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Research Article

The pattern of immunoglobulin and Physico-chemical composition of goat (*Capra hircus*) colostrum

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ABSTRACT

Colostrum composition of 20 primiparous local Pantja goat were evaluated and there was a slight increase in the pH of colostrum from 0 hr. to 64 hr. (i.e. from 6.63±0.078 to 6.88 ±0.027). After that, there was a decrease in pH values. Conductivity values of colostrum also showed an increasing trend. The specific gravity of colostrum showed a decreasing trend from parturition to 96 hr. post-partum. A decreasing trend was also noted for IgG and fat content. Maximum IgG concentration was at 0 hr. (75.52±1.421 mg/ml) while minimum IgG content was noted at 96 hr. post-partum i.e. 36.38 ±1.163 mg/ml. Maximum fat content was at 0 hours (9.57 percent) while minimum fat content was noted at 88 hours post-partum (3.5 percent). The total solids content of colostrum followed the decreasing trend. The maximum total solids content of colostrum was found at 0 hr. (i.e.23.45±0.949 percent) while minimum content was found at 96 hr. (i.e. 12.48±0.303 percent). SNF content of colostrum also showed a decreasing trend. Maximum and minimum SNF content of colostrum were estimated at 0 hr. and 88 hr. (i.e. 14.23±0.519 and 8.37±0.124, respectively). The protein showed a decreasing trend till 80 hr (i.e. 3.39±0.084 percent) after that at 96 hr it showed a slight increase (i.e.3.54±0.09 percent). The lactose content of colostrum had an increasing trend from parturition to 96 hr. post-partum (i.e. from 1.87 ± 0.088 to 4.14 ± 0.168 percent) while there was a decrease in ash content of colostrum as time passed from 0 to 96 hr. The highest and lowest values of ash content were recorded as 2.01±0.175 percent and 0.75±0.018 percent at 0 hr. and 88 hr. respectively.

Keywords- *Keywords: Immunoglobulin, Colostrum, Goat, Physical property, Chemical property*

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1. INTRODUCTION

Since the beginning of civilization in the Neolithic Period, small ruminants have been used by humans all throughout the world, especially the developing countries[1]. It is worth noting goat was the first domesticated livestock species to produce edible products for human beings [1]. Goats have many features that benefit small and landless communities, such as low input for production, short generation intervals, low feed requirements, and the production of a constant supply of small quantities of milk suitable for immediate household consumption [2-3]. Goat milk is an important milk source in the dairy industry and has been chosen by many consumers for its rich nutrients and excellent bioactivity [2,4]. Colostrum contains a large number of nutrients that promote the growth, differentiation, and biological functions of goat kids' early somatic cells and immunoglobulins, which are crucial to meet the nutritional demands, immune function, and the health of goat kids later growth[5].

Colostrum is the first secretion from the mammary gland after parturition and the most important nutritional food of newborn kids, colostrum plays an essential role in newborn survival during the first hours of life[6-7] . It is important to note that newborn kid mortality was not noted as a priority disease in a breeding system, despite mean kid losses of up to 25 to 30 % in some developing countries.

It is important to notice that a goat's placenta is of the connective chorionic membrane, so antibodies and Ig cannot be transmitted from the placenta to the fetus[8]. Colostrum is the initial milk secreted by mammals during parturition and the first few days after birth. It protects the immune system of newborns and passive immunity against pathogens[9]. Colostrum changes with time to become mature milk. Less information, however, is available on changes in the composition of goat milk during the transition from colostrum to mature milk in the first weeks after delivery[10].

The present study aims to observe changes in immunoglobulin concentration and reference for the scientific utilization of goat colostrum in the goat breeding system and support for the healthy rearing of kids.

