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RESEARCH ARTICLE

PHYSICO-CHEMICAL CHANGES OBSERVED DURING CONVERSION OF MURRAH BUFFALO COLOSTRUM TO MILK

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ABSTRACT

Colostrum is a fluid of mammary glands obtained by newborn in their early life to protect them against infections and provide nutrients. The phenomenon of physico-chemical changes takes place during conversion of colostrum to milk was studied. Study revealed that colostrum contains higher amount of proteins and total solids in comparison to milk. The colostrum obtained during evening hours was found rich in nutrients in comparison to morning colostrum.

Key words: colostrum, milk, protein, casein, lactalbumin, fat, total solids, solid-not-fat.

INTRODUCTION

Colostrum is vital food secreted from mammary glands for the newborn of all mammals within the first 5-7 days after parturition. Colostrum is a rich source of various nutrients such as protein, fat, carbohydrate, water- and fat-soluble vitamins and minerals. It also contains various biologically active substances such as immunoglobulins, antimicrobial factors, growth factors and others (Elfstrand *et al*., 2002; Kehoe *et al*., 2007; Georgiev, 2005 and Strekozov *et al*., 2008) (1-4). It is very important fluid for the newborns life because in the early life of newborns are solely dependant on the colostrum. In his early life newborns get immunity against infections only from the colostrum because they born without blood immunoglobulins (Igs) (Quigley, 2002). The quality of colostrum has a strong relationship with the development of the newborn in the early days of life. The composition of colostrum and its quality are influenced by a variety of factors, including maternal age, parity, breed, nutritional status, season, premature parturition, premature lactation, colostral handling factors (pooling colostrum and storage temperature), induction of parturition and health status (Maunsell *et al*., 1998; Tittle, 2002; Zarcula at al., 2010).

The changes observed in composition and properties of fluids in conversion of colostrum to milk may be gradual or sometimes sudden (Arain *et al*., 2008). The study on compositional variation from colostrum to milk colostrum and post-colostrum secretions helps in establishing the facts that such milk is suitable for processing and determine the best use for that milk (Tsioulpas *et al*., 2007). Several studies have been carried out on changes in the chemical composition of cow colostrum after parturition, but the study on buffalo colostrum is scanty though it has major contribution in India. Therefore, a comparative study was planned to explore the composition of colostrum in the process of its conversion to milk in murrah buffalo immediately after parturition.

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MATERIALS AND METHODS

Colostrum

200 ml colostrum samples were collected from each of the six murrah buffaloes recently parturited in Instructional Livestock Farm Complex of U.P. Pt. Deen Dayal Upadhyay Veterinary University and Go Anusandhan Sansthan, Mathura, U. P. India and examined for various parameters in the Department of Livestock Products Technology of the same university.

Diet and Quality of Life of Murrah Buffaloes

All six buffaloes were reared under semi-intensive system of rearing in the Instructional Livestock Farm Complex of U.P. Pt. Deen Dayal Upadhyay Veterinary University and Go Anusandhan Sansthan , Mathura, U.P. India. Ad libitum water was given to the animals and health of the animals was good. They were given the green fodder (maize+ lobia+M.P.Chari +Desi Jowar in equal quantity), hay and ration (choker+jai cerels+khali+chana+chooni in balanced ration form) in the ratio of 80:10:10).

Methodology

Collected samples were analysed for physical appearance, specific gravity, titrable acidity, total solids, solid- not –fat,

Table1: Physico-chemical status of colostrum/milk during conversion of colostrum to milk

