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Determination of colostrum quality in sheep using a brix refractometer and colostrometer

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Abstract

This study aimed to evaluate the quality of sheep colostrum using a digital Brix refractometer and a colostrometer. The study material consisted of 30 pregnant Norduz ewes. Within the first six hours after birth, approximately 250 ml of colostrum was collected from each ewe's udder by hand milking. The birth weight, birth type, gender of the lambs, and dam age were recorded. The average Brix value of Norduz ewe colostrum samples was found to be 21.31%, with values ranging from 15.40% to 29.70%. Birth type, gender of the lamb, and dam age did not statistically affect the Brix value of the colostrum. The average specific gravity of Norduz ewe colostrum was found to be 1.049. The effects of dam age and gender on specific gravity were not significant. On the other hand, the specific gravity of the colostrum was found to be 1.051 and 1.028 for ewes with single and twin lambs, respectively ($p < 0.001$). The quality of the colostrum in the Norduz ewes was rated as high by the colostrometer, but it was slightly below the threshold of 22% by the digital Brix refractometer.

Keywords: Colostrum, immunoglobulin, refractometer, specific gravity

Introduction

Colostrum is formed by the accumulation of breast secretions and proteins passed from the blood during the last few weeks of pregnancy. Colostrum, the first milk produced by mammary glands, is secreted just before and during the first week after birth (Güngör, 2006) ^[1]. Since colostrum is the sole nutritional source of newborns, it is the second most important factor affecting survival after body reserves. Nutrient-rich colostrum contains high levels of immunoglobulins, enzymes, hormones, growth factors and neuroendocrine peptides (Nowak and Poindron, 2006) ^[2]. The first day after birth is crucial for lambs, as inadequate colostrum intake or poor quality can result in insufficient passive immunity (Tsiliogianni *et al.*, 2012) ^[3]. In ruminants, syndesmochorial placentation prevents the in utero transmission of immunoglobulins, resulting in low serum IgG levels at birth. Therefore, it is crucial for neonatal lambs to absorb maternal immunoglobulins from colostrum at an early stage to acquire passive immunity and survive (Koyuncu *et al.*, 2018) ^[4]. Immunoglobulins, which play an important role in establishing passive immunity in newborns, are present in high levels in colostrum (Jaster, 2005) ^[5].

The ability of the newborn to transfer adequate passive immunity depends on the age at colostrum intake and the immunoglobulin concentration in the colostrum. Therefore, it is important to be able to measure the quality of colostrum produced by the mother (Perez-Marín *et al.*, 2023) ^[6].

Colostrum quality is directly related to immunoglobulin concentration (Ahmann *et al.*, 2021) ^[7]. Various methods, such as electrophoresis (Lopreiato *et al.*, 2017) ^[8], radial immunodiffusion (Akköse *et al.*, 2025) ^[9], and the enzyme-linked immunosorbent assay (ELISA) (Schoen *et al.*, 2025) ^[10], were used to determine immunoglobulin levels in sheep colostrum. These methods are the gold standard for determining levels of immunoglobulin G (IgG), immunoglobulin G1 (IgG1), immunoglobulin G2 (IgG2), immunoglobulin M (IgM), and immunoglobulin A (IgA). However, these analyses require laboratory equipment and expertise and take a lot of time. Rapid on-site assays, such as colostrometer and refractometer,

effectively assess the quality of colostrum and correlate well with the gold standard methods (Lemberskiy-Kuzin *et al.*, 2019) ^[11]. On-farm testing studies using colostrometer (Karakuş and Atmaca, 2016) ^[12] and Brix refractometer (Hamer *et al.*, 2023 ^[13]; Sarica and Aydoğdu, 2024 ^[14]; Akköse, 2025) ^[15] were also conducted to estimate immunoglobulin values.

The colostrometer estimates colostrum quality by measuring specific gravity, which reflects total solids. Since protein is 64% of total solids and globulins are 47% of protein, specific gravity correlates well with immunoglobulin content (Nava-Cruz *et al.*, 2024) ^[16]. The Brix refractometer also provides a rapid and simultaneous estimation of colostrum's total solids concentration (Akköse, 2025) ^[15].