2. MATERIAL AND METHODS

2.2 Animals and Diet

A total of 20 clinically healthy 1.5 to 2-year-old Pantja goats were studied. Pantja is the local goats of the Tarai region of Uttarakhand, India. These are medium-sized goats having brown red dorsal coat color with a black line and lighter ventral surface. There is the presence of white streaks on either side of the face. These characteristics are permanent and pass from one generation to another. The goats were housed in the small Ruminant shed of the Department of Livestock Production and Management, G.B. Pant University of Agriculture and Technology, (GBPUA &T). All of the goats were fed meadow hay *ad libitum* and 300 g of concentrate per goat twice a day and had constant access to drinking water.

2.3 Sample collection

Colostrum samples werecollected from the time of kiddingup to

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96 hours at 8 hourly intervals. Samples were taken in a sterilized container after cleaning the teat orifice with 70 % ethyl alcohol and formalin solution in the proportion of 1: 20,000 was used to preserve the milk samples till further analysis. The samples were subjected to certain physicochemical analyses, viz. pH, Electrical Conductivity (EC), fat, protein, lactose, solid not fat (SNF), total solids, and immunoglobulin G (IgG).

2.4 Physical Parameters

2.4.1 pH

The pH of colostrum and milk was recorded with the help of a digital pH meter (Narang Scientific Works, New Delhi).

2.4.2 Electrical conductivity

The electrical conductivity was recorded with the help of a Digital Conductivity Meter (Model 611 E, Century Scientific Works (Regd.) Chandigarh. Measurements were carried out at room temperature and results were expressed in mili Siemens per cm (mS/cm).

2.5 Chemical composition

2.5.1 Fat estimation

The fat percentage was determined by the Gerber method(IS: 1224, 1958).In this method, 10 ml of Gerber sulfuric acid was taken into the butyrometer. A 10.75 ml of the well-mixed sample of milk was taken with the help of a pipette and transferred into the butyrometer carefully. With the help of a tilt pipette 1 ml of amyl alcohol was added to the butyrometer. The lock stopper was put and the contents were mixed by shaking the butyrometer at 45 degrees until all the curd had been dissolved. The butyrometer was placed in the centrifuge and the machine was balanced. Centrifugation was done for 5 minutes at 1000 to 1200 r.p.m. The butyrometer was removed from the centrifuge and the fat column within the scale on the butyrometer was adjusted and read.

2.5.2 Protein estimation

Determination of protein in the sample of milk was performed by formal titration method [11]. For this 10 ml of the well-mixed milk was taken with the help of a pipette into a 100 ml flask. 5 drops of phenolphthalein indicator were added to it. Then the milk was titrated against the standard alkali to its endpoint. 2 ml of neutral formalin was added to it and mixed well. Again titrated against the standard alkali to the same endpoint as before. The volume of alkali used was recorded in the second titration.

Protein (%) = v × 1.7

Where v = Volume of N/10 Sodium hydroxide required by 10 ml of milk treated with formaldehyde and 1.7 is pynes constant

2.5.3 Lactose estimation

The lactose content in milk was determined by the colorimetric method [12] and expressed as %. For this 1 ml of milk was taken into a 100 ml volumetric flask and 2 ml of 10 % Sodium tungstate was added. 2 ml of 2/3 N Sulfuric Acid was then added and it was let stand for 5 minutes followed by dilution to the mark with water and filtration. Then 1 ml of filtrate and 1 ml of water were introduced in a Folin-Wu sugar tube. 2 ml of standard lactose solution was placed into another tube. 2 ml of the Folin-Wu alkaline copper solution was added to each tube and then heated in boiling water for 8 minutes and allowed to cool. 4 ml of acid molybdate reagent was added to each tube. After 1 minute, dilute acid molybdate solution (1:4) was added up to 25 ml mark, mixed, and the absorbance was taken with the help of a spectrophotometer at 420 nm (the instrument was calibrated at zero against water blank).

$$\text{Lactose (per cent)} = \frac{\text{Density of Unknown}}{\text{Density of Standard}} \times 0.6 \times \frac{100}{0.01} \times \frac{1}{1000}$$

