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Effect of the average daily milk yield during postpartum transition period on various physico-chemical, compositional and microbiological characteristics of bovine colostrum

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Abstract
The current investigation was undertaken with the aim of studying the effect of average milk yield of the animal on various physico-chemical, compositional and microbiological characteristics of colostrum. In this study the data was generated using the colostrum obtained from animals with different milk yield. The animals were then assigned to three different groups viz group A, group B and group C according to their average milk yield per day, Group A – animals yielding 2-4 litres of milk per day; Group B – animals yielding 5-7 litres of milk per day; Group C – animals yielding 8-10 litres of milk per day. During the study, it was found that the specific gravity and fat content of the colostrum samples of group A animals possessed significantly (*et al* 0.05) higher values compared to group B animals. Fat, total protein, whey proteins and total solids of group C animals was significantly (*et al* 0.05) higher compared to group B animals. The Casein protein of group C animals showed significantly (*et al* 0.05) higher values compared to both group A and group B animals which among themselves possessed comparable values. The lactose content of group A animals was significantly (*et al* 0.05) higher than both group B and group C animals which among themselves possessed comparable values for lactose. The solids not fat, ash, pH, electrical conductivity and total plate count (TPC) of the colostrum samples from different milk yield groups showed no significant ($p > 0.05$) difference among themselves.

Keywords: average milk yield, bovine, colostrum, composition, physico-chemical, quality

Introduction
The steady increase in the Milk production due to various breeding, feeding and managemental interventions has encouraged people to comprehend the vast potential lying in the setting up of organized dairy farming. Improvements such as decrease in inter-calving periods, lower age at first calving, increased rates of conception and several other factors of progress have resulted in increase in yield of milk. Colostrum is defined, as the secretion of the mammary gland formed shortly after parturition (Levieux and Ollier, 1999) [11], during the first 24 h after calving or over the first few days after birth (Tsioulpas *et al*., 2007) [18]. Colostrum is an effective natural immune booster for human beings. Colostrum has the capability to prevent from bacteria and viruses, and to improve the gastrointestinal and body condition (Houser *et al.*, 2008) [8]. The immune factors and growth factors of bovine colostrum are similar to the ones present in human colostrum but are in higher quantities in bovine colostrum: IgG concentration of human colostrum is 2% while in bovine colostrum it is 86% (Wilson, 1997) [19]. Colostrum is used in treatment of range of health conditions, including, respiratory tract disorders, gastrointestinal disorders and tissue repair (Li and Aluko, 2006) [12]. Colostrum is effective in treatment of intestinal inflammation caused by the injurious effects of NSAID, it also has therapeutic potential for other ulcerative conditions in the bowel (Cairangzhuoma *et al*., 2013) [3]. Bovine colostrum rebuilds the immune system, destroys bacteria, viruses and fungi, hastens healing of all body tissue, assists in losing weight, burn fat, increase lean muscle mass, bone mass and reverses aging. Bovine colostrum has many purported health benefits. Keeping in view the above versatility of colostrum along with its immense food, nutritional and economic value, the present study is envisioned to help utilizing the surplus colostrum effectively for mitigating the problems such as food, nutritional insecurity and prevention of spoilage of a salubrious product: With this background the current work was undertaken with the aim of studying the effect of breed of the animal on various physico-chemical, compositional and microbiological characteristics of bovine colostrum.

Materials and Methods

Source of colostrum

Colostrum samples were collected from the MLRI, SKUAST-Kashmir and various field locations. A total of ninety-nine samples were collected. The samples were collected in sterile containers and transported to the laboratory in ice cool totes, thereafter the samples were analyzed for the following parameters for three consecutive days post parturition as per approved procedures:

1. Specific gravity (Lactometer method)
2. Total protein (Kjeldahl/Formal titration method)
3. Casein protein (Kjeldahl/Formal titration method)
4. Whey protein (Kjeldahl/Formal titration method)
5. Fat (Gerber method)
6. Lactose (Lane-Eynon Oxidation –Reduction Reaction method)
7. Ash (Incineration method)
8. Total solids (Gravimetric method)
9. SNF (By Difference)
10. pH (Microprocessor based electrical pH meter)
11. Electrical conductivity (electrical conductivity meter)
12. Total plate count (APHA)

Chemicals

All the chemicals used were of analytical grade and were obtained from standard firms (Qualigens Fine Chemicals, Nice Chemicals Pvt. Ltd., Hi Media Lab. Pvt. Ltd. etc.).

