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PHYSICOCHEMICAL AND ANTIMICROBIAL PROPERTIES OF COLOSTRUM AND MILK UNDER TRANSITION STATE IN SAHIWAL AND CHOLISTANI CATTLE OF PAKISTAN

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ABSTRACT:
Sahiwal and Cholistani cattle are considered as heat-tolerant breeds of Pakistan. The colostrum and transition milk of these cattle obtained as Sahiwal (n =10) and Cholistani cow (n=10) at 06 hours interval after calving, and then in every morning and evening till five days at regular intervals (n=220). At morning, samples were marked as 12, 36, 60, 84 and 108 hours while at evening marked as 24, 48, 72, 96 and 120 hours. The physico-chemical examination of the nutritional characteristics of colostrum and transition milk included measurements of pH, acidity,fat, protein, total solids, solids without fat, lactose, ash, specific gravity, and viscosity. Measurements were also made of antimicrobial characteristics such as lactoferrin, immunoglobulins, and lysozyme. The findings indicated that while lactose percentage and pHvalues of colostrum grew, fat, protein, total solids, solids not fat, and ash content in colostrum and transition milk from Sahiwal and Cholistani cow breeds steadily declined. After six hours, the fat concentrations of the Sahiwal and Cholistani cows were 6.80±0.06 and 5.70±0.06, respectively. At 120 hours post-calving, the immunoglobulin levels in transition milk of both breeds of cattle were 11.61±0.01l and 19.25±0.01l, respectively. After calving, viscosity, LR, specific gravity, and immunoglobulins dropped from 06 to 120 hours. Lysozyme in colostrum of Sahiwal at 06 hours of post calving was 0.39±0.00 and then decreased to the level of 0.06±0.00 after 120 hours of calving. The concentration of lactoferrin in colostrum and transition milk were highly significant $p<0.0001$ in both breeds of the cattle.

Keywords: Physic-chemical, antimicrobial, properties, colostrum, transition milk, Sahiwal, Cholistani breeds

INTRODUCTION

Colostrum is considered as the best nourishment for a newly born calf within the first 03 days. The significance of colostrum seems from the fact that it provides all required nutrients such as carbohydrates, lipids, proteins, vitamins, immunoglobulins, antibodies and minerals. Moreover, it has higher concentration of very essential nutrients such as protein, lipid, vitamins, antibodies and minerals but lower concentration of carbohydrates especially lactose. Further colostrum has higher level of immunoglobulins to provide nourishment for newborns. Immunoglobulins help in positioning meconium because of its laxative effect. In addition to providing nutrients including protein, fat, minerals, and vitamins, colostrum also contains a variety of biologically active components that are required for certain processes (Kulkarni & Pimpale, 1989). When compared to the composition of milk, the colostrum that cows produce in the initial days following parturition differs greatly in composition. It is an alkaline yellow liquid that is viscous and sticky. Compared to milk, the content of fat-soluble vitamins, iron, and water-soluble vitamins such vitamin B12 is greater in colostrum (Szulc & Zachwieja, 1998). According to Kehoe, Jayarao, and Heinrichs (2007), colostrum is the milk secreted by the mammary glands soon following parturition, which ends four days after calving (Gopal & Gill, 2000). In comparison to milk in its mature form, colostrum contains less lactose and more fats, proteins, peptides, non-protein nitrogen, ash, vitamins, minerals, growth factors, hormones, nucleotides, and cytokines; the value of these constituents decreases rapidly during the first three days following calving, excluding lactose (Blum, & Hammon, 2000).

After calving, there were considerable changes in the levels of activity of the principal components of colostrum (milk protein, dry matter, lactose, and solids-not-fat extract), with the levels on thethird day approaching those of mature milk (Georgiev, 2005). Colostrum is rich in components that are both physiologically and immunologically active. These include lysozyme, immunoglobulins, lactoferrin, leucocytes, cytokines, and other immune-modulatory substances. The applications of these bioactive substances are increasing in pharmaceutical and nutritional practices (Roginski, Fuquay, & Fox, 2003). The first colostrometer test was created by Fleenor & Stott (1980) by combining the specific gravity of fresh entire colostrum with the connection between immunoglobulin concentrations in bovine colostrum. Chewing gum, beverages, and dietary supplements based on colostrum have been launched to the market by several enterprises in the past few years. Food based on cow colostrum is also utilized in gastrointestinal treatments and to boost patient immunity. Without a doubt, it includes components that are important to humans due to its numerous uses in preventative measures as well as their ability to lessen negative effects from chemotherapy or antibiotic treatment (Dzik et al., 2017).