Studies on colostrum quality and its influencing factors have generally been conducted on cows. Additionally, few studies have compared the Brix refractometer and colostrometer methods for assessing the quality of colostrum in sheep. The aim of this study was to evaluate the quality of sheep colostrum using a digital Brix refractometer and a colostrometer.

Materials and Methods

The study was conducted in 2025 at the Research and Application Farm of Yüzüncü Yıl University in Van, Türkiye. The study examined 30 pregnant Norduz sheep raised under semi-intensive conditions. The ewes were fed a diet consisting of alfalfa hay, barley straw, and a concentrate feed. Approximately 250 ml of colostrum were collected by hand milking from both udders of each ewe within the first six hours after birth. The birth weight, birth type, gender of the lambs, and dam age were recorded.

Colostrum specific gravity was measured using a colostrometer (KRUUSE) designed for bovine colostrum, with a range of 1.025-1.075 at a temperature of 20°C. The quality of colostrum is categorized by specific gravity (SG) into poor (red zone, <1.035), intermediate (light-green zone, 1.035-1.045), and good (dark-green zone, >1.045) (Karakuş and Atmaca, 2016) ^[12].

The Atago PAL-1 Digital Refractometer (0-53 Brix) was used in the digital refractometer analysis. After cleaning the sample chamber with distilled water and obtaining a value of zero, a few drops of the colostrum sample were added, and the measurement was taken. Measurements were performed at room temperature. The results were confirmed by repeating the digital refractometer analysis. Descriptive statistics of the obtained data were performed using the SAS (2022) ^[17] package program.

Results and Discussion

Factors affecting Brix values (%) of Norduz ewe colostrum are given in Table 1. Colostrum with a Brix percentage below 22% is considered poor quality. In contrast, colostrum with a Brix value of 22-26% is considered medium quality, while those above 26% are considered high quality (Kara and Şenel, 2025) ^[18]. Of the colostrum samples examined in this study, 16 were below 22% Brix, 11 were between 22% and 26%, and three were above 26% (Figure 1). The average Brix value of Norduz ewe colostrum samples was found to be 21.31%, ranging from 15.40% to 29.70%. The Brix value obtained in the study was found to be similar to the 21.02% reported by Todaro *et al.* (2023) ^[19], but lower than the 27.69% reported by Sarica and Aydoğdu (2024) ^[14] and the values of 24.39% and 24.30% reported by Övet (2024) ^[20] for sheep and goats, respectively. Uysal *et al.* (2024) ^[21] reported that the Brix

percentages of colostrum varied according to sheep breeds and ranged from 21.6-44.7% at 0 hours postpartum, 15.1-45.3% at 4 hours, and 12.0-40.4% at 24 hours. These differences in the literature may stem from many factors, primarily breed, as well as the ewes' feeding regimen, year of birth, season of lambing, vaccination status during pregnancy, and the method used to analyze colostrum quality.

Table 1: Factors affecting Brix values (%) of Norduz ewe colostrum

Factor	n	Brix value (%)	Minimum	Maximum
General	30	21.31	15.40	29.70
Dam age				
1	8	20.41	16.30	28.00
2	9	22.54	16.00	29.70
3	3	22.57	20.40	24.70
4	5	19.72	15.40	24.30
5+	5	21.36	16.00	24.30
Birth type				
Single	27	21.42	16.00	29.70
Twin	6	20.33	15.40	24.30
Gender				
Female	16	21.47	16.00	28.00
Male	17	20.99	15.40	29.70

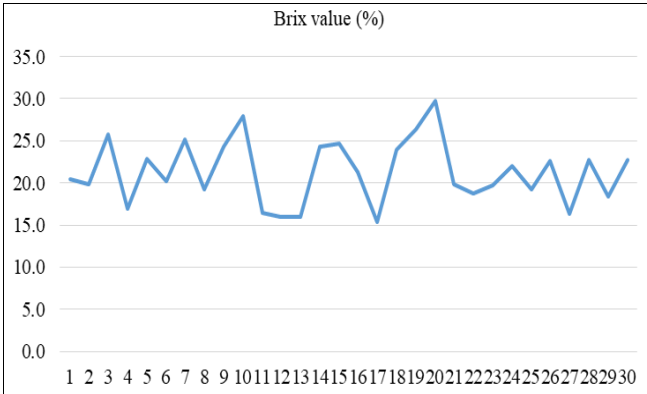


Fig 1: Brix value (%) distribution of colostrum samples

Although no statistically significant differences were found among the dam age groups, the highest average Brix values were found in colostrum samples from two- and three-year-old dams. Akköse (2025) ^[15] found no difference in colostrum quality between ewes and yearling lambs, as determined by the Brix refractometer.

