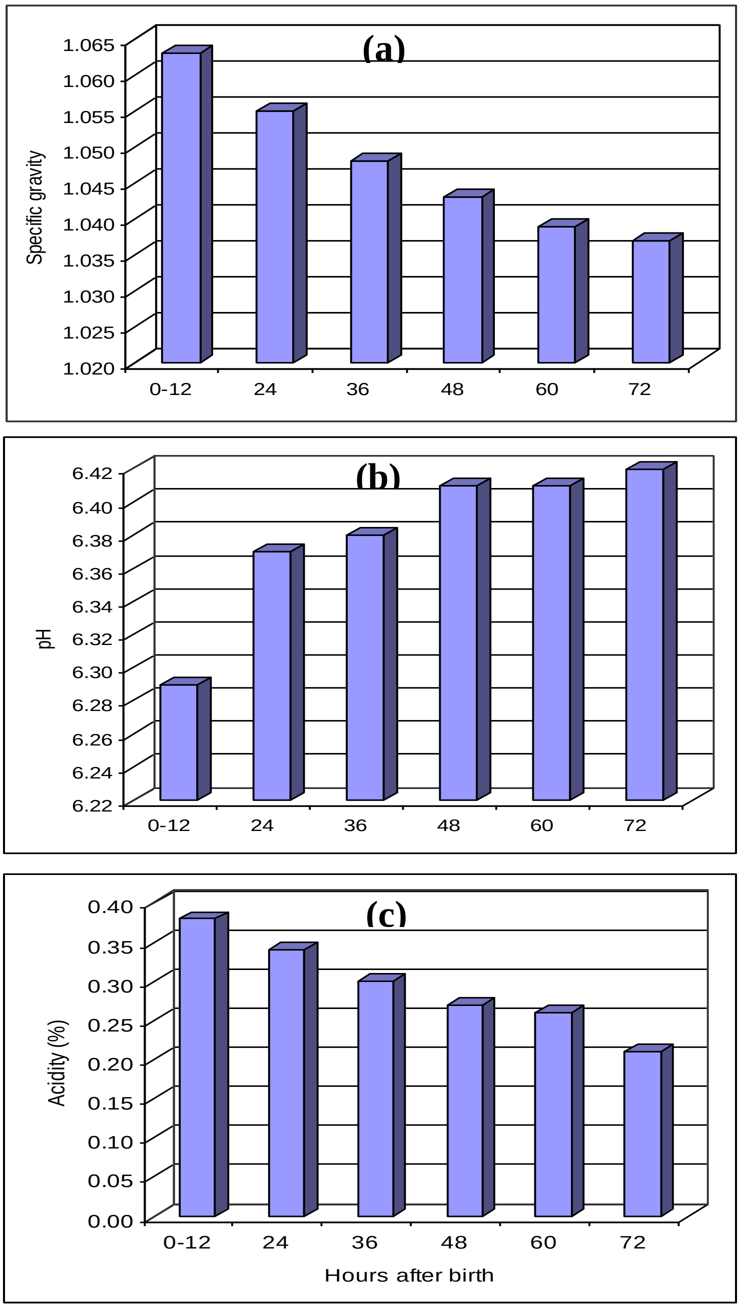


Fig. (3): Changes in specific gravity, pH values and acidity percentages of buffalo's colostrum during three days postpartum.

The fat content of buffalo's colostrum ranged from 4.55 to 8.80 with an average of 5.75 % during three days. Milk fat contents were 7.32, 5.29 and 4.70 % at 0-12, 48 and 72 h milking after parturition respectively. A similar trend was noted as reported by Rifaat *et al*., (1972); El-Loly, (2005); El-Loly and Salim (2008), where the fat content of colostrum initially was high, then reached it lowest levels after about a third milking.

Solids not fat content was high after parturition (23.08 %) and then dropped gradually until it reached a level of 10.45 % at the 72 h after parturition. Also, El-Agamy *et al.* (1998) found that the mean value of SNF for normal milk was 9.44 % which is lower than our results at third day. These wide variations in SNF content of colostrum might be due to the evidence of individuality in buffaloes (Andrew, 2001).