MATERIALS AND METHODS

Research Station: Research was carried out at the University of Veterinary and Animal Sciences (UVAS), Ravi Campus, Pattoki, District Kasur, Pakistan, at the Department of Dairy Technology and the Central Laboratory Complex, A-Block.

Colostrum and transition milk sampling: During the initial five days following parturition, the colostrum and transition milk of ten Sahiwal and Cholistani cows (each with a second calving) were milked in the morning and evening. For analysis, a total of 220 samples were gathered. Sahiwal cow colostrum from B-block, Dairy farm UVAS, Ravi Campus Pattoki; on the other hand, sterile bottles containing the colostrum and transition milk of the Cholistani breed were acquired from the dairy farm Jugait-peer, Bahawalpur, Punjab, Pakistan. After being labeled and placed in ice packs, the samples were brought to the UVAS Department of Dairy Technology lab at the Ravi Campus in Pattoki to be examined. Below is the sampling detail (Table No. 1).

Table No. 1: Sampling detail.

Species	Cow	
Breed	Sahiwal	Cholistani
Days	1-5	
Milking time	Morning + Evening	
Experimental Unit	(10 animals of each breed), Species = 1, Breeds = 2Colostrum & Transition milk= 5 days, Timing= 2 10 x1 x 2 x 5 x 2 = 200 After calving of 6 hours (10 animals of 2 breeds =10 x 2= 20) Total samples (n)= 200+20 = 220	

Nutritional Attributes:
The nutritional characteristics of colostrum and transition milk were assessed using the following methods for physical and chemical assessment (pH, acidity, fat, protein, total solids, and ash) (AOAC, 2005). The technique outlined by Pearson (1976) was used to determine the solid-not-fat (SNF) of colostrum and transition milk. The Anthrone technique, as described by Richard (1959), was used to quantify the lactose concentration in colostrum and transition milk. The technique outlined by (AOAC, 2000) was used to test the viscosity of transition milk and colostrum. In the Bio-imaging Laboratory of the Central Laboratory Complex on the Ravi Campus, immunoglobulins of colostrum and transition milk were measured using the technique outlined by Fleenor and Stott in1980. Using the methodology outlined by (Billakanti, Fee, Lane, Kash, & Fredericks, 2010), lactoferrin as well as lysozyme of colostrum and transition milk were measured using HPLC (Model1260, infinite II, Agilent tech., Germany) in Central Laboratory Complex, A-Block, Ravi campus UVAS.

Statistical analysis: The study was carried out using a fully randomized design (CRD). The data analysis method employed was the factorial evaluation of variance methodology (ANOVA). For a substantial difference between treatment means, the DMR test is employed (Steel, 1997).

RESULTS AND DISCUSSIONS

Fat: Mean fat percent values of Sahiwal cow after the 6 hours of calving was maximum (6.80±0.06) as compared to 120 hours' study which was (3.91±0.01) and it's the transition milk. Fat %age of Cholistani cow colostrum after the 6 hours of calving was (5.70±0.06) which was lower as compared to the value of 12 hours of study of colostrum and from 12 hours' study to onward values of mean fat % of Cholistani decreased and mean fat % of Cholistani cow transition milk was (4.65±0.01) (Table No. 1, Figure No. 1). There was a significant difference (P<.0001) in the fat percentage analysis of cows from the Sahiwal and Cholistani breeds.

The current study's findings were associated with that of a study conducted in 2024 by Ahmad, Inayat, Nadeem, and Sheikh, which reported a reduction in fat percentage from six hours to 120 hours following calving. The present study's findings were similar to those of a 2007 study by Kehoe, Jayarao, and Heinrichs that examined the composition of cow colostrum and found that the mean fat percentage was 6.7%. The fat percentage of colostrum and transition milk in Sahiwal and Cholistani breeds is connected to a research by Roy (1980) that found 3.5% of fat in colostrum, although Naylor & Ralston (1991) reported a greater fat content of 6.7% in colostrum. In a 1978 study, Foley and Otterby found that the fat content of colostrum was 6.7%, which was linked to 4% of mature milk. Hassabo (2001) examined the fat percentages of the milk from dairy cattle with fat values of 5.3% and 4.7%, 4.55% and 3.45% based on the kenana type, and 50%, 62.5%, and 75%for the cross pedigree* friesion x kenana, correspondingly.

