



A comparative study on the Physico-chemical characteristics of milk samples collected from Damani goat and sheep of livestock research and development station Paharpur, D.I. Khan and its surroundings areas

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Article Info

ISSN (online): 2582-7138

Volume: 03

Issue: 04

July-August 2022

Received: 27-05-2022;

Accepted: 13-06-2022

Page No: 09-13

Abstract

The Research work was designed to study and compare the physico-chemical Characteristics of milk samples of two different species like Damani goat and sheep. 300 Milk samples were collected from the Damani Goat and Sheep maintained at Livestock Research and development station Paharpur, Dera Ismail Khan and its surroundings areas. The milk samples were analyzed for different physio-chemical parameters, including pH, specific gravity, titratable acidity, total solids, ash, fat, protein and lactose. It was recorded that Damani Goat milk had 0.17±0.01% titratable acidity, 1.030±0.001 specific gravity, 6.52±0.07 pH, 12.86±0.57% total solids, 0.76±0.14% ash, 3.98±0.52% fat, 3.17±0.33% protein and 4.37±0.34% lactose. Damani Sheep milk contained 0.23±0.01% titratable acidity, 1.035±0.002 specific gravity, 6.62±0.05 pH, 18.16±0.22% total solids, 6.50±0.24% fat, 5.32±0.30% protein, and 4.74±0.31% lactose and 0.89±0.07% ash. All the parameters tested were higher in Damani Sheep milk to Damani Goat milk.

Keywords: Physicochemical parameters, Damani goat milk, Damani sheep milk, Paharpur, Dera Ismail Khan

Introduction

Milk, which is the secretion of the mammary glands, is the only food of the young mammal during the first period of its life. The substances in milk provide both energy and the building materials necessary for growth. Milk also contains antibodies which protect the young mammal against infection (Bylund, 1995) ^[9]. Milk plays a tremendous role in building a healthy society and can be used as vehicle for rural development, employment and slowing down the migration of the rural population (Sarwar *et al.*, 2002) ^[33]. In the year 2019-2020, Pakistan produced 61690 million tons of milk; of which 965 million tons was contributed by goats, and 41 million tons by sheep (Anonymous, 2020) ^[3].

Goat has been referred as a “poor man Cow” his great contribution to the health and nutrition of the landless and rural poor (Dresch, 1988) ^[11]. Goat milk differs from cow or human milk in having better digestibility, alkalinity and buffering capacity (Park, 1994) ^[31]. Damani Goat is one of the most important and predominant breed of goat in District D.I. Khan The average body weight of male and female is 35 and 30 kg respectively. The milk production of this breed varies from 1.4 to 2 kg /day. Shah (1994) reported milk yield in local goat breed of Damani (110 litres in 110 days).

Sheep milk is an excellent raw material for the milk processing industry especially in cheese production (Park *et al.*, 2007) ^[30]. Sheep milk has higher fat percentage, protein percentage, specific gravity, viscosity, titratable acidity, and lower freezing point than average cow milk (Haenlein and Wendorff, 2006) ^[15]. Damani sheep are small to medium with a white body coat and the weight range between 27 to 32 kg and milk production of this breed is 80kg in 120 days of lactation. The information regarding the Damani goat and sheep are very limited therefore the present study was designed with the aim to assess and compare the physicochemical characteristics of milk samples collected from Damani goat and Sheep from Tehsil Paharpur District D.I.Khan, Khyber Pakhtunkhwa Pakistan.

Materials and Methods

Collection of samples

Three hundred Freshly Milk Samples of Damani Goat and Sheep (150 sample of each one) were collected in sterile bottles from the Farm section of Livestock Research and Development Station Paharpur, Dera Ismail Khan and its surroundings. The Milk samples were collected and processed to Dairy Technology Laboratory Section of Livestock Research and Development Station Paharpur for Analysis of Physico-Chemical Properties.

Physical Properties

The pH was determined by digital pH meter calibrated with pH 4 and 7 buffers. Titratable acidity was measured by titrimetric method as described by AOAC (2000) [4]. Specific gravity was determined by Pycnometer as described by AOAC (2000) [4].

Chemical Properties

Total solids content, Fat, Protein and Lactose content were determined by Lacto Scan Analyzer. Ash content was determined by gravimetric method using a muffle furnace at 550 C as described by AOAC (2000) [4].

Statistical Analysis

The statistical analysis was carried out by using SPSS program (Statistical Package for Social Sciences version 16). The significant differences between means will be calculated by one-way Analysis of Variance (ANOVA) using Tukey range test.