The colostrum Brix value of ewes giving birth to single lambs was 21.42%, while that of ewes giving birth to twins was 20.33 (p>0.05). However, Sarica and Aydoğdu (2024) ^[14] found that the optical and digital Brix values of the colostrum from ewes that gave birth to twins were significantly higher (p≤0.05) than those from ewes that gave birth to a single lamb. Similar to birth type, no statistically significant difference was found in the Brix values of colostrum between ewes that gave birth to female and male lambs.

Of the colostrum samples collected in the study, five were found to be of poor quality (<1.035), eight were found to be of moderate quality (1.035-1.045), and 17 were found to be of good quality (>1.045) (Figure 2). The average specific gravity of Norduz ewe colostrum was found to be 1.049 (Table 2). This value was the same as the value reported for Norduz breed by Karakuş and Atmaca (2016) ^[12]. Because this value was greater than 1.045, it was classified as good-quality colostrum, and its immunoglobulin level was above the reported threshold of 20 mg/mL for sheep (Eğdir, 2023) ^[22]. Although factors such as fat and solids content, colostrum

temperature, have been reported to affect colostrometer readings, colostrometers can still be useful for distinguishing high-quality colostrum from low-quality colostrum (Godden, 2008) [23].

Table 2: Factors affecting specific gravity of Norduz ewe colostrum

Factor	n	Specific gravity	Minimum	Maximum
General	30	1.049	1.020	1.077
Dam age				
1	8	1.048	1.030	1.065
2	9	1.055	1.025	1.077
3	3	1.055	1.055	1.055
4	5	1.043	1.020	1.060
5+	5	1.042	1.025	1.060
Birth type		**		
Single	27	1.051	1.025	1.077
Twin	6	1.028	1.020	1.040
Gender				
Female	16	1.051	1.025	1.075
Male	17	1.043	1.020	1.077

**: $p < 0.001$

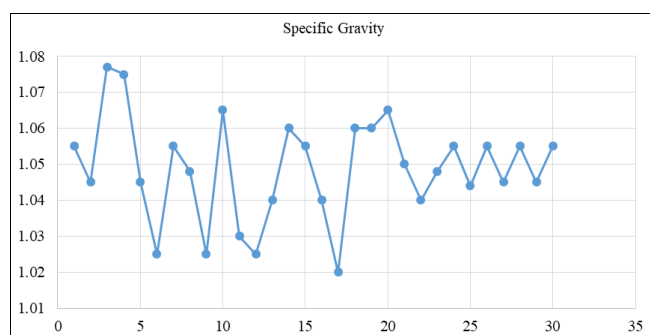


Fig 2: Specific gravity distribution of colostrum samples

The effects of dam age and gender on colostrum specific gravity were not significant. On the other hand, the specific gravity of the colostrum was determined to be 1.051 and 1.028 for dams with single and twin lambs, respectively. The difference was found to be significant ($p < 0.001$). The specific gravity of the colostrum produced by ewes that gave birth to twins was within a much narrower and lower range. This situation showed that colostrum was systematically less concentrated (lower in solids) compared to single-birth ewes.

Conclusion

According to the study results, the quality of colostrum in Norduz sheep was determined to be high by a colostrometer. It was also evaluated as slightly below the 22% threshold value by a digital Brix refractometer. However, since a definitive threshold value for quality colostrum has not yet been established for sheep, as it has for cattle, more studies are needed to make an accurate assessment.

Conflict of Interest

There are no conflicts of interest to report for any of the authors.

References

- Güngör Ö. Neonatal buzağlar ve kolostrum. Kafkas Univ Vet Fak Derg. 2006;12(1):103-108.
- Nowak R, Poindron P. From birth to colostrum: early steps leading to lamb survival. Reprod Nutr Dev. 2006;46:431-446.