Protein: Colostrum was shown to have the highest levels of protein, fat, ash, T.S., SNF, and acidity on day 1, whereas day 3 revealed the highest levels of moisture, lactose, and pH. At 6 hours postpartum, the mean protein percentage of Sahiwal & Cholistani cows was 11.01±0.12&9.54±0.17,

and at 120 hours, it was 4.24±0.18&3.69±0.09 (Table No. 1, Figure No. 1). Protein percentage analysis of variance for the Sahiwal and Cholistani breeds of cows was substantially high (P<.0001), non-significant (P>0.05) for Breeds*Time, and highly significant (P<.0001) in the model based on statistical analysis. In this investigation, the average protein content in the third days of the Sahiwal cow's colostrum was 5.27%. Colostrum protein results from day three in Cholistani cows revealed a lower proportion (4.57%). According to Fox, McSweeney, and Paul (1998), the protein concentration varies amongst species, ranging from 1% to 14%. Based on Roy's (1980) research, the first 24 hours following calving, colostrum contains around 14.3% protein. According to Blum and Hammon's (2000) research, 14.9% of the protein in cow colostrum is detected. Protein was determined to be at 4.90%, which was more than the value reported by Mohammed (2004). The current study's findings were connected to a study by Ahmad, Inayat, Nadeem, and Sheikh (2024), in which the protein percentage dropped from 6.82±0.33c to 3.97±0.10h after calving.

Lactose in colostrum: Results showed that lactose percentage in Sahiwal & Cholistani cow after the 6 hours of calving were 2.49±0.01& 2.71±0.01, respectively. After 120 hours of calving lactose percentage was increased to the level 4.39±0.01 in Sahiwal cow which was significantly higher during this period (Table No. 1). However, in the present study lactose contents of Sahiwal and Cholistani cow colostrum were 2.49% after 6 hours and 2.71% in colostrum after 6 hours of calving,respectively. The overall mean values were 3.58% and 3.89% in Sahiwal and Cholistani cow colostrum's, respectively. The current study's findings were associated with a study conducted in 2024 by Ahmad, Inayat, Nadeem, and Sheikh, in which the percentage of lactose rose from 2.72±0.14c at 6 hours after calving to 4.49±0.01i at 120 hours. Compared to mature milk, the colostrum of Holstein cows has 2.3% less lactose (Naylor & Ralston, 1991). In colostrum, the average lactose content is 2.7%, but in mature milk, it is around 5% (Foley & Otterby, 1978). Lactose reported by (Kehoe, Jayarao, & Heinrichs, 2007) 2.5%.

Solids-Non-Fat (SNF): The mean percent value of Solids not Fat of Sahiwal & Cholistani cows colostrum were 11.81±0.01& 13.01±0.01, respectively, which were remarkably higher (Table No. 2). According to Foley, & Otterby (1978), the mean SNF level in cow colostrum at days-1,-2,-3,-4, and 5 was 160.70, 120.20, 90.80, 90.50, and 80.80 g/kg, respectively. These results are consistent with our research and with those of Ibeawuchi & Dangut (1996), who found that the average amountof SNF in cow colostrum was 9.66%. The current study's findings were comparable to those of a study conducted in 2024 by Ahmad, Inayat, Nadeem, and Sheikh, in which the percentage of solids that were not fat dropped from 20.07±0.01a to 10.97±0.01c hours after calving.

Total solids: Mean±SD value of Sahiwal colostrum was 17.52±0.01. Maximum value of total solids in Cholistani colostrum was 25.27±0.01 after the six hours of calving while minimum value was 14.95±0.01 after 120 hours in transition milk (Table No. 2). Statisticaly results showed that total solids % value of colostrum and transition milk in Sahiwal and Cholistani cow colostrum and transition milk were highly significant (p<.0001). According to Roy (1980), mature milk includes 12.5% total solids within the first 24 hours, whereas colostrum comprises 22.5% total solids. According to Kehoe, Jayarao, and Heinrichs (2007), the total solid content of cow colostrum is around 27.6%. In one research, the estimated total solids in colostrum's ranged from 14 to 18% (Daniels, Hall, Hornsby, & Collins, 1977). These results were also consistent with the conclusions of a few other investigators (Ibeawuchi, & Dangut, 1996). The present study's results were compared with those of a study conducted in 2024 by Ahmad, Inayat, Nadeem, and Sheikh, in which the percentage of total solids decreased from 28.91±0.01a to 16.67±0.01g after calving.