Milking time	Days of study						
	1st day	2nd day	3rd day	4th day	5th day	6th day	7th day
				Specific gravity			
Morning	$1.041^{a}\pm0.004$	$1.023^{e}\pm0.005$	$1.031^{c}\pm0.004$	$1.035^{abc}\pm0.005$	$1.031^{c}\pm0.004$	$1.0317^{c}\pm0.004$	$1.030^{cd}\pm0.000$
Evening	$1.028^{de}\pm0.004$	$1.040^{ab}\pm0.000$	$1.031^{c}\pm0.004$	$1.030^{cd}\pm0.000$	$1.030^{cd}\pm0.000$	$1.033^{bc}\pm0.008$	$1.030^{cd}\pm0.000$
				Titrable acidity (%)			
Morning	$0.54^{Aa}\pm0.009$	$0.32^{Abc}\pm0.006$	$0.33^{Ab}\pm0.008$	$0.30^{A\,bc}\pm0.007$	$0.23^{Aef}\pm0.011$	$0.21^{Afg}\pm0.015$	$0.21^{Ag}\pm0.013$
Evening	$0.26^{Bd}\pm0.022$	$0.29^{Bc}\pm0.025$	$0.20^{Bgh}\pm0.004$	$0.24^{Bde}\pm0.007$	$0.21^{Bgh}\pm0.006$	$0.19^{Bgh}\pm0.012$	$0.18^{Bh}\pm0.005$
				Total solid (%)			
Morning	$17.08^{Ac}\pm0.016$	$15.66^{Aef}\pm0.023$	$17.86^{Ab}\pm0.009$	$15.38^{Aef}\pm0.107$	$15.95^{Ade}\pm0.004$	$16.29^{Ad}\pm0.370$	$12.40^{Ak}\pm0.290$
Evening	$22.41^{Ba}\pm0.240$	$14.39^{Bi}\pm0.079$	$13.27^{Bj}\pm0.194$	$10.36^{Bl}\pm0.701$	$15.04^{Bfg}\pm0.030$	$14.60^{Bhi}\pm0.225$	$12.76^{Bjk}\pm0.683$
				Solid –not -fat (%)			
Morning	$11.53^{Ab}\pm0.138$	$7.75^{Ag}\pm0.155$	$9.40^{Ade}\pm0.116$	$11.33^{Ab}\pm0.099$	$9.82^{Ac}\pm0.286$	$9.61^{Acd}\pm0.195$	$7.62^{Ag}\pm0.075$
Evening	$12.48^{Ba}\pm0.187$	$8.82^{Bf}\pm0.173$	$7.91^{Bg}\pm0.074$	$6.49^{Bi}\pm0.232$	$9.24^{Be}\pm0.043$	$7.31^{Bh}\pm0.016$	$7.81^{Bg}\pm0.036$
				Fat (%)			
Morning	$5.53^{h}\pm0.103$	$8.00^{c}\pm0.000$	$7.18^{de}\pm0.331$	$8.63^{b}\pm0.196$	$4.11^{i}\pm0.160$	$6.61^{f}\pm0.147$	$6.76^{ef}\pm0.081$
Evening	$9.93^{a}\pm0.471$	$6.26^{g}\pm0.332$	$5.56^{h}\pm0.273$	$3.68^{i}\pm0.292$	$7.48^{d}\pm0.116$	$6.78^{ef}\pm0.194$	$6.66^{fg}\pm0.136$
				Lactose (%)			
Morning	$6.42^{Ac}\pm0.117$	$5.96^{Ade}\pm0.030$	$6.85^{Ab}\pm0.076$	$5.84^{Ae}\pm0.040$	$6.06^{Ade}\pm0.013$	$6.16^{Acd}\pm0.097$	$4.72^{Aij}\pm0.135$
Evening	$8.76^{Ba}\pm0.174$	$5.42^{Bf}\pm0.101$	$5.05^{Bg}\pm0.057$	$4.54^{Bj}\pm0.110$	$5.42^{Bf}\pm0.307$	$4.92^{Bgh}\pm0.098$	$4.90^{Bgh}\pm0.207$
				Casein (%)			
Morning	$3.15^{fg}\pm0.054$	$4.13^{b}\pm0.051$	$3.83^{c}\pm0.081$	$2.54^{j}\pm0.035$	$3.62^{de}\pm0.043$	3.62 ± 0.043	$2.78^{i}\pm0.007$
Evening	$4.90^{a}\pm0.034$	$3.47^{e}\pm0.184$	$2.98^{gh}\pm0.010$	$3.25^{f}\pm0.059$	$3.77^{cd}\pm0.233$	$3.67^{cd}\pm0.137$	$2.94^{hi}\pm0.057$
				Lactalbumin (%)			
Morning	$0.86^{Abc}\pm0.015$	$0.78^{Ae}\pm0.000$	$0.88^{Ab}\pm0.005$	$0.76^{Aef}\pm0.004$	$0.79^{Ade}\pm0.010$	$0.82^{Acd}\pm0.005$	$0.67^{Ah}\pm0.015$
Evening	$0.97^{Ba}\pm0.046$	$0.72^{Bg}\pm0.015$	$0.65^{Bhi}\pm0.021$	$0.47^{Bj}\pm0.008$	$0.77^{Be}\pm0.019$	$0.73^{Bfg}\pm0.016$	$0.63^{Bi}\pm0.008$

Superscripts showing capital letters differ column wise significantly (P<0.05)
Superscripts showing small letters differ row wise significantly (P<0.05)

lactose, casein and lactalbumin contents according to the procedure described in AOAC, 1999. Fat was determined by Gerber method according to Ling, 1963. Physical appearance of the colostrum and milk were observed on the basis of colour and appearance, flavour etc. using organoleptic tests. The colostrum samples were also checked for foreign particles.