Preparation of samples

Colostrum samples

Colostrum was warmed and thoroughly mixed by pouring into the clean receptacle and back repeatedly and whenever needed with plunger/stirrer to reincorporate any material adhering to containers in order to make sure that the samples collected were representative of the entire batch of colostrum that was being sampled. After thorough mixing about 200ml of colostrum was taken in sampling bottles with the help of colostrum sampler and the analysis was carried out immediately.

Laboratory analysis

All the analytical procedures required for the analysis of colostrum were carried out in the laboratory of the Division of Livestock Products Technology, Faculty of Veterinary sciences and Animal Husbandry, SKUAST-Kashmir, Shuhama Alusteng, Ganderbal. For physico-chemical analysis about 200ml of colostrum was used for the determination of various parameters.

pH of colostrum

The pH of colostrum samples was recorded by directly dipping the combined electrode of digital pH meter (Tanco Lab. Equipments), after proper calibration of the instrument, into the samples. Two readings were taken for each sample and average pH recorded.

Specific gravity of colostrum

For determination of specific gravity of colostrum, Zeal type lactometer was used. After recording the temperature of the sample correctly lactometer reading was recorded. The corrected lactometer reading was calculated to arrive at the correct specific gravity

Titratable acidity of colostrum

A 10ml quantity of thoroughly mixed colostrum samples were taken in a conical flask with the help of dry pipette. To this few drops of phenolphthalein indicator were added. Then the colostrum was carefully titrated against 0.1N sodium hydroxide till faint pink colour appeared and persisted for 15 seconds. The volume of 0.1N sodium hydroxide used was recorded and titratable acidity (expressed as a percentage of lactic acid) was calculated as per formula given below:

$$\text{Per cent titratable acidity} = \frac{\text{No. of ml of 0.1 N NaOH used} \times 0.009}{\text{Weight of sample in grams}} \times 100$$

Electrical conductivity (EC) of colostrum

Electrical conductivity of the samples was taken by dipping the electrode of Electrical digital conductivity meter (brand "TANCO, India Lab. Equipments") into the sample after proper calibration of instrument. Two or three readings were taken for each sample and average electric conductivity was calculated.

Proximate composition

The colostrum samples were analyzed for determination of various physico-chemical parameters using the standard procedures of Association of Official Analytical Chemists (A.O.A.C., 1995). Brief description of the methods is outlined below:

Total Solids (TS) of colostrum

For the determination of total solids about 10g of the colostrum sample in duplicate was weighed accurately on electronic balance, corrected up to 0.1mg, in a dry, pre-weighed, flat bottomed moisture cups and kept in hot air oven at 102 ±1°C for 4 hours. Then moisture cups were transferred immediately to a desiccator to cool to the room temperature (at least 30 minutes). The process of drying, cooling and weighing was repeated at 30 minutes interval until the difference between the two consecutive weighing readings was less than one milligram. Weight loss of the cup after drying was recorded and expressed in terms of total solids percent.

Calculation

$$\% \text{ Total Solids} = [(W_1 - W)/ (W_2 - W)] \times 100$$

Where,
W = weight of empty dried cup (g)
W_1 = weight of cup + sample after drying (g)
W_2 = weight of cup + sample (g)

Solids Not Fat (SNF) (colostrum)

SNF of the colostrum was calculated by indirect method. The difference between total solids (%) and fat (%) gave the SNF content in colostrum.

$$\text{SNF (\%)} = \text{TS\%} - \text{Fat\%}$$

Fat (colostrum)

Fat of colostrum was estimated by Gerber's method (IS: 1224 (1977). 10ml of Gerber's sulphuric acid (90ml of concentrated sulphuric acid added to 10ml of distilled water) was taken carefully in a clean dry butyrometer (ISI marked) with the help of automatic dispenser (tilt measure) without wetting the neck. To this 10.75 ml of thoroughly mixed colostrum sample was added with the help of milk pipette on the side walls of the butyrometer. Then 1ml of amyl alcohol

was added to the butyrometer on the sides. Dry rubber lock stopper was used to close the butyrometer. These were then shaken and inverted 2-3 times till complete dissolution of the acid and colostrum contents. Then tubes were placed in water bath for 5 minutes at 65±2 °C to ensure that all the casein particles were dissolved. The butyrometer tubes were then placed in a centrifuge in a radial symmetry and as evenly spaced as possible. Centrifugation was done for 4 minutes at 1100 rpm. Butyrometer tubes were then removed from centrifuge and placed again in water bath for 5 minutes at 65±2 °C. With the help of stopper and key, the fat level was adjusted in such a way that scale reading corresponds to the lowest point of the fat meniscus and the surface of separation of the fat and acid. The observed fat level was recorded as percent fat of test sample.