In addition, the very first-milking colostrum is comprised largely of proteins, where it had an average of 18.44 % within 12 h of parturition, followed by rapid decrease to reach an average of 5.83 % at 48 h postpartum, then gradually decreased to an average value of 4.18 % at 72 h postpartum. This decline trend is normally due to higher concentration of globulin that serves as the carrier of antibodies for suckling calf against disease producing organism ((Ebina *et al.,* 1985; Nickerson, 1995). The obtained results are in accordance trend with that obtained by Rifaat, *et al*., (1972); El-Agamy *et al.,* (1998); Walstra *et al.*, (1999); El-Loly, (2005); El-Loly and Salim (2008).

On contrary, it could be noticed that the lactose concentration was lower (3.27 %) in colostrum and then gradually increased to reach its normal level 5.44 % on the third day after calving. This difference is an advantage because lactose can induce the young to scour (diarrhea) with subsequent death or unthriftiness (Roy, (1970). These results were in accordance with pervious finding Rifaat, *et al.,* (1972); Foley and Otterby (1978); Walstra *et al.,* (1999); El-Loly, (2005); El-Loly and Salim (2008). While it was higher than those of El-Agamy *et al.,* (1998).

Moreover, the change in ash content of buffalo colostrum throughout the first three days postpartum was observed (Fig. 5). It was high after parturition (1.07 %) and then decreased gradually up to three days parturition (0.96, 0.89, 0.84, 0.80 and 0.79 % at 24, 36, 48, 60 and 72 milking respectively). These results agree with those reported by Abd El-Salam and El-Shibiny (1966); Kholif, (1989); El-Loly, (2005).

In general, very large variations occurred in physical properties of the milk and these changes were related to chemical composition. For example, the total solids, total protein, fat and ash contents were highest after parturition and then decreased rapidly to reach values of normal milk almost after three days of parturition. While the changes in the lactose content followed an opposite trend to other constituents. Also, coagulation properties were affected by milking number.

Table (1): Chemical characteristics of buffalo's colostrum during three days of parturition. *

Hours after birth	Components (%)					
	Total solids	Fat	Solids not fat	Total protein	Lactose	Ash
0-12	30.40 ± 1.193	7.32 ± 0.498	23.08 ± 0.784	18.44 ± 0.852	3.27 ± 0.125	1.07 ± 0.044
24	27.68 ± 1.252	6.36 ± 0.186	21.32 ± 1.192	15.23 ± 0.582	4.20 ± 0.100	0.96 ± 0.021
36	22.74 ± 0.408	5.83 ± 0.147	16.91 ± 0.303	11.08 ± 0.328	4.85 ± 0.163	0.89 ± 0.010
48	17.42 ± 0.518	5.29 ± 0.161	12.13 ± 0.393	5.83 ± 0.257	5.17 ± 0.231	0.84 ± 0.016
60	15.81 ± 0.179	5.00 ± 0.083	10.81 ± 0.116	4.57 ± 0.144	5.34 ± 0.168	0.80 ± 0.018
72	15.15 ± 0.098	4.70 ± 0.047	10.45 ± 0.096	4.18 ± 0.055	5.44 ± 0.142	0.79 ± 0.014

***: The average of duplicate was taken for each sample.**

Conclusion:

This study was carried out to evaluate the heat stability and quality characteristics of buffalo colostrum during its transition to normal milk. Gradual change as coagulation time was observed up to sixth postpartum milking when heated at boiling temperature. No coagulation was occurred in third day postpartum milk heated for 1 h at boiling temperature.

The results demonstrate that the colostral specific gravity was more strongly correlated with colostral total protein concentrations especially immunoglobulins that were primary factor in variation of colostrum.

These data showed that great variations occur in both physical properties and composition of the mammary secretion during transition from colostrum to milk. Because of these variations seen between animals, it might be better to separate milk based on the composition of the milk instead of time from calving. This period should not be shorter than three days if milk composition is the criterion as it is not until this time come close to levels.