Ash: The results showed that that ash contents go on decrease with the increase in time. The mean value of ash in colostrum was 0.91±0.04 after six hours while it was 0.75±0.02 at 120 hours after parturition.in Sahiwal cow colostrum to transition milk. Similarly, in Cholistani breed ash content also

goes on decrease and was 0.84±0.02 after 6 hours and at 120 hours after calving (Table No. 2). Analysis depicted that ash percent value in Sahiwal and Cholistani colostrum was not significantly different between two breeds ($p>0.05$). Additionally, the results indicated that there was no significant difference ($p>0.05$) between the model and the time breed*time interaction. Day 1, Day 2, Day 3, Day 4, and Day 5 colostrum ash content levels were 8.60, 8.40, 8.30, and 8.50g/kg, respectively, according to Roadhouse and Henderson, 1950. These values were somewhat comparable to the current findings. This result also coincided with the results of Ibeawuchi, & Dangut, (1996) who observed the mean solids-not-fat content of colostrum was 0.94%. The current study's findings were related to a study conducted in 2024 by Ahmad, Inayat, Nadeem, and Sheikh, in which the percentage of ash fell from 1.04±0.10 hours after calving to 0.76±0.01 hours later.

pH: The pH results of colostrum in both breeds showed that it was increased after 6 hours of parturition but statistically non-significant ($p> 0.05$). The pH level (mean ± SD) in Sahiwal was 6.15±0.01 at 6 hours while 6.62±0.01 after 120 hours. Similarly, the pH level of Cholistani breed (mean ± SD) in transition milk was 6.25±0.01 and 6.68±0.01 after 6 and 120 hours of calving, respectively, (Table. 3). Caulfield, & Riddell, (1936) affirmed that the average pH of first colostrum was 6.25, and then increased gradually to 6.57 by the 15th day after calving. The colostrum samples collected on the first day had the highest levels of protein, SNF, fat, T.S., ash, and acidity, whereas the samples collected on the third day had the highest levels of moisture, lactose, and pH. Protein and fat levels are highest on the first postpartum day and gradually drop on successive postpartum days (Fox, McSweeney, & Paul, 1998).

Acidity: After six hours of parturition, the Sahiwal breed's acidity % level was 0.36±0.01, however, after 120 hours, it was 0.18±0.01. This indicates that the acidity level decreases with time. The acidity % was measured in the colostrum and transitional milk of the Cholistani and Sahiwal breeds. The results for the colostrum of the Cholistani breed were also similar, indicating an acidity level of 0.27±0.01 after 6 hours after calving and 0.20±0.01 after 120 hours, as shown in Table No.3 *i.e.*, $p<0.0001$ (very significant).

The results of the current study were roughly in line with Prasad's (1997) description of the typical range for colostrum acidity %, which was 0.2–0.4. Colostrum samples taken on the first day had the highest levels of protein, SNF, fat, T.S., ash, and acidity; those taken on the third day had the highest levels of moisture, lactose, and pH (Fox, McSweeney, & Paul, 1998).

Viscosity: At six hours post-calving, the viscosity of the Sahiwal and Cholistani cows was determined to be 6.91±0.01b and 5.79±0.01c, respectively. At 120 hours postpartum, the viscosities of the Cholistani and Sahiwal cows were 1.37±0.01g and 1.47±0.00g, specifically (Table No. 4). Parallel to the Cholistani cow, colostrum and transitional milk of Sahiwal cows had a greaterviscosity at 6 & 120 hours after calving. The initial three milking sessions saw the fastest change. The percentage viscosity of the Cholistani and Sahiwal breeds was substantially greater ($p<0.0001$). In both breeds, the viscosity of the transition milk from colostrum to the first day after calving dropped at 6 and 120 hours, respectively.

During the shift from colostrum to milk, the flow rate rises from 2.6 to 212 mL per minute. The variations in albumin-globulin, specific gravity, solids-not-fat, and total protein percentage seemed to be connected with these discrepancies. When cooked, colostrum takes on the appearance of gel, much like egg albumin, due to the elevated serum protein concentration level. Colostrum often has alower coagulation temperature than regular milk (Kadian, 2000).