Protein

Micro-kjeldahl method was followed for determination of protein content of colostrum. Micro-kjeldahl distillation apparatus was used for distillation of digested sample. About two grams of colostrum sample in duplicate were taken in kjeldahl flask and digested with 20 ml of concentrated sulphuric acid. A small amount of digestion mixture (sodium sulphate and copper sulphate in the ratio of 95:5) was added to aid digestion. After all the contents were digested, the digested samples were transferred to 250 ml volumetric flask and the volume was made up to the mark, with rinsing of kjeldahl flask, with distilled water. From the volume of 250 ml, 10 ml was taken into micro-kjeldahl assembly along with the 10 ml of 40 per cent sodium hydroxide for distillation. Upon distillation the ammonia was liberated which was collected in 4 per cent boric acid solution. The titration of the collected ammonia was carried out against N/50 sulphuric acid to get amount of nitrogen present in the sample.

Calculation

$$\text{Per cent protein (g protein/ 100 gm of sample)} = \frac{B \times 0.00028 \times 250 \times 100 \times 6.38}{W \times V}$$

Where,

B	burette reading of N/ 50 sulphuric acid
250	volume of aliquot
W	weight of sample
V	volume of aliquot used for distillation
6.38	Empirical factor (for milk protein)
0.00028	factor for N/50 sulphuric acid used

Ash

For determination of ash about 10 ml of colostrum samples in duplicate were accurately weighed on electronic balance, corrected upto 0.1 mg, in dried and preweighed crucibles and kept in hot air oven at 102 ±1°C for 4 hours. The sample in the crucible was subjected to carbonization followed by incineration of the sample by placing the crucible in muffle furnace at 550°C - 600°C for about 2 hours.

Calculation

$$\text{Ash per cent} = [W1 - W2/ W2 - W] \times 100$$

Where,

W = weight of empty dried crucible (g)

W1 = weight of crucible + sample after ashing (g)

W2 = weight of sample (g)

Lactose

Lane-Eynon Oxidation–Reduction Reaction method was followed for determination of lactose content of colostrum samples. About 25 ml of colostrum was taken in a 500 ml conical flask and diluted with distilled water to about 200 ml. About 3.75 ml of 10 per cent acetic acid solution were added to it and then subjected to boiling. On cooling, it was transferred quantitatively to a 250 ml volumetric flask and the volume was made up to mark with distilled water. It was then filtered through a filter paper and the filtrate was collected in a dry conical flask. The burette was filled with this filtrate. 5 ml of each of Fehling solution A and B were pipetted into 250 ml of conical flask and preliminary titration was made by adding the filtrate containing lactose, from the burette, 1 ml at a time, to the Fehling solution kept boiling till the blue colour changes to red. About 5 drops of methylene blue indicator were added to the boiling mixture and titration was completed within a total boiling time of 3 minutes by additions of 4 to 6 drops of the filtrate till end point was reached indicated by the change of blue colour to colourless supernatant.

Calculation

$$\text{Lactose (\%)} = W/V \times 250 \times 100/25 \times 1/1000$$

Where,

V = Volume of filtrate required for complete reduction of 10 ml of Fehling solution

W = Lactose equivalent in mg for V ml

Microbiological analysis

The colostrum samples were collected in sterile containers and bought under hygienic conditions to the laboratory of Division of LPT, F. V. Sc. and A. H., SKUAST-K, were subjected to microbiological analysis for total plate count using standard plate count technique as per APHA (2004).

Sample preparation and serial dilution

About 10ml of colostrum was aseptically transferred to a pre-sterilized volumetric flask and 90ml of peptone water was added to it to get solution of 10^{-1} dilution. About 1ml of this diluted solution was transferred to another tube containing 9ml of sterile 0.1 percent peptone water (peptone from Qualigens Fine Chemicals) to get 10^{-2} dilution. This procedure was repeated to obtain 10^{-3} dilution and so on, until appropriate dilution was achieved which yielded plates with 25 to 250 colony forming units (cfu). All the procedures were performed in the sterilized environmental conditions of laminar air flow (NSW-201 Horizontal Laminar Flow cabinet).