REFERENCES

Abd El-Salam, M.H. and El-Shibiny, S. (1966). The chemical composition of buffalo milk. I. General composition. Indian J. Dairy Sci., 19: 151-154.

Andrew, S. (2001). Composition of colostrum from heifer. J. Dairy Sci., 84: 100-106.

Barnett, A.J. and Abd El-Tawab, G. (1957). Rapid method for determination of lactose in milk and cheese. J. Sci. Food Agric., 8 (7): 437-441.

Birgitte, D.M.; Morten, D.R.; Mette, O.N.; Lars, W. And Lotte, B.L. (2004). Physical properties of mammary secretions in relation to chemical changes during transition from colostrums to milk. J. Dairy Res. 71: 263-272.

Brambell, F.W. (1969). Transmission of immune globulin's from mother to the fetal and newborn young. Prac. Nutr. Soc. 28: 35- 41.

Bush, L.J. and Staley, T.E. (1980). Absorption of colostral immunoglobulins in new born calves. J. Dairy Sci. 63: 672-680.

Butler, J.E. (1974). Immunoglobulins of the mammary secretions. In Lactation. A comprehensive Treatise Vol. III. Ed. By B.L. Larson and V.L. Smith. Acadimic Press, New York, pp.217-255.

Campbell, B. and Petersen, W. E. (1963). Immune – Milk. A historical survey. Dairy Science Abstract 25: 345-358.

Ebina, T.; Sato, A.; Umezu, K.; Ishida, N.; Ohyama, S.; Oizumi, A.; Aikawa, K.; Katagiri, S.; Katsushima, N.; Imai, A.; Kitaob, S.; Suzuki, H. and Konno, T. (1985). Prevention of rotavirus infection by oral administration of cow colostrum containing antihumanrotavirus antibody. Med. Microbiol. Immunol. 174: 177-185.

Edelsten, D. (1988). Composition of milk. In Meat Science, Milk Science and Technology, pp. 175-199 (Eds H.R. Cross and A.J. Overby). Amsterdam: Elsevier Science Publishers B.V.

El-Agamy, E.I.; Zeinab, I.A.S. and Abdel-Kader, Y.I. (1998). Gel electrophoresis of proteins, physicochemical characterization and vitamin C content of milk of different species. Alex. J. Agric. Res. 43 (2): 57-70.

El-Loly, M.M. (2005). On the carbohydrate moiety of immunoglobulins from buffalo colostrum, milk and blood serum. Milchwissenchaft 60 (4): 392-395.

El-Loly, M.M. and Salim, A. (2008). Specific immune system factors in buffalo's milk. In: Proc. 3 [rd] International Conference on Food Science & Nutrition, "Nutrition, Nutritional Status, and Food Sciences in Arab Countries", NRC, Cairo, Egypt, 3-5 Nov. 2008: 208-219.

Fleenor, W.A. and Stott, G.H. (1980). Hydrometer test for estimation of immunoglobulin concentration in bovine colostrum. J. Dairy Sci. 63: 973-977.

Foley, J.A. and Otterby, D.E. (1978). Availability, storage, treatment, composition and feeding value of surplus colostrum: A review. J. Dairy Sci. 61: 1033-1060.

Ganguli, N.C. (1974). Physico-chemical make-up of buffalo milk in the standardization of techniques of handling, processing and manufacture products. XIX Int. Dairy Congr. Vol. II New Delhi, 358-377.

Gopal, P.K. and Gill, H.S. (2000). Oligosaccharides and glycoconjugates in bovine milk and colostrum. Br. J. Nutr. 84 (Suppl 1): S69-S74.

Haggag, H.F.; Hamzawi, L.F. and Mahran, G.A. (1991[a]). Physico-chemical properties of colostrum and clinical and subclinical mastitic buffalo milk. Egypt. J. Dairy Sci.19 (1): 55-63.

Haggag, H.F.; Mahran, C.A.; Ali, M.M. and Hamzawi, L.F. (1991[b]). Casein fraction of abnormal Egyptian buffalo milk. Egyptian J. Dairy Sci., 19 (2): 209-219.