2.5.4 Solids not fat (SNF), total solids, and specific gravity determination

Solids not fat and total solids were determined as per the standard procedure (IS: 1183, 1957). The temperature of the colostrum/milk sample was adjusted near to 70^0F (not below 65^0F or above 75^0F). It was then gently mixed by pouring several times from one vessel to another, avoiding the incorporation of air or foam formation. A sufficient amount of colostrum/ milk was poured into the lactometer jar to allow the lactometer to float freely. The lactometer was placed in the colostrum/milk and allowed to come at a constant level. The lactometer reading and temperature of colostrum/milk were taken as soon as it assumed a constant level.

$$\textbf{Solid not fat (S N F)} = \frac{\textbf{CLR}}{\textbf{4}} + \textbf{0.21 F} + \textbf{0.36}$$

$$\textbf{Total solid (T S)} = \frac{\textbf{CLR}}{\textbf{4}} + \textbf{1.21 F} + \textbf{0.36}$$

$$\textbf{Specific Gravity} = \frac{\textbf{1+CLR}}{\textbf{1000}}$$

where,

CLR is corrected lactometer reading = Observed reading to correction factor (for every degree (^{0}F) raise of temperature in milk to above 70^0F, 0.2 lactometer reading was added to the observed lactometer reading, likewise for every ^{0}F lowering of temperature of milk; 0.2 was deducted from observed lactometer reading) F is the fat content of milk which has to be ascertained by Gerber method.

2.5.5 IgG

To calculate the IgG concentration in colostrum radial immunodiffusion (RID)assay was used. A RID assay is a specialized form of immunodiffusion in which the antibody was incorporated into molten agarose, which was poured into a Petri dish and allowed to solidify. Small wells were cut into the agarose gel and filled with known concentrations of antigen, which correspond to the antibody in the agarose. Samples of unknown concentrations were placed in similar wells. The antigens in solution then diffuse outwards from the well in a circular precipitate ring surrounding the well. Generally, it took 24 to 48 hours for optimal diffusion to occur and precipitation to become apparent. The diameter of the precipitin ring was proportional to the concentration of the antigen present in the test sample. By comparing the diameter of the test specimen precipitin ring to known standards.

2.5.5.1 Materials required

Agarose, PBS buffer -0.01 M (pH 7.4), Rabbit antigoat IgG, and Standard goat IgG. All the reagents were to be stored at 2-8°C when not in use. Materials like a micropipette, Tips, a Moist chamber (box with wet cotton), a Gel puncher or bore mouth 1 ml micro tip, a Glass slide/plates of 5cm×7.5cm, a conical flask, and a measuring cylinder.

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2.5.5.2 Preparation of Standards (serial dilutions)
The concentration of Standard antigen was 5 mg/ml with this two-fold dilutions were made. Label five micro test tubes: 1:2, 1:4, 1:8, 1:16, and 1:32. There were now six antigen samples for the standard curve i.e. Undiluted 5 mg/ml, 1:2 2.5 mg/ml, 1:4 1.25 mg/ml, 1:8 0.625 mg/ml, 1:16 0.3125 mg/ml and 1:32 0.15625 mg/ml.

2.5.5.3 Preparation of Agarose Gel
1.0 % agarose was prepared by PBS heating slowly till agarose dissolved completely. The molten agarose was allowed to cool to approx 55℃. Approximately 2 ml of molten agarose solution was saved for sealing the wells. 450 µl of Antiserum was added to 10 ml of agarose solution. Antibody was mixed by gentle swirling. Agarose solution containing the antiserum was poured onto a clean Petri dish and allowed to solidify for 15-20 minutes. After solidification, the gel appeared slightly opaque. The wells were punched using a gel puncher. The wells were sealed with 15µl of molten agarose solution per well by uniform distribution and allowed to solidify for 15-20 minutes. Before loading label, the wells on the bottom of the plate by marker as 1, 2, 3, 4, 5, and 6, and then the well was loaded with standard undiluted 1:2, 1:4, 1:8, 1:16, and 1:32 standard antigen dilutions in respective wells. The dish was placed inside the moist chamber (box containing wet cotton) and it was incubated at room temperature for 24 to 48 hr.