Total plate count

For determination of TPC, total plate count agar (Hi-Media Laboratories, Pvt. Ltd., Mumbai) was used. About 17.5g of it was dissolved in 1000ml of distilled water followed by sterilization in an autoclave at 15 lb pressure (121ºC) for 15 minutes and cooled to remain at 45ºC. With the help of sterile pipette serial dilutions of sample were made and 1ml from each test tube was inoculated into a double set of pre-sterilized petridishes. Pour plate technique were followed for plating. The innoculum and media in petridishes were mixed thoroughly and uniformly by rotating the plates alternatively in clockwise and anticlockwise directions followed by back and forth motion on level surface. When media in plates solidified, they were inverted and incubated aerobically at 35±1°C for 24±3 hours. The number of micro-organisms per

ml of sample was calculated by selecting plates containing 25 to 250 cfu/ml or selecting plates with count closest to this range. The cfu/ml was calculated by using the formula:

$$N = \sum C / [(1 \times n_1) + (0.1 \times n_2)]d$$

Where,
N = number of colonies per milliliter of product
$\sum C$ = sum of all colonies on all plates counted
n_1 = number of plates in lower dilution counted
n_2 = number of plates in next higher dilution counted
d = dilution from which the first counts were obtained
Finally, the cfu/ml was expressed as $\log_{10}$ cfu/ml of sample

Sensory appraisal
The sensory evaluation of the *fermented colostrum product* was carried out by a trained and semi-trained experienced panel consisting of scientists of LPT Division and PG students of F.V.Sc. & A.H, SKUAST-K. The panelists evaluated the coded samples of *fermented colostrum product* for various sensory attributes viz., appearance, flavour, body and texture and overall acceptability as per 9 point Hedonic scale where 9 denoted extremely desirable and 1 denoted extremely poor as given in score sheet.

Statistical analysis
The data obtained from duplicate samples were averaged and the data so generated were analyzed statistically following the method of Snedecor and Cochran (1980), Gomez and Gomez (1984) and Steel and Torrie (1984). The data was processed in a computer using SPSS software package. The analysis of variance of group mean was computed and significance of means tested by using Least Significant Difference test at 5 per cent level of significance. One way and two way analysis of variance with all possible interactions was carried out. The nested means were compared when the interaction was found to be significant. In the absence of such significance the overall means were compared.

Results and Discussion
In this study the data was generated using the colostrum obtained from animals with different milk yield. The animals were then assigned to three different groups viz group A, group B and group C according to their average milk yield per day as mentioned below
Group A – animals yielding 2-4 litres of milk per day
Group B – animals yielding 5-7 litres of milk per day
Group C – animals yielding 8-10 litres of milk per day
The data pertinent to the study related to the effect of average daily milk yield per day during the transition period on various physico-chemical, compositional and microbiological characteristics of bovine colostrum is depicted in Table I and graphically represented in Figs. I and II. Regardless of the milk yield of the animal, the day 1 postpartum colostrum samples had significantly (*et al* 0.05) higher specific gravity than day 2 and day 3 colostrum samples and between the latter two samples the day two samples had significantly (*et al* 0.05) higher specific gravity compared to day 3 samples, thereby portraying a crystal clear trend of transition from a higher specific gravity towards normally lower specific gravity as the transition period passed on. The results agree favourably with those of Foley and Otterby (1978) [5], Quigley III *et al.* (1994) [15], Morin *et al.* (2001) [13] and Sobczuk-Szul *et al.* (2013) [17]. Without regard to the days of transition, the specific gravity of the colostrum samples of group A (2 - 4 L) was significantly (*et al* 0.05) higher compared to group B (5 – 7 L). The findings are parallel to those as reported by Sobczuk-Szul *et al.* (2013) [17]. The fat content of the colostrum samples during various periods postpartum showed a declining trend with values being significantly (*et al* 0.05) different from one another irrespective of the milk yield of the animals under study. The values are close to the values reported by Foley and Otterby (1978) [5], Klimes *et al.* (1986) [10] and Raducan *et al.* (2013) [16].

Table I: Effect of the average daily milk yield during postpartum transition period on various physico-chemical, compositional and microbiological characteristics of bovine colostrum (Mean ± S.E.)