Harding, F. (1995). Milk Quality. Blackie Academic and Professionals an Imprint of Chapman and Hall, pp: 157-158.

Hofi, A.A.; Rifaat, I.D. and Khorshid, M.A. (1966). Studies on some physico-chemical properties of Egyptian buffaloes and cows milk. Indian J. Dairy Sci., 19: 158-161.

Johnson, A.H., (1978). The Composition of Milk. In: Fundamentals of Dairy Chemistry. B.H. Webb, A.H. Johnson and J.A. Alford (Edn) The Avi Publishing Company, Inc: Westport, Connecticut, pp: 1-57.

Kholif, A.M. (1989). Effect of supplementing rations with buffers on the productive performance of dairy buffalo. Ph D. Thesis. Fac. Of Agric., Ain Shams Univ., Cairo.

Ling. E.R. (1963). A Text Book of Dairy Chemistry Vol. II, 3rd ed., Chapman and Hall, Ltd., London.

Mahran, G.A.; El-Alamy, H.A.; Mahfouz, M.B.; Hegazi, A.G.; El-Loly, M.M. and El-Kholy, A.F. (1997). Immunoglobulins of buffaloe's milk. In Proc. 5th World Buffalo Congress Proceeding, October 13-16, 1997, Royal Palace Caserta, Italy.

MARL (Ministry of Agriculture and Reclamation Land) (2002).

Matte, J.J.; Girard, C.L.; Seoane, J.R. and Brisson, G.J. (1982). Absorption of colostral immunoglobulin G in the new born calf. J. Dairy Sci. 65: 1765-1770.

McGuire, J.C.; Pfeiffer, N.E.; Weilke, J.M. and Bartsch, R.C. (1976). Failure of colostral immunoglobulin transfer in calves dying from infectious disease. JAVMA 169: 713-718.

Mourad, K.A. (1997). Buffaloes in Egypt. Buffalo Bull. 16 (4): 81-85.

Nickerson, S.C. (1995). Milk Production: Factor Affecting Milk Composition. Blackie Academic and Professionals, pp: 22-23.

Oyeniyi, O.O. and Hunter, A.G. (1978). Colostral constituents including immunoglobulins in the first three milkings postpartum. J. Dairy Sci.61: 44-48.

Parry, R.M. (1974). Milk coagulation and protein denaturation. In Fundamentals of Dairy Chemistry, pp. 603-661 (Eds B.H. Webb; A.H. Johnson and J.A. Alford). Westport, Connecticut: AVI Publishing Company.

Prasad, J. (1997). Animal Husbandry and Dairy Science. Kalyani publishers, New Delhi, p: 316.

Pritchett, L.C.; Gay, C.C.; Hancock, D.D. and Besser, T.E. (1994). Evaluation of the hydrometer for testing immunoglobulin G_1 concentrations in Holstein colostrum. J. Dairy Sci. 77: 1761-1767.

Rifaat, I.D.; Hassan, A.; El-Alamy, H, A. and Abd El-Salam, M.H. (1972). The chemical composition and properties of colostrum from buffaloes I. Chemical composition and some physical properties. Egyptian J. Anim. Prod., 12 (2) 67-75.

Robinson, J.D.; Ston, G.H. and DeNise, S.K. (1988). Effects of passive immunity on growth and survival in the dairy heifer. J. Dairy Sci. 71:1283-1287.

Roy, J.H. B. (1970). Management and feeding. The calf. Vol. I. Butterworth and Co., Toronto.

Sindhu, J.S. (1996). Suitability of buffalo milk for products manufacturing. Indian Dairyman 1996, XLVIII, 2: 41-47.

Stefano, F. DE (1998). The market for buffalo production in Italy. Georgofili 45 (4) : 91-114. C.F. DSA: 1999, 5275, (61) 7.

Stott, G.H.; Fleenor, W.A. and Kleese, W.C. (1981). Colostral immunoglobulin in two fractions of first milking postpartum and five additional milkings. J. Dairy Sci. 64: 459-465.