2.5.5.4 Colostrum IgG Determination
Colostral IgG concentrations were measured using a previously reported procedure. IgG concentrations were determined using radial immunodiffusion (RID). RID plates for measuring colostral IgG were prepared by dissolving 1% agarose of Genei Bangalore in PBS. Rabbit–antigoat IgG of Genei (1 %) was added to the thawed agarose solution. Ten milliliters of the agarose solution were added to the slide (5×7.5cm). After the agarose solidified, 3-mm wells were cut in the agar. Colostrum samples were diluted 1:4 using PBS and 15 µL was inoculated in each well. The diameter of the precipitation zone was recorded after 72 hours of incubation at 23˚C. Colostral IgG concentrations were determined by comparing the diameter of zones of precipitation with a standard curve generated using serial dilutions of a goat IgG standard

2.5.5.5 Reading the results
The precipitin rings become visible in 24 to 48 hours. The plate was held carefully so that the overhead room lights shone through it. Opaque circles around each well were seen where antigen and antibody have precipitated. With a ruler, the diameter (through the centers of the wells) of the precipitin ring was measured in millimeters. A graph of the diameter of the ring (on the Y-axis) versus the concentration of antigen (on the X-axis) was plotted. The value of the unknown antigen concentration was calculated from the graph.

3. RESULTS AND DISCUSSION

Colostrum yield
The colostrum yield varies greatly among different breeds of goats, especially during the first 24 h after delivery[13,9]. However, in the present case, medium size Pantja goat yielded 300 to 450 ml in a day. Our finding is similar to the meat type of goat which usually produce less than 500 ml [14]. Generally speaking, meat goats such as Majorera breed goats and Murciano-Granadina goats, which generate 2358.57 mL and 1786.5 mL of postpartum colostrum, respectively, produce less colostrum than dairy goats. Between 12 and 24 hours after delivery, there was a rapid fall, followed by a rise and stabilization at a given level[13, 9]. However, the colostrum yield of meat goats was less than 500 mL after postpartum among meat goats, and that was mainly because of the difference in mammary gland development and the availability of nutrients ([14]. Besides, colostrum yield is lower in primiparous than multiparous dairy goats and increases with the lactation number [15]. In the present study, all the goats were primipara which also contributed to lower milk production. There is also proof that the quantities of several blood metabolites, including total proteins, thyroid hormone, and glucose, are connected with colostrum output [16,17]

B. Colostrum composition
(a) pH
The pH value of colostrum was noted from 0 to 96 hrat 8 hourly time intervals. Maximum and minimum pH were observed at 64 hr and 0 hr (6.88±0.027 and 6.63±0.078), respectively. There was a slight increase in pH from 0 hr to 64 hr (from 6.63±0.078 to 6.88±0.027). After that, there was a decrease in pH values. Similar to the finding of the present investigation Arguello *et al.* (2006) also reported an increase in pH of colostrum from 0 to 132 h post-partum.

(b) Conductivity
The conductivity of colostrum showed an increasing trend. Maximum and minimum conductivity values were found at 96 hr and 0 hr (4.92±0.123 and 3.76±0.118 mS/cm respectively). The present study is in total agreement with that of Arguello *et al.*[18] who reported conductivity values of colostrum at parturition between 3.33 and 3.79mS/cm, increasing at 132 h postpartum (between 4.34 and 4.88 mS/cm), depending upon the concentration of ions.

(c) Specific gravity
The specific gravity of colostrum showed a decreasing trend from birth to 96 hr postpartum. Maximum and minimum specific gravity values of colostrum reported were 1.051±0.0017 and 1.030±0.0006 at 0 and 96 hr, respectively. The present investigation has the agreement with Arguello *et al.*[18] regarding the drop in specific gravity over time.