Days Post-Partum	Average milk yield per day in litres			Overall mean
	Group A (2-4 L)	Group B (5-7 L)	Group C (8-10 L)	
Specific gravity				
D1	1.053±0.003	1.046±0.003	1.051±0.003	1.050±0.002[1]
D2	1.045±0.002	1.040±0.002	1.043±0.002	1.043±0.001[2]
D3	1.041±0.002	1.036±0.001	1.038±0.002	1.038±0.001[3]
Overall mean	1.046±0.002[a]	1.041±0.001[b]	1.044±0.002[ab]	1.044±0.001
Fat (%)				
D1	8.0±0.51	6.4±0.47	8.1±0.51	7.5±0.31[1]
D2	6.3±0.35	5.4±0.35	6.5±0.48	6.0±0.24[2]
D3	5.2±0.34	4.5±0.26	5.1±0.31	4.9±0.18[3]
Overall mean	6.5±0.32[a]	5.4±0.25[b]	6.6±0.35[a]	6.1±0.18
Total protein (%)				
D1	11.5±0.79	10.3±0.78	12.6±1.29	11.4±0.55[1]
D2	8.7±0.39	8.3±0.59	10.4±1.03	9.1±0.42[2]
D3	7.4±0.25	7.0±0.40	7.8±0.52	7.4±0.23[3]
Overall mean	9.2±0.44[ab]	8.5±0.43[a]	10.3±0.68[b]	9.3±0.30
Casein protein (%)				
D1	3.4±0.28	3.0±0.24	3.6±0.46	3.3±0.19[1]
D2	6.5±0.28	6.3±0.40	7.8±0.79	6.8±0.31[2]
D3	5.6±0.19	5.4±0.30	6.0±0.40	5.6±0.18[3]
Overall mean	5.2±0.29[a]	4.9±0.31[a]	5.8±0.48[b]	5.3±0.21
Whey protein (%)				
D1	8.1±0.52	7.3±0.57	8.9±0.94	8.0±0.40[1]
D2	2.2±0.18	1.9±0.17	2.6±0.27	2.2±0.13[2]
D3	1.8±0.10	1.6±0.11	1.8±0.13	1.7±0.07[2]
Overall mean	4.0±0.59[ab]	3.6±0.52[a]	4.5±0.74[b]	4.0±0.35
Lactose (%)				
D1	2.8±0.05	2.7±0.06	2.6±0.04	2.7±0.03[1]
D2	3.6±0.08	3.2±0.14	3.4±0.08	3.4±0.06[2]
D3	4.0±0.10	3.6±0.16	3.8±0.11	3.8±0.08[3]
Overall mean	3.5±0.11[a]	3.2±0.10[b]	3.3±0.11[b]	3.3±0.06

Table I: contd…

Days Post-Partum	Average milk yield per day in litres			Overall mean
	Group A (2-4 L)	Group B (5-7 L)	Group C (8-10 L)	
Total solids (%)				
D1	25.1±1.29	23.0±1.39	25.9±1.90	24.5±0.88[1]
D2	20.3±0.66	18.9±1.0	22.0±1.61	20.3±0.66[2]
D3	17.9±0.50	16.3±0.77	18.5±1.05	17.5±0.47[3]
Overall mean	21.1±0.77[ab]	19.4±0.79[a]	22.1±1.07[b]	20.7±0.51
Solids not fat (%)				
D1	17.1±0.81	16.6±0.98	17.8±1.44	17.1±0.60[1]
D2	14.0±0.45	13.6±0.67	15.4±1.15	14.3±0.45[2]
D3	12.7±0.35	11.8±0.54	13.4±0.79	12.6±0.34[3]
Overall mean	14.6±0.48[a]	14.0±0.56[a]	15.5±0.74[a]	14.7±0.34
Ash (%)				
D1	1.06±0.07	1.17±0.12	1.23±0.19	1.15±0.07[1]

D2	0.87±0.02	0.90±0.03	0.89±0.07	0.89±0.02[2]
D3	0.79±0.02	0.81±0.02	0.79±0.12	0.79±0.08[2]
Overall mean	0.90±0.03[a]	0.96±0.05[a]	0.97±0.08[a]	0.94±0.03
pH				
D1	6.37±0.02	6.38±0.02	6.37±0.03	6.38±0.01[1]
D2	6.47±0.03	6.45±0.02	6.43±0.02	6.45±0.01[2]
D3	6.53±0.03	6.53±0.02	6.52±0.03	6.53±0.02[3]
Overall mean	6.5±0.02[a]	6.5±0.02[a]	6.4±0.02[a]	6.5±0.01
Electrical conductivity (mS/cm)				
D1	5.6±0.29	5.5±0.17	5.6±0.18	5.6±0.12[1]
D2	4.9±0.26	4.6±0.22	4.8±0.25	4.7±0.14[2]
D3	4.3±0.17	4.2±0.13	4.4±0.18	4.3±0.09[3]
Overall mean	4.9±0.17[a]	4.8±0.14[a]	4.9±0.16[a]	4.9±0.09
Total plate count (log_{10} CFU/ml)				
D1	4.7±0.08	4.6±0.07	4.6±0.06	4.6±0.04[1]
D2	4.8±0.05	4.7±0.05	4.8±0.05	4.8±0.03[2]
D3	4.9±0.05	4.8±0.05	4.9±0.04	4.9±0.03[3]
Overall mean	4.8±0.04[a]	4.7±0.03[a]	4.8±0.04[a]	4.8±0.02

Mean±*SE* with different superscripts row-wise (alphabets) and column wise (numerals) differ significantly (*et al*, 0.05)