LR and Density/Specific Gravity (SG): After 6 hours of calving in both breeds; Mean±SD of LR values were 65.00±0.58b and 68.00±0.58b, respectively. Table No. 4 shows that the LR values of

transition milk and colostrum from Cholistani cows were greater than those of Sahiwal cows. The specific gravity and LR % of the Cholistani and Sahiwal breeds were much greater ($p<0.0001$). Six hours after calving, the SG values of the Cholistani and Sahiwal cows were 1.068±0.00b and 1.065±0.00b, respectively. The specific gravities (SG) of the two breeds in colostrum to transition milk dropped between 6 and 120 hours post-calving; they were 1.031±0.00e and 1.034±0.00e, in that order (Table No. 4).

At 15.5 °C, whole milk's specific gravity (SG) ranged from 1.030 to 1.035 (Jenness & Patton, 1959). According to Kertz (2008), during the first five milkings following calving, the specific gravity of colostrum decreases from 1.056 to 1.033.

Immunoglobulins (Ig): Table 5 and Figure 2 show the immunoglobulin findings from colostrum and transition milk (Sahiwal, Cholistani). Immunoglobulins of both cows at 6 hours after the calving were 98.21±0.01d and 74.18±0.01, respectively. While immunoglobulins in transition milk at 120 hours were 11.61±0.01l and 19.25±0.01l, respectively, after calving in both cows. The results indicated that there was a non-significant difference in immunoglobulin levels across breeds and periods of time ($p=0.2516$, $p>0.05$) but a substantial increase in immunoglobulin levels in two breeds ($p=0.0064$, $p<0.0001$).

The immunoglobulins are the main protein components found in colostrum (Roginski, Fuquay, & Fox, 2003). The class of globular proteins known as immunoglobulins has antibacterial and other defensive bio-activities that shield the gut mucosa from harmful microbes. The five classes of immunoglobulins are IgG, IgM, IgD, IgA, and IgE. The most significant immunological component is the immunoglobulin G (IgG: IgG1 & IgG2), of which IgG1 accounts for approximately 80% of milk's total Ig content (Seth & Das, 2011). According to Roginski, Fuquay, and Fox (2003), immunoglobulin levels in bovine colostrum and milk were 20–200 and 0.7 g/L, respectively, which was consistent with our study's findings. The range of 30-200 mg/mL for immunoglobulins (Ig) in the first milk after calving might vary considerably (Gapper, Copestake, Otter, & Indyk, 2007). Colostrum has a fast declining antibody content. Cow's initial colostrum had a decreased concentration of immunoglobulins, with an average of 58.4 g/L (Błaszkowska, 2006). Colostrum from second-lactation of cows had higher immunoglobulin levels than that of primiparous cows (Guliński, Niedziałek, SalaMończyk, & Górski, 2006). Lactoferrin and Lysozyme in Transition Milk and Colostrum: Lysozyme results in Sahiwal Colostrum were 0.39±0.00h and 0.06±0.00k at 6 and 120 hours after calving, with a Mean±SD value of 0.17±0.00j. The colostrum of Cholistani cow contains 0.43±0.00h lysozyme level after 6 hours of calving. These lysozyme values in transition milk of Cholistani decreased and reached at the level of 0.08±0.00k after the 120 hours after parturition (Table No. 5). Statistically, Lysozyme of Sahiwal and Cholistani breeds were found highly significant ($p<0.0001$).

The result of lactoferrin value in colostrum of Sahiwal cow shown was 1.29±0.01c.at 6hrs after calving. The lactoferrin in Sahiwal was 0.61±0.01i at 120 hours of calving. Lactoferrin in colostrum of Cholistani cow after 6 hours was 1.21±0.01d, and after 24 hours of calving was 1.23±0.19c, observed (Table No. 5). Statisticaly lactoferrin of Sahiwal and Cholistani breeds were highly significant ($p<0.0001$).

Lysozyme is a well-known anti-bacterial and lytic enzyme described through (Seth, & Das, 2011). Lysozyme levels in mature milk were shown to be as low as 0.1 mg/liter, compared to values of 0.3 to 0.8 mg/L in colostrum (Roginski, Fuquay, & Fox, 2003). According to Seth and Das (2011), the presence of lactoferrin enhances the antibacterial activity of lysozyme against E. coli. According to Farkye (2002), lysozyme activity in colostrum is greater than in milk.
According to Tripathi and Vashishtha (2006), the ranges for lysozyme concentrations in colostrum and regular milk were 0.07 to 0.6 mg/mL and 0.14 to 0.7 mg/mL, respectively. Between 0.02 mg/mL

and 0.75 mg/mL of lactoferrin were found in milk (Hahn, Schulz, Schaupp, & Jungbauer, 1998). Reiter (1978) reported that the amount of lactoferrin in colostrum was found to be thirty times greater than that in milk.