Stott, G.H.; Marx, D.B.; Menefee, B.E. and Nightengale, G.T. (1979). Colostral immunoglobulin transfer in calves I. Period of absorption. J. Dairy Sci. 62: 1632-1638.

Walstra, P. and Jennes, R. (1984). Dairy Chemistry and Physics. John Wiley and Son. Inc: Canada, pp: 137-138, 411.

Walstra, P.; Geurts, T.J.; Noomen, A.; Jellema, A. and vanBoekel, M.A.J.S. (1999). Dairy Technology, Principales of Milk Properties and Processes. New York: Marcel Dekker.

الثبات الحرارى والصفات الفيزوكيميائية فى اللبن الجاموسى

محمد منصور اللولي ، محمد مرسى الشيخ و أحمد حسن زغلول
قسم الألبان - المركز القومى للبحوث - الدقى - القاهرة

لقد أمكن التعرف على مدى الثبات الحرارى للبن الجاموسى خلال الثلاثة أيام الأولى بعد الولادة مباشرة (السرسوب) ، وكذلك تم تقدير بعض الصفات الطبيعية والمكونات الكيماوية الأساسية فى هذا اللبن.
وأوضحت النتائج أنه عند المعاملة الحرارية (الغليان) للبن قد لوحظ زيادة زمن التخثر تدريجياٍ مع تقدم الوقت بعد الولادة ، حيث أنه حدث تخثر للبن بعد دقيقة ونصف من الغليان بعد الولادة بأربع ساعات ، ووصل إلى أربعة وعشرون دقيقة وثلاثة عشر ثانية بعد ستون ساعة من الولادة أى فى بداية اليوم الثالث ، أما فى نهاية اليوم الثالث عند ٧٢ ساعة لم يحدث أى مظاهر للتخثر عند الغليان لمدة ساعة كاملة ، مما يدل على أن اللبن تقريباً أصبح طبيعياً ، وأن لبن السرسوب أكثر حساسية وأقل ثباتاً عند معاملته بالحرارة ولذلك فإنه لايصلح للعمليات التصنيعية المختلفة ، ويرجع ذلك إلى إرتفاع نسبة البروتين الكلى خصوصاً البروتينات المناعية (Immunoglobulins) والتى لها أهمية حيوية وفريدة من حيث إمداد الرضيع بالمناعة حتى ينضج جهازه المناعى.

لقد تم إستخدام الهيدروميتر (Hydrometer) فى إيجاد علاقة بين كلٍ من قيم الكثافة (الوزن النوعى Specific gravity) وتركيز البروتينات المناعية الكلية فى سرسوب اللبن الجاموسى ، حيث تتميز هذه الطريقة بأنها بسيطة وسريعة وغير مكلفة ولكنها تعتبر إختبار تشخيصى أو تقريبي بالمقارنة بالطرق الأخرى. وتؤدى هذه الطريقة إلى معرفة مدى جودة السرسوب وعلى أساسه يتم إختيار السرسوب عالى الجودة (مرتفع فى محتوى البروتينات المناعية) والذى بدوره يستخدم فى تغذية العجول الرضيعة الأخرى ، وفى الخارج تجمع فى بنوك السرسوب والزائد منها يتم حفظه بالتجميد لحين إستخدامه.
وأوضحت نتائج التحليل الكيماوى أن محتوى الدهن ينخفض فى السرسوب عنه فى اللبن الطبيعى ، بينما محتوى اللاكتوز يزداد تدريجياً بعد الأيام الأولى من فترة الحليب ، وكان محتوى البروتين هو أكثر المكونات تغيراً حيث كان ذو قيم مرتفعة فى الساعات الأولى من فترة الحليب ثم ينخفض سريعاً فى نهاية اليوم الأول والثانى ، بينما محتوى الرماد ينخفض تدريجياً بعد ١٢ ساعة وحتى اليوم الثالث من الولادة ، ويقترب تركيب السرسوب ليصبح طبيعياً فى اليوم الثالث بعد الولادة.