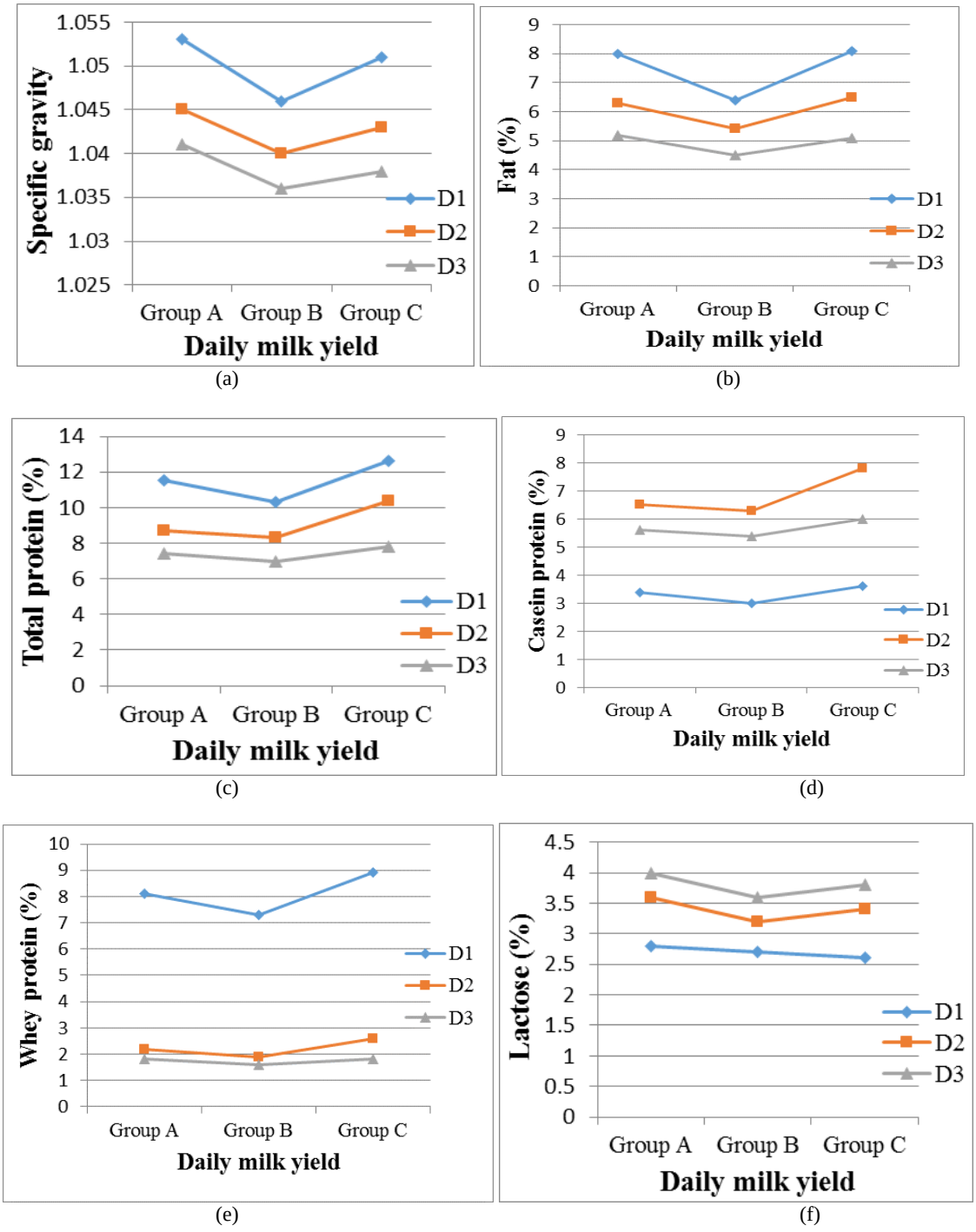

Fig I: Effect of the average daily milk yield during postpartum transition period on specific gravity (a), fat (b), total protein (c), casein protein (d), whey protein (e) and lactose (f) of bovine colostrum