- Tsiligianni T, Dovolou E, Amiridis GS. Efficacy of feeding cow colostrum to newborn lambs. Livest Sci. 2012;149:305-309.
- Koyuncu M, Duymaz Y, Karaca M. Improvement of survival in newborn offspring. J Biol Environ Sci. 2018;12(34):23-29.
- Jaster EH. Evaluation of quality, quantity, and timing of colostrum feeding on immunoglobulin G1 absorption in Jersey calves. J Dairy Sci. 2005;88:296-302.
- Perez-Marin CC, Cano D, Arrebola FA, Petrusa VH, Skliarov PM, Entrenas JA, *et al.* Colostrum quality assessment in dairy goats using an on-farm optical refractometer. Biology. 2023;12:626.
- Ahmann J, Steinhoff-Wagner J, Büscher W. Determining immunoglobulin content of bovine colostrum and factors affecting the outcome: A review. Animals. 2021;11:3587.
- Lopreiato V, Ceniti C, Trimboli F, Fratto E, Marotta M, Britti D, *et al.* Evaluation of capillary electrophoresis method for measurement of immunoglobulin concentration in ewe colostrum. J Dairy Sci. 2017;100:6465-6469.
- Akköse M, Özbeyaz C, Buczinski S, Gündoğar U, Ünal N. Reliability of Brix refractometer for evaluation of colostrum quality in sheep. Vet Med Sci. 2025;11:e70433.
- Schoen C, Johnson B, Lawson S, Nold R, Chase C, St-Pierre B, *et al.* Evaluation of colostrum substitutes on passive immune protection and immune development in lambs. Preprints. 2025. DOI:10.20944/preprints202508.1875.v1
- Lemberskiy-Kuzin L, Lavie S, Katz G, Merin U, Leitner G. Determination of immunoglobulin levels in colostrum using online milk analyzer. Can J Anim Sci. 2019;99:631-633.
- Karakuş F, Atmaca M. Effect of ewe body condition at lambing on lamb growth and colostrum specific gravity. Arch Anim Breed. 2016;59:107-112.
- Hamer K, Bellingham M, Evans NP, Jones RO, Denholm KS. Digital Brix refractometry thresholds for IgG in ewe colostrum and lamb serum. Prev Vet Med. 2023;218:105988.
- Sarica M, Aydoğdu U. Determination of colostrum quality using Brix refractometer in sheep. Acta Vet Hung. 2024;72(2):116-124.
- Akköse M. Comparative evaluation of colostrum quality in Konya ewes and yearling lambs using Brix refractometer. Res Pract Vet Anim Sci. 2025;2(2):66-73.
- Nava-Cruz A, Flores-Salas J, Torres-Rodríguez E, Arellano-Rodríguez F, Robles-Trillo P, Alvarado-Espino A, *et al.* Comparison of Brix refractometer and colostrometer to estimate colostrum quality in dairy cows. Abanico Veterinario. 2024;15:1-8.
- SAS Institute Inc. SAS/STAT User's Guide. Version 9.3. Cary (NC): SAS Institute Inc.; 2022.
- Kara H, Şenel Y. Comparison of colostrum quality between Merino and Akkaraman ewes. Turkish Vet Res. 2025;9(2):109-115.
- Todaro M, Maniaci G, Gannuscio R, Pampinella D, Scatassa ML. Chemometric approaches to analyze ewe colostrum composition. Animals. 2023;13:983.
- Övet C. Trakya bölgesindeki keçi ve koyunlarda kolostrum kalitesi ve etkileyen faktörler [PhD thesis]. Aydın: Aydın Adnan Menderes University; 2024.
- Uysal S, Uysal A, Öz C, Yörük MA, Ölmez M. Evaluation of sheep colostrum after lambing by Brix

- refractometry and color scoring. *Res Pract Vet Anim Sci.* 2024;1(1):27-35.
22. Eđdir C. Anneden dođal emme ve biberonla kolostrum verilen kuzularda pasif transfer karřılařtırması [MSc thesis]. Kırıkkale: Kırıkkale University; 2023.
23. Godden S. Colostrum management for dairy calves. *Vet Clin Food Anim Pract.* 2008;24:19-39.

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