Conclusion: In conclusion, physicochemical contents like fat, protein, solids not fat, total solids, lactometer readings, specific gravity and ash percentage, and antimicrobial components such as immunoglobulin's, and lysozyme were noticeably measured higher in both breeds in earlier six hours of colostrum parallel to transition milk.

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Table No. 1 Physicochemical propserties of Sahiwal and Cholistani Cow Breeds

Time	Fat %		Protein %age		Lactose %age	
	Sahiwal	Cholistani	Sahiwal	Cholistani	Sahiwal	Cholistani
6	6.80±0.06d	5.70±0.06e	11.01±0.12a	9.54±0.17b	2.49±0.01h	2.71±0.01h
12	6.60±0.06d	6.85±0.01d	8.91±0.72c	8.12±0.00c	2.96±0.01h	3.41±0.01g
24	6.02±0.01d	6.21±0.01d	7.46±0.67c	6.85±0.57d	3.18±0.01g	3.61±0.01g
36	5.81±0.01e	6.08±0.01d	6.72±0.55d	5.95±0.12e	3.31±0.01g	3.73±0.01g
48	5.39±0.01e	5.98±0.01e	6.21±0.48d	5.39±0.27e	3.46±0.01g	3.84±0.01g
60	5.12±0.01e	5.73±0.01e	5.69±0.55e	5.01±0.38e	3.52±0.01g	3.96±0.01g
72	4.41±0.01f	5.50±0.06e	5.27±0.27e	4.57±0.49f	3.66±0.01g	4.01±0.01f
84	4.34±0.01f	5.41±0.01e	4.83±0.07f	4.38±0.44f	3.92±0.01g	4.21±0.01f
96	4.12±0.01f	5.30±0.06e	4.49±0.14f	4.14±0.31f	4.17±0.01f	4.33±0.01f
108	4.03±0.01f	4.82±0.01f	4.35±0.19f	3.88±0.15g	4.28±0.01f	4.45±0.01f
120	3.91±0.01g	4.65±0.01f	4.24±0.18f	3.69±0.09g	4.39±0.01f	4.53±0.01f
Mean±SD	5.14±0.02e	5.65±0.02e	6.29±0.35d	5.59±0.27e	3.58±0.01g	3.89±0.01g

Same letters in the table show non-significant results

Table No. 2 Physicochemical properties of Sahiwal and Cholistani Cow Breeds colostrum and transition milk

Time	SNF %age		TS %age		Ash %age	
	Sahiwal	Cholistani	Sahiwal	Cholistani	Sahiwal	Cholistani
6	18.47±0.01e	18.97±0.01e	26.29±0.01a	25.27±0.01b	0.91±0.04l	0.84±0.02m
12	14.17±0.00g	15.73±0.01f	22.51±0.01c	22.61±0.01c	0.89±0.04m	0.83±0.03m
24	13.04±0.01h	13.84±0.01h	20.15±0.01d	20.65±0.01d	0.87±0.03m	0.82±0.02m
36	12.02±0.01i	13.31±0.01h	18.83±0.01e	20.01±0.01d	0.86±0.03m	0.81±0.02m
48	11.66±0.01i	12.79±0.01h	18.09±0.01e	19.21±0.01e	0.83±0.03m	0.79±0.02n
60	11.09±0.01j	12.48±0.01i	16.21±0.01f	18.73±0.01e	0.82±0.03m	0.79±0.02n
72	10.44±0.01j	11.93±0.01i	14.95±0.01g	17.62±0.01e	0.80±0.03m	0.77±0.02n
84	10.17±0.01j	11.66±0.01i	14.67±0.01g	17.09±0.01e	0.79±0.03n	0.75±0.02n
96	9.88±0.01k	11.39±0.01j	14.15±0.01g	16.75±0.01f	0.78±0.03n	0.75±0.01n
108	9.60±0.01k	10.78±0.01j	13.61±0.01h	15.69±0.01f	0.76±0.02n	0.73±0.01n
120	9.33±0.01k	10.24±0.01j	13.27±0.01h	14.95±0.01g	0.75±0.02n	0.72±0.01n
Mean±SD	11.81±0.01i	13.01±0.01h	17.52±0.01f	18.96±0.01e	0.82±0.03m	0.78±0.02n

Same letters show non-significant results

Table No. 3 Physicochemical properties of colostrum and transition milk of cow:

Time	pH		Acidity	
	Sahiwal	Cholistani	Sahiwal	Cholistani
6	6.15±0.01a	6.25±0.01a	0.36±0.01d	0.27±0.01e
12	6.24±0.01a	6.39±0.00b	0.33±0.01d	0.25±0.01e
24	6.30±0.01a	6.41±0.01b	0.30±0.01d	0.23±0.01e
36	6.35±0.01b	6.43±0.01b	0.28±0.01e	0.22±0.01e
48	6.38±0.01b	6.45±0.01b	0.27±0.00e	0.20±0.01f
60	6.44±0.01b	6.49±0.01b	0.26±0.00e	0.19±0.00f
72	6.47±0.01b	6.52±0.00c	0.23±0.01e	0.19±0.01f
84	6.52±0.01c	6.55±0.01c	0.21±0.00e	0.18±0.01f
96	6.57±0.01c	6.59±0.01c	0.19±0.01f	0.17±0.01g
108	6.59±0.01d	6.61±0.01d	0.19±0.01f	0.19±0.01f
120	6.62±0.01d	6.68±0.01d	0.18±0.01f	0.20±0.01f
Mean±SD	6.42±0.01b	6.49±0.01b	0.25±0.01e	0.21±0.01f

Same letters show non-significant values

Table No. 4 Physical properties of colostrum and transition milk of cows breeds

Time	LR		SG (%age)		Viscosity(cP)	
	Sahiwal	Cholistani	Sahiwal	Cholistani	Sahiwal	Cholistani
6	65.00±0.58b	68.00±0.58b	1.065±0.00b	1.068±0.00b	6.91±0.01b	5.79±0.01c
12	48.00±0.58d	54.00±0.58c	1.048±0.00d	1.054±0.00c	4.83±0.01d	5.12±0.01c
24	44.00±0.58d	47.00±0.58d	1.044±0.00d	1.047±0.00d	3.16±0.01e	4.54±0.01d
36	40.00±0.58d	45.00±0.58d	1.040±0.00d	1.045±0.00d	3.09±0.00e	4.19±0.00d
48	39.00±0.58e	43.00±0.58d	1.039±0.00e	1.043±0.00d	2.18±0.00f	3.92±0.01e
60	37.00±0.58e	42.00±0.58d	1.037±0.00e	1.042±0.00d	1.93±0.01g	3.33±0.01e
72	35.00±0.58e	40.00±0.58d	1.035±0.00e	1.040±0.00d	1.88±0.01g	2.85±0.01f
84	34.00±0.58e	39.00±0.58e	1.034±0.00e	1.039±0.00e	1.71±0.01g	2.53±0.01f
96	33.00±0.58e	38.00±0.58e	1.033±0.00e	1.038±0.00e	1.63±0.01g	2.23±0.01f
108	32.00±0.58e	36.00±0.58e	1.032±0.00e	1.036±0.00e	1.52±0.00g	1.95±0.01g
120	31.00±0.58e	34.00±0.58e	1.031±0.00e	1.034±0.00e	1.47±0.00g	1.37±0.01g
Mean±SD	39.82±0.58e	44.18±0.58d	1.040±0.00d	1.044±0.00d	2.76±0.01f	3.43±0.01e

Same letters show non-significant results in table

Table No. 5 Lysozyme, Lactoferrin and Immunoglobulins in colostrum and transition milk ofcow breeds

Time	Lysozyme (µg/mL)		Lactoferrin (mg/ml)		Immunoglobulins (mg/ml)	
	Sahiwal	**Cholistani**	**Sahiwal**	**Cholistani**	**Sahiwal**	**Cholistani**
6	0.39±0.00h	0.43±0.00h	1.29±0.01c	1.21±0.01d	98.21±0.01d	74.18±0.01
12	0.31±0.00h	0.40±0.00h	1.28±0.01c	1.09±0.01d	54.91±0.01h	70.19±0.01f
24	0.30±0.00h	0.37±0.00h	1.16±0.01d	1.23±0.19c	44.72±0.01i	52.36±0.01h
36	0.23±0.00i	0.32±0.00h	1.12±0.01d	1.08±0.01e	34.53±0.01j	47.27±0.01i
48	0.19±0.00j	0.27±0.00i	1.15±0.01d	1.03±0.01e	31.99±0.01j	42.18±0.01i
60	0.13±0.00j	0.22±0.00i	1.10±0.06d	0.98±0.01f	26.89±0.01k	39.63±0.01j
72	0.08±0.00k	0.16±0.00j	1.07±0.01e	0.97±0.01f	21.80±0.06k	34.53±0.01j
84	0.07±0.00k	0.10±0.00j	0.88±0.01g	0.94±0.01f	19.25±0.01k	31.99±0.01j
96	0.07±0.00k	0.09±0.00k	0.83±0.01g	0.91±0.01f	16.70±0.06l	29.44±0.01k
108	0.06±0.00k	0.09±0.00k	0.72±0.01h	0.51±0.01j	14.16±0.01l	24.35±0.01k
120	0.06±0.00k	0.08±0.00k	0.61±0.01i	0.28±0.01m	11.61±0.01l	19.25±0.01l
Mean±SD	0.17±0.00j	0.23±0.00i	1.02±0.01d	0.93±0.01f	34.07±0.01j	42.31±0.01i