Statistical analysis

Data obtained in the study on various parameters were analysed for analysis of variance using tukey and descriptive analysis through the SPSS-14 software. The paired t-test was also performed by the same software.

RESULTS AND DISCISSION

Physical appearance

The colostrum obtained for the study was initially yellowish in colour with pleasant salty sweet smell in both of the collection periods. On the advances of days of conversion of colostrum to milk it continuously get reduced in yellowness and increased in sweetness. On day 7th fluid became white in colour and sweet pleasant in flavours. The conversion of colour from colostrum to milk is depicted in Figure 1.

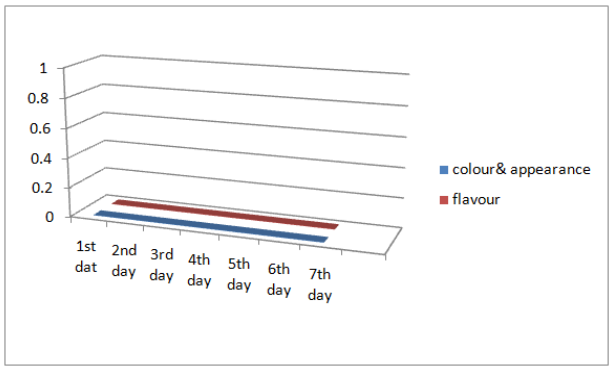

Figure 1: Physical appearance of fluid during conversion of colostrum to milk

Phsico-chemical changes

The physico-chemical changes observed in the study in terms of specific gravity, titrable acidity, fat, total solids, solid-not-fat, lactose, casein and lactalbumin is given in Table1. On the study we found that the evening clostrum/milk were significantly (P<0.05) different from morning one in term of all the parameters except specific gravity, fat and casein. However, day wise study overall revealed decreasing trend of the values with respect to the advancement of the days of conversion except in fat contents which showed the increasing trend. The range of values during whole of the

study period were 1.028±0.004 to 1.041±0.004 for specific gravity, 0.18 ±0.005 to 0.54±0.009 for titrable acidity, 10.36±0.701 to 22.41±0.240 for total solids, 6.49±0.232 to12.48±0.187 for solid-not-fat, 4.11±0.160 to 9.93±0.471 for fat, 4.54±0.110 to 8.76±0.174 for lactose, 2.54±0.035 to 4.90±0.034 for casein and 0. 47±0.008 to 0.97±0.046 for lactalbumin. The overall study revealed higher values in evening colostrum as compared to morning colostrum except the values of specific gravity and titrable acidity. However, the values of titrable acidity, fat and lactalbumin in morning milk were higher as compared to evening milk while other values were higher in evening milk except specific gravity which was almost similar in both of the milk.

The changes in physico-chemical characteristics from colostrum to milk showed a vide range of values as suggested by the Arain *et al*., 2008. These changes might be due to differences in the composition of colostrum and milk such as colour and appearance of colostrum was yellowish while it was white in milk which might be due to the variation in protein contents as suggested by Cziszter *et al*., 2008 in colostrum of black and white cows. Changes in proteins, fat, lactose and total solids concentration of buffalo colostrum were similar as reported by Nawar,2006 in case of Egyptian buffaloes colostrum. As the transition period advanced, these components in both colostrums decreased gradually as suggested by Qyeniyi *et al*., 1978 and Toshiyoshi *et al*., 1982.

Conclusion

On the basis of study it may be concluded that murrah buffaloes colostrum was rich in total solids and protein contents in comparison to the milk obtained after seven days. The titrable acidity of the colostrum was quite high in comparison to milk. The further study on the level of immunoglobulins and specific proteins are required to assess the specific effect of colostrum on newborn immunity and well beings.

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