(d) Immunoglobulin G (IgG)
Ig is an important component of globulin with high efficiency of absorption in colostrum. The content of Ig of kids before eating colostrum is very low in serum, but increases significantly after sucking colostrum.45. IgG concentration of colostrum of Pantja goats showed a decreasing trend. Maximum IgG was at 0 hr (75.52±1.421 mg/ml) while minimum IgG content was noted at 96 hr post-partum (36.38±1.163 mg/ml). The results of the present investigation are in agreement with those of Arguello *et al.* [18] who also reported a quick drop in IgG concentration from parturition until 36 postpartum, after which the decrease was slow. Rudovsky *et al.* reported the IgG concentration as 49.1±25.7 mg/ml [19].

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Table 1: Mean ± SE of physical composition and IgG level of colostrum at 8-hour interval

Hours	pH	Conductivity (mS/cm)	Specific Gravity	IgG (mg/ml)
0	6.63 ± 0.078	3.76 ± 0.118	1.051 ± 0.001658	75.52±1.421
8	6.68 ± 0.092	3 .99 ± 0.11	1.044 ± 0.002587	71.57±1.453
16	6.69 ± 0.063	4.65 ± 0.099	1.038 ± 0.001941	66.77±1.403
24	6.79 ± 0.052	4.78 ± 0.097	1.035 ± 0.001641	62.66±1.319
32	6.83 ± 0.044	4.78 ± 0.084	1.033 ± 0.000675	59.35±1.311
40	6.84 ± 0.053	4.79 ± 0.1	1.033 ± 0.000739	55.58±1.312
48	6.86 ±0.053	4.8 ± 0.11	1.033 ± 0.000573	51.65±1.405
56	6.87 ± 0.068	4.83 ± 0.098	1.033 ± 0.000734	48.87±1.394
64	6.88 ± 0.027	4.86 ± 0.072	1.033 ± 0.000605	46.19±1.43
72	6.85 ± 0.024	4.87 ± 0.102	1.032 ± 0.000587	43.12±1.366
80	6.8 ± 0.023	4.88 ± 0.112	1.033 ± 0.000515	40.68±1.305
88	6.76 ± 0.031	4.89 ± 0.072	1.031 ± 0.000448	37.66±1.278
96	6.67 ± 0.058	4.92 ± 0.123	1.033 ± 0.000586	36.38 ±1.16