Same letters show non-significant results

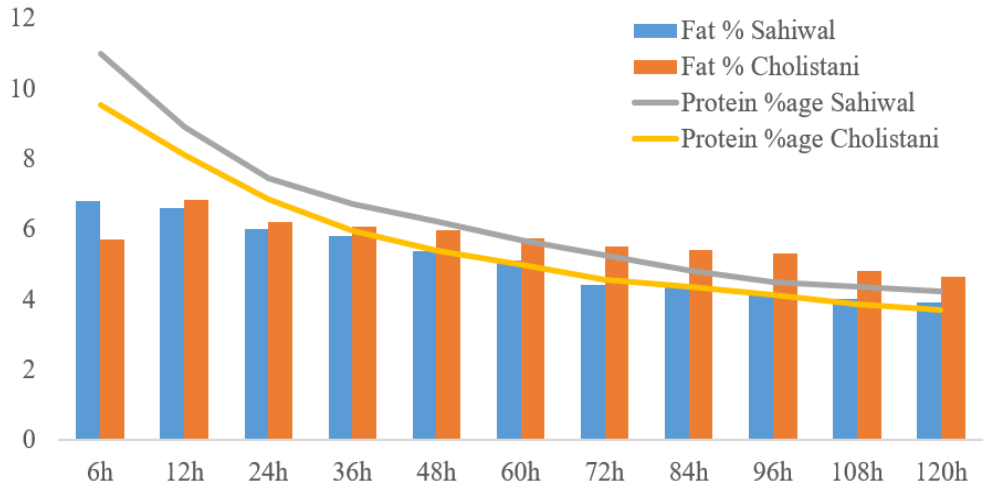

Figure No. 1 Physicochemical parameters of colostrum and transition milk from Sahiwal and

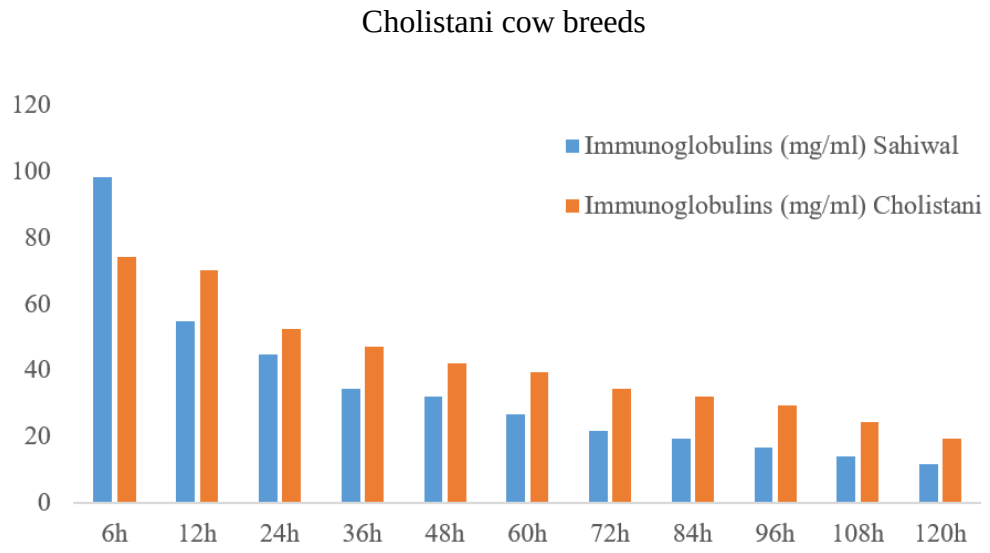

Figure No. 2 Immunoglobulins in colostrum and transition milk of Sahiwal and Cholistanicow breeds