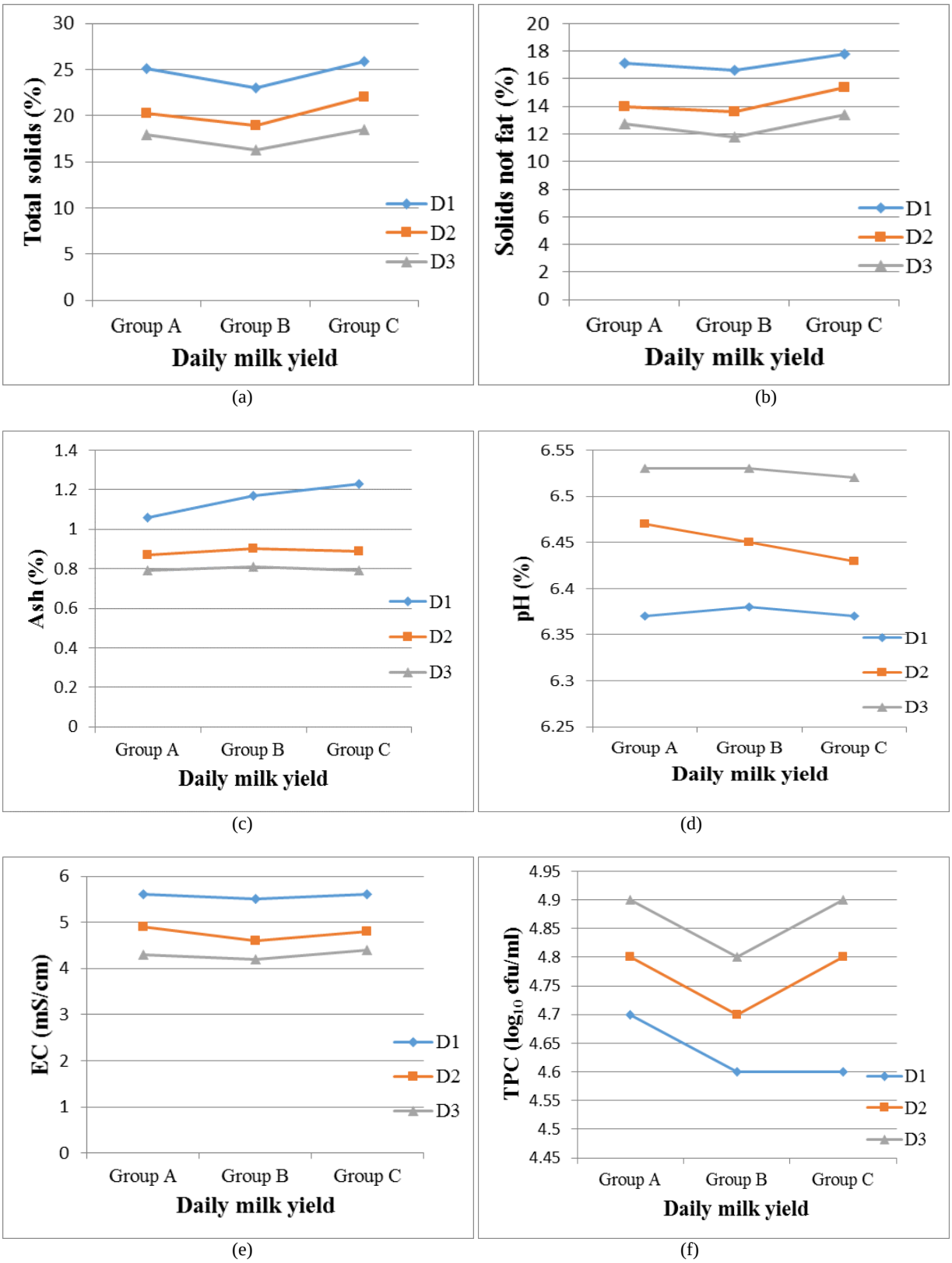

Fig II: Effect of the average daily milk yield during postpartum transition period on total solids (a), solids not fat (b), ash (c), pH (d), electrical conductivity (e) and total plate count (f) of bovine colostrum

As far as the fat values of the colostrum samples from different milk yield groups are concerned, the group A animals showed significantly (*et al*, 0.05) higher values compared to group B animals. The results agree favourably with the findings of Sobczuk-Szul *et al.* (2013) [17].

Total protein content of the colostrum during the transition period postpartum declined progressively with values at each day under study being significantly (*et al*, 0.05) different from one another. Similar results are reported by Foley and Otterby (1978) [5], Klimes *et al.* (1986) [10], Elfstrand *et al.* (2002) [4] and Raducan *et al.* (2013) [16]. Irrespective of the days of transition, the total protein content of group B animals was significantly (*et al*, 0.05) lower than group C animals. Upon examining the casein protein values of the colostrum samples the values of casein protein on day 1 were significantly lower than day 2 and day 3 while the values at day 2 were significantly higher than day 3. Similar trend has been reported by Benheng and Chengxiang (1996) [2]. Without