Fig. 1: Radial immunodiffusion (Standard IgG) - Original

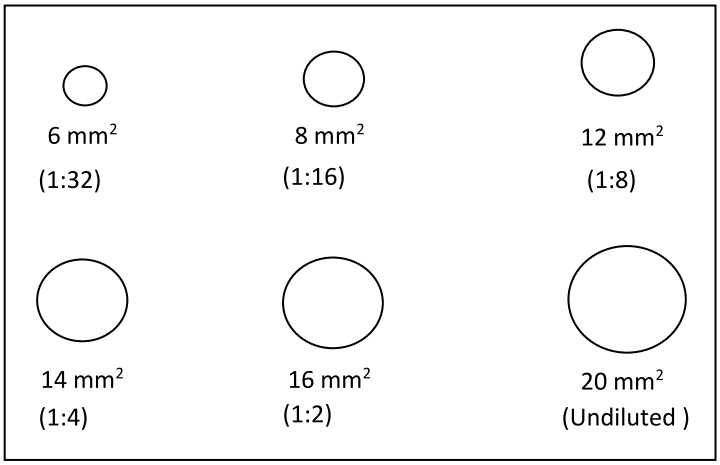

Fig. 2: Radial immunodiffusion (Standard IgG)–Estimates

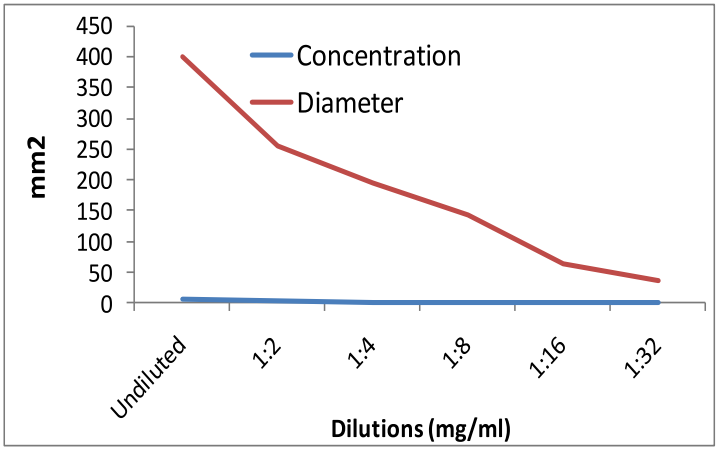

Fig. 3: Standard IgG Concentration curve

While Yang *et al.*reported the IgG concentration, (72.01 mg/ml) after 3 hr post-partum [20]. The results on IgG concentration of colostrum of Pantja goats in the present investigation were higher than those of earlier reports of colostrum IgG concentration of other goat breeds. Therefore, it may be concluded that the colostrum of the Pantja goat has better IgG concentration than other breeds of goats for providing protection to kids(Fig.3). Bergman and Turner[21]reported that the globulin of colostrum decreased from 1.76% to 0.40% on the 1st day postpartum, and decreased to 0.11% on the 9th day. Ig content fell sharply during postpartum 48 h in line with the changing trend of protein content[22, 13, 9]. It may be associated with mammary gland function, which allowed Ig transported from blood to the mammary gland in early lactation, at the same time also it proved the difference between colostrum and mature milk mainly because of the difference in Ig content[5].

(e) Fat Content

Fat is the main source of energy for newborn kids and it is the key component to determine the quality of colostrum.The fat content of colostrum of Pantja goat from 0-96 hours at 8-hour intervals showed a decreasing trend. Maximum fat content was at 0 hours (9.57 %) while minimum fat content was noted at 88 hours post-partum (3.5 %). In contrast to the findings of the present experiment, Arguello *et al.* [18] reported an increase in the fat content of colostrum from birth to 24 hours postpartum in Majorera goats. Macias *et al.,* Yang, and Romero *et al.* showed that colostrum fat content was high, reaching 9.53%, 7.70%, and 7.73%, respectively [13,9,23]. Guo *et al*[24] showed that the colostrum fat content was 9.1% after 24 h of postpartum, reduced to 7.51% after 7 d of postpartum, and then kept at a constant level, which was in accordance with that reported by Bergman, Yang, and Li (Fig. 1).[23,25].

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Table 2: Mean ± SE of physical composition and IgG level of colostrum at 8-hour interval

Hours	pH	Conductivity (mS/cm)	Specific Gravity	IgG (mg/ml)
0	6.63 ± 0.078	3.76 ± 0.118	1.051 ± 0.001658	75.52±1.421
8	6.68 ± 0.092	3 .99 ± 0.11	1.044 ± 0.002587	71.57±1.453
16	6.69 ± 0.063	4.65 ± 0.099	1.038 ± 0.001941	66.77±1.403
24	6.79 ± 0.052	4.78 ± 0.097	1.035 ± 0.001641	62.66±1.319
32	6.83 ± 0.044	4.78 ± 0.084	1.033 ± 0.000675	59.35±1.311
40	6.84 ± 0.053	4.79 ± 0.1	1.033 ± 0.000739	55.58±1.312
48	6.86 ±0.053	4.8 ± 0.11	1.033 ± 0.000573	51.65±1.405
56	6.87 ± 0.068	4.83 ± 0.098	1.033 ± 0.000734	48.87±1.394
64	6.88 ± 0.027	4.86 ± 0.072	1.033 ± 0.000605	46.19±1.43
72	6.85 ± 0.024	4.87 ± 0.102	1.032 ± 0.000587	43.12±1.366
80	6.8 ± 0.023	4.88 ± 0.112	1.033 ± 0.000515	40.68±1.305
88	6.76 ± 0.031	4.89 ± 0.072	1.031 ± 0.000448	37.66±1.278
96	6.67 ± 0.058	4.92 ± 0.123	1.033 ± 0.000586	36.38 ±1.16

Yang *et al.*[20] reported fat percentage in sannen goat colostrum at 3 hr of lactation as 7.73%. While Rudovsky*et al*. [19] reported colostrum fat as 9.45 %. Whereas Pantjagoats had 9.56±0.525 % fat in their colostrum. The results on the fat contents of the colostrum of Pantja Goats in the present investigation were higher than those of earlier reports on colostrum fat content of other goat breeds. Kehoe *et al.* [26] reported 6.7 % fat in the colostrum of dairy animals. Therefore, it may be concluded that the colostrum of Pantja goats has a better fat content than other breeds of goats and dairy animal milk.