Results and Discussion

pH: pH of milk samples was noted from Damani Goat and Sheep at the time of sampling. The values of pH of milk samples of both species are shown in Table 1. The results showed that pH values were in the range of 6.45-6.63 in goat milk and 6.54-6.67 in sheep milk. The results showed that pH values of Damani Sheep and goat were non-significantly ($p>0.05$) different from each other. pH values of sheep milk were similar to that reported by Kurkdjian and Gabrielian (1962) [23]; Haenlein and Wendorff (2006) [15]. pH values of goat milk were similar to that reported by Sawaya *et al.* (1984) [34].

Specific gravity

Specific gravity of milk samples collected from Damani goat and sheep is given in Table 2. Specific gravity was found in range of 1.028- 1.033 in goat milk and 1.032-1.036 in sheep milk. Specific gravity of sheep milk was higher than that goat milk at highly significant ($p<0.001$) level. The specific gravity of goat milk was in accordance with that reported by Juarez and Ramos (1986) [19]. The specific gravity of sheep milk was quietly similar to that described by Kurkdjian and Gabrielian (1962) [23]; Haenlein and Wendorff (2006) [15]. Specific gravity of sheep milk high was due to its high content of solids-non-fat.

Titratable acidity

The values of titratable acidity of milk samples collected from Damani goat and sheep is given in Table 3. It was observed from results that the values of titratble acidity was in the range of 0.14- 0.18% in goat milk and 0.21-0.27% in sheep milk. The values of titratable acidity of sheep milk were also higher than that of goat milk at highly significant

($p<0.001$) level. The titratable acidity values of goat milk were similar to the findings of Sawaya *et al.* (1984) [34]. The values of titratable acidity of sheep milk were similar to that reported by Kurkdjian and Gabrielian (1962) [23], Haenlein and Wendorff (2006) [15]. Acidity of milk is due the presence of lactic acid, citric acid and phosphoric acid (Bylund, 1995) [9].

Total solids

The concentration of total solids in milk samples collected from goat and sheep is given in Table 4. These results illustrated that the concentration of total solids was in range of 12.01- 13.74% in goat milk and 17.93-18.56% in sheep milk. The concentration of total solids in Damani sheep milk was also higher than that in goat. The concentration of total solids found in goat milk was similar to that reported by Kanwal *et al.* (2004) [20] and Imran *et al.* (2008) [18]. The concentration of total solids found in sheep milk was similar to the findings of Talevski *et al.* (2009) [36].

Ash

Ash content in milk samples collected from Damani goat and sheep is given in Table 5. The results of this study revealed that the ash content was in the range 0.58-0.98% in Damani goat milk and 0.77-0.99% in sheep milk. There was non-significant ($p>0.05$) difference between the amount of ash content in the milk samples collected from goat and sheep. Amount of ash content found in goat milk during this study was in line with the findings of Bhosale *et al.* (2009) [6] and Keskin *et al.* (2004) [21]. Imran *et al.* (2008) [18] reported higher ash content in goat milk. Ash content found in sheep milk during this research work was similar to that reported by Adewumi and Olorunnisomo (2009) [1] and Bylund (1995) [9].

Fat

Fat content in milk samples collected from Damani goat and sheep is given in Table 6. Results indicated that fat content was in the range of 3.15-4.75% in goat milk and 6.07-6.82% in sheep milk. The amount of fat content in sheep milk was higher than that in milk of goat milk at highly significant ($p<0.001$) level. Amount of fat content found in goat milk during this investigation was similar to that cited by Strzalkowska *et al.* (2009) [35] and Bhosale *et al.* (2009) [6]. Amount of fat content found in sheep milk during this research work was lower than that reported by Adewumi and Olorunnisomo (2009) [1], Talevski *et al.* (2009) [36] and Pavic *et al.* (2002).

Protein

Protein content in milk samples collected from Damani goat and sheep is given in Table 7. According to these results protein content was in range of 2.37-3.49% in goat milk and 4.54-5.53% in sheep milk. The amount of protein content in sheep milk was higher than that in the milk of goat at highly significant ($p<0.001$) level. Protein content found in goat milk during this investigation was similar to the findings of Strzalkowska *et al.* (2009) [35] and Aneja *et al.* (2002) [2]. Protein content found in sheep milk during this research work was lower than that reported by Pavic *et al.* (2002). The reduction might be due breed difference, health status of the udder and stage of lactation.

Lactose

Lactose content in milk samples collected from Damani goat

and sheep is given in Table 8. Results illustrated that the lactose content was in range of 3.69-4.89% in goat milk and 4.36-5.25% in sheep milk. There was non-significant ($p>0.05$) difference between the amount of lactose content in cow, goat and sheep milk. Lactose content in goat milk was in accordance with that reported by Imran *et al.* (2008) [18], Strzalkowska *et al.* (2009) [35], Bhosale *et al.* (2009) [6] and Sawaya *et al.* (1984) [34]. Lactose content in sheep milk was similar to that reported by Pavic *et al.* (2002) and Bylund (1995) [9].