regard to the days of transition, the Casein protein of group C animals showed significantly (*et al* 0.05) higher values compared to both group A and group B animals. The whey protein content of the colostrum samples during various periods postpartum showed a declining trend with the values at day 1 being significantly (*et al* 0.05) higher compared to either day 2 or day 3 which within themselves were comparable. These results corroborate the findings of Klimes *et al.* (1986) [10] and Benheng and Chengxiang (1996) [2]. As far as the whey protein values of the colostrum samples from different milk yield groups are concerned, the whey protein content of group B animals was significantly (*et al* 0.05) lower than group C animals. Lactose, conversely went on increasing with each passing day post-partum having lowest value at day 1 and highest at day 3 postpartum, all the three values being significantly (*et al* 0.05) different from one another. These results are in agreement with the findings of Foley and Otterby (1978) [5], Benheng and Chengxiang (1996) [2], Elfstrand *et al.* (2002) [4] and Kleinsmith (2011) [9]. Irrespective of the days of transition, the lactose content of group A animals was significantly (*et al* 0.05) higher than both group B and group C animals. The results uphold the findings of Sobczuk-Szul *et al.* (2013) [17]. Total solids of the colostrum samples during various periods postpartum showed a declining trend with values being significantly (*et al* 0.05) different from one another, irrespective of the milk yield of the animal under consideration. Similar trend has been reported by Foley and Otterby (1978) [5], Klimes *et al.* (1986) [10] and Raducan *et al.* (2013) [16]. As far as the total solids value of the colostrum samples from different milk yield groups are concerned, the total solids content of group B animals was significantly (*et al* 0.05) lower than group C animals. Irrespective of the different milk yield groups, the day 1 postpartum colostrum samples had significantly (*et al* 0.05) higher solids not fat than day 2 and day 3 colostrum samples and between the latter two samples, the day 2 samples had significantly (*et al* 0.05) higher solids not fat compared to day 3 samples. Similar trend has been reported by Raducan *et al.* (2013) [16]. As far as the solids not fat value of the colostrum samples from different milk yield groups are concerned, there was no significant ($p > 0.05$) difference among them. The findings are in tune with the findings of Georgiev (2005) [7]. Irrespective of the different milk yield groups, the day 1 postpartum colostrum samples had significantly (*et al* 0.05) higher ash content than day 2 and day 3 colostrum samples which within themselves possessed comparable ash content. Similar findings have been reported by Klimes *et al.* (1986) [10] and Tsioulpas *et al.* (2007 [18]). Without regard to the days of transition, the ash content of the colostrum samples showed no significant ($p > 0.05$) difference among different age groups. The pH of the colostrum samples among different milk yield groups was found to be possessing comparable values having no significant ($p > 0.05$) difference among themselves whatsoever. Irrespective of the different milk yield groups, pH values increased significantly (*et al* 0.05) with every passing day post-partum upto day 3 post-partum. The day 1 postpartum colostrum samples had significantly (*et al* 0.05) lower pH value than day 2 and day 3 colostrum samples and between the latter two samples, the day 2 samples had significantly (*et al* 0.05) lower pH values compared to day 3 samples. Similar increase has been reported by Klimes *et al.* (1986) [10] and Elfstrand *et al.* (2002) [4]. Regardless of the days of transition, the electrical conductivity of the colostrum samples showed no significant ($p > 0.05$) difference among different milk yield groups whatsoever. Irrespective of the different milk yield groups, the day 1 postpartum colostrum samples had significantly (*et al* 0.05) higher values than day 2 and day 3 colostrum samples and between the latter two samples, the day 2 samples had significantly (*et al* 0.05) higher value compared to day 3 samples. The results at day 1 uphold the findings of Fraga e Silva Raimondo *et al.* (2009) [6] and Bar *et al.* (2010) [1]. Without holding upon at the days of transition, the total plate count (TPC) of the colostrum samples showed no significant ($p > 0.05$) difference among different milk yield groups. Irrespective of the different milk yield groups the total plate count (TPC) showed an increasing trend with the passage of post-partum period with values being significantly (*et al* 0.05) lower at day 1 followed by a significant (*et al* 0.05) increase at day 2 and further significant (*et al* 0.05) increase at day 3. The findings are close to the findings of Morrill *et al.* (2012) [14].

Conclusion

The specific gravity and fat content of the colostrum samples of group A were significantly (*et al* 0.05) higher values compared to group B animals. Fat, total protein, whey proteins and total solids of group C animals was significantly (*et al* 0.05) higher compared to group B animals. The Casein protein of group C animals showed significantly (*et al* 0.05) higher values compared to both group A and group B animals. The lactose content of group A animals was significantly (*et al* 0.05) higher than both group B and group C animals which among themselves possessed comparable values for lactose. The solids not fat, ash, pH, electrical conductivity and total plate count (TPC) of the colostrum samples from different milk yield groups showed no significant ($p > 0.05$) difference among themselves.

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