(f) Total solids

The total solids content of colostrum at 8hourly intervals from 0 to 96 hrs follows the decreasing trend over time. The maximum total solid content of colostrum was found at 0 hr (23.45±0.949 per cent) while minimum content was found at 96 hrs (12.48±0.303 per cent). Kehoe *et al.*[26] reported total solids content of bovine colostrum as 27.6 per cent at 2 hr post-partum. Therefore, from the results of the present study, it may be concluded that bovine colostrum has higher total solids than Pantja goat colostrum.

(g) Solids not fat (SNF)

The mean SNF content of colostrum of Pantja goat at 0 to 96 hours at 8-hour intervals also showed a decreasing trend. Maximum and minimum SNF content of colostrum were estimated at 0 hr and 88 hri.e. 14.23±0.519 and 8.37±0.124, respectively. Similar findings were also reported by [27].

(h) Protein content

The colostrum protein is of high quality and its biological titer is over 80, which provides a solid guarantee for the construction of the immune system in newborn kids[28]. The protein content of colostrum at 8-hour intervals shows a decreasing trend till 80 hri.e. 3.39±0.084% after that at 96 hr it shows a slight increase (3.54±0.09). The highest protein content was recorded at 0 hr 10.24±0.372 % whereas, the lowest was at 80 and 88 hrs (3.39 ± 0.071 per cent). Yang *et al.* [20] reported protein content in Sannen goat colostrum at 3 hr postpartum as 10.24%. WhileRudovsky*et al.*[19] reported a protein content of 9.45 % in caprine colostrum which is lower than the protein content of Pantja goat colostrum. The present study is in total agreement with the result of Arguello *et al.*[18] who found a drop in protein content from birth to 132 hr postpartum in Majorera goats.

Table 3: Mean ± SE of the chemical composition of Colostrum at 8 hour intervals (%)

Hours	Fat	Total solids	Solid not fat	Protein	Lactose	Ash
0	9.57 ± 0.525	23.45 ± 0.949	14.23 ± .519	10.24 ± 0.372	1.87 ± 0.088	2.01 ± 0.175
8	8.65 ± 0.429	21.42 ± 1.184	12.82 ± 0.644	9.21 ± 0.369	2.67 ± 0.186	1.62 ± 0.123
16	7.35 ± 0.335	17.75 ± 0.933	10.7 ± 0.549	7.83 ± 0.371	3.06 ± 0.127	1.46 ± 0.121
24	6.54 ± 0.299	16.15 ± 0.784	10.15 ± 0.45	6.75 ± 0.358	3.36 ± 0.134	1.37 ± 0.097
32	6.04 ± 0.295	15.35 ± 0.697	9.82 ± 0.261	5.78 ± 0.347	3.65 ± 0.153	1.3 ± 0.09
40	5.29 ± 0.292	14.53 ± 0.537	9.6 ± 0.232	5.13 ± 0.388	3.85 ± 0.104	1.05 ± 0.094
48	4.85 ± 0.236	13.87 ± 0.361	9.1 ± 0.212	4.78 ± 0.271	4.02 ± 0.104	1.01 ± 0.072
56	4.17 ± 0.206	13.25 ± 0.361	8.81 ± 0.175	4.29 ± 0.201	4.33 ± 0.092	0.94 ± 0.061
64	4.13 ± 0.215	12.93 ± 0.354	8.83 ± 0.181	3.71 ± 0.132	4.39 ± 0.156	0.87 ± 0.047
72	3.79 ± 0.154	12.57 ± 0.296	8.55 ± 0.106	3.41 ± 0.086	4.59 ± 0.111	0.81± 0.039
80	3.68 ± 0.147	12.49 ± 0.204	8.82 ± 0.116	3.39 ± 0.071	4.66 ± 0.131	0.76 ± 0.029
88	3.49 ± 0.126	12.58 ± 0.396	8.37 ± 0.124	3.39 ± 0.084	4.56 ± 0.171	0.75 ± 0.018
96	3.69 ± 0.119	12.48 ± 0.303	8.48 ± 0.108	3.54 ± 0.09	4.14 ± 0.168	0.86 ± 0.017