Table 1: pH of milk samples collected from Damani Goat and Sheep milk

pH Values				
Source of Milk	Min	Max	Mean	(SD±)
Goat	6.45	6.63	6.52	0.07
Sheep	6.54	6.67	6.62	0.05
Significance Goat milk v/s Sheep milk n.s				

Significance: *** = $p<0.001$, * = $p<0.05$, n.s = $p>0.05$, Min. = Minimum, Max. = Maximum, SD = Standard Deviation

Table 2: Specific gravity of milk samples collected from Damani Goat and Sheep milk

Specific gravity Values				
Source of Milk	Min	Max	Mean	(SD±)
Goat	1.028	1.032	1.030	0.001
Sheep	1.032	1.037	1.035	0.002
Significance Goat milk v/s Sheep milk: ***				

Significance: *** = $p<0.001$, * = $p<0.05$, n.s = $p>0.05$, Min. = Minimum, Max. = Maximum, SD = Standard Deviation

Table 3: Titratable acidity of milk samples collected from Damani Goat and Sheep milk

Titratable Acidity (%)				
Source of Milk	Min	Max	Mean	(SD±)
Goat	0.14	0.18	0.17	0.01
Sheep	0.21	0.27	0.23	0.01
Significance Goat milk v/s Sheep milk: ***				

Significance: *** = $p<0.001$, * = $p<0.05$, n.s = $p>0.05$, Min. = Minimum, Max. = Maximum, SD = Standard Deviation

Table 4: The concentration of Total solids in milk samples collected from Damani Goat and Sheep milk

Total Solids (%)				
Source of Milk	Min	Max	Mean	(SD±)
Goat	12.01	13.74	12.86	0.57
Sheep	17.93	18.56	18.16	0.22
Significance Goat milk v/s Sheep milk: ***				

Significance: *** = $p<0.001$, * = $p<0.05$, n.s = $p>0.05$, Min. = Minimum, Max. = Maximum, SD = Standard Deviation

Table 5: The Ash value in milk samples collected from Damani Goat and Sheep milk

Ash (%)				
Source of Milk	Min	Max	Mean	(SD±)
Goat	0.58	0.98	0.76	0.14
Sheep	0.77	0.99	0.89	0.07
Significance Goat milk v/s Sheep milk: n.s				

Significance: *** = $p<0.001$, * = $p<0.05$, n.s = $p>0.05$, Min. = Minimum, Max. = Maximum, SD = Standard Deviation

Table 6: The Fat value in milk samples collected from Damani Goat and Sheep milk

Fat (%)				
Source of Milk	Min	Max	Mean	(SD±)
Goat	3.15	4.75	3.98	0.52
Sheep	6.07	6.82	6.50	0.24
Significance Goat milk v/s Sheep milk***				

Significance: *** = $p<0.001$, * = $p<0.05$, n.s = $p>0.05$, Min. = Minimum, Max. = Maximum, SD = Standard Deviation

Table 7: The Protein value in milk samples collected from Damani Goat and Sheep milk

Protein (%)				
Source of Milk	Min	Max	Mean	(SD±)
Goat	2.37	3.49	3.17	0.33
Sheep	4.54	5.53	5.32	0.30
Significance Goat milk v/s Sheep milk***				

Significance: *** = $p<0.001$, * = $p<0.05$, n.s = $p>0.05$, Min. = Minimum, Max. = Maximum, SD = Standard Deviation

Table 8: The Lactose value in milk samples collected from Damani Goat and Sheep milk

Lactose (%)				
Source of Milk	Min	Max	Mean	(SD±)
Goat	3.69	4.89	4.37	0.34
Sheep	4.36	5.25	4.74	0.31
Significance Goat milk v/s Sheep milk n.s				

Significance: *** = $p<0.001$, * = $p<0.05$, n.s = $p>0.05$, Min. = Minimum, Max. = Maximum, SD = Standard Deviation

Conclusion

Damani Sheep milk must be promoted due to its highly nutritional value and greater potential for processing into valuable dairy products with desirable quality attributes. It is evident from the study that all the tested parameters like Specific gravity, Titratable acidity, Total Solids, Fat, Lactose ash and Protein percentages were higher in Damani sheep as compare to Damani Goat milk. This clearly indicated the importance of Damani sheep milk to be used as rich source of food for the fulfilment of Nutritional requirement for the peoples of southern Regions of Khyber Pakhtunkhwa.

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