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Kehoe *et al.*[26] reported the protein content of bovine colostrum at 2 hr postpartum as 14.9 %. Therefore, from the result of the present study, it may be concluded that bovine colostrum has higher protein content than Pantja goat colostrum. This change in protein content may be because of species and breed differentiation.

(I) Lactose content

The sugars in colostrum are mono- and disaccharides, which are quickly broken down and absorbed. The most prevalent sugar in colostrum is lactose, which the small intestine breaks down into simple sugars and absorbs [5]. Lactose content at different time intervals shows the increasing trend of lactose content from parturition to 96 hr post-partum

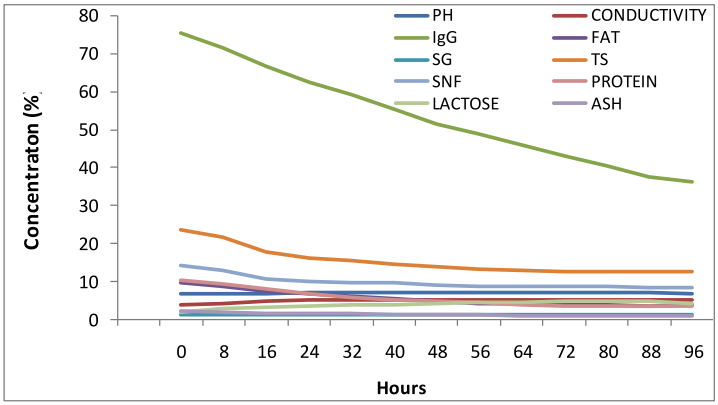

Fig. 4: Colostrum composition at 8-hour interval

the minimum lactose content of colostrum was estimated at 80 hr and 0 hr (4.66±0.131and 1.87±0.088 %), respectively.The result of the present investigation shows total agreement with those of Arguello *et al.*[18] and Zhou *et al.*[5]. While Yang *et al.*[20] reported the lactose content as 1.93 % at 3 hr of lactation after kidding in Sannen goat. Kehoe *et al.*[26] reported the lactose content of bovine colostrum at 2 hr postpartum as 2.5 %. Therefore, from the result of the present study, it may be concluded that bovine colostrum has higher lactose content than Pantja goat colostrum. This variation in lactose content may be because of a variation in the sample collection time or due to breed differentiation.

(j) Ash content

Ash content of colostrum from 0 to 96 hr postpartum showed a decreasing trend. The highest and lowest values of ash content were recorded as 2.01±0.175 and 0.75±0.018 % at 0 hr and 88 hr, respectively. Along with this, it shows again a slight increase in the ash content at 96 hr (0.86 %). Yang *et al.* [20] reported the ash content in the colostrum of Sannen goat as 1.57 % at 3 hr post-partum. The present study shows the highest ash content at 0 hr (2.01±0.175 %). Kehoe *et al.*[26] reported the ash content of bovine colostrum at 2 hr postpartum as 0.05%.Therefore, from the result of the present study, it may be concluded that bovine colostrum has similar ash content to Pantja goat colostrum.

4. CONCLUSION

From the present study, it was concluded that the colostrum of Pantja goat had better fat content than other breeds of goats and dairy animal milk while ash content was similar in bovine colostrum. It was also found that bovine colostrum has higher total solids, protein, lactose content, and lower fat content than the Pantja goat colostrum.

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