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Research Article

Colostrum Quality in Saudi Goats: Breed, Parity, and Seasonal Effects on Immunoglobulins Secretion Dynamics Postpartum

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Abstract | Goat kids are born without antibodies in their bloodstream to fight off infections because the epitheliochorial structure of the goat's placenta prevents transfer of immunoglobulins from the dams to the fetus during pregnancy. The current study is designed to explore the values of immunoglobulins in colostrum and milk of goats across the four days postpartum according to Ardi and Harri breeds, sex of kids, months of deliveries, and parity. Colostrum and milk samples were collected from 100 goats (60 Ardi and 40 Harri) across days 1, 2, 3 and 4 postpartum. The colostrum and milk samples of Ardi and Harri goats underwent refractometer immunoglobulins determination directly after milking. The colostrum and milk immunoglobulins values were classified according to Ardi and Harri goat breeds, sex of kids, months of deliveries, and parity. The results showed that Ardi goats had higher immunoglobulins values of colostrum and milk samples compared to Harri ones across days 1, 2, 3 and 4 postpartum. Deliveries occurred in October month gave higher immunoglobulins values of colostrum and milk samples compared to other months. Higher parity was associated with higher immunoglobulin values of colostrum and milk samples. The single male delivery gave higher Igs values ($P > 0.05$) of colostrum and milk samples compared to female delivery. In addition, the twin delivery gave higher ($P < 0.05$) Igs values of colostrum and milk samples if compared to single ones. In conclusion, goat Ardi breed, month of parturition, twin delivery, and parity gave higher colostrum and milk Igs values if compared to Harri goat breed and other variables.

Keywords | Goats, Ardi, Harri, Colostrum, Milk, Immunoglobulins

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INTRODUCTION

In Saudi Arabia, goats represent a vital component of the Kingdom's cultural heritage and agricultural economy, particularly within the traditional pastoral systems of the Arabian Peninsula (Mohammed and Al-Suwaiegh, 2023). The country is home to several distinct indigenous breeds, most notably the Aradi (known for its hardiness and black coat), the Harri (native to the volcanic regions of the Hijaz), and the Jabali (adapted to the rugged mountain terrains) (Al-Suwaiegh *et al*., 2025). These breeds have evolved over centuries to thrive in hyper-arid climates, exhibiting remarkable physiological resilience to heat stress and limited water resources (Alamer, 2003). Beyond their historical role in bedouin subsistence, goats are a primary source of high-quality red meat and nutrient-rich milk, significantly contributing to national food security (Mohammed *et al*., 2025). As the Kingdom moves toward modernizing its livestock sector under Vision 2030, there is an increasing focus on improving the genetic potential and health management of these local breeds to optimize productivity while preserving their unique environmental adaptations (MEWA's, 2022).

The Ardi goat is arguably the most prominent and resilient indigenous breed in Saudi Arabia, highly regarded for its exceptional adaptation to the harsh, hyper-arid environments of the Najd region (Mahmoud *et al*., 2020). The Ardi goats typically features a long, sleek black coat, though white markings on the head and extremities are common (Al-Suweigh *et al*., 2025). One of its most distinguishing physical traits is its long, pendulous ears, which aid in thermoregulation by dissipating heat (Mohammed and Al-Suweigh, 2023). The Ardi goats are morphologically large-framed animals with a robust skeletal structure, allowing them to travel long distances in search of forage. Beyond their hardiness, the Ardi goats are prized for their dual-purpose productivity, offering high-quality meat and a reliable milk yield that is rich in total solids (Mohammed and Al-Suweigh, 2023). Their ability to maintain reproductive efficiency and maternal care under extreme temperature fluctuations makes them a cornerstone of local livestock production and a vital genetic resource for sustainable desert farming.

The Harri goat is a distinguished indigenous breed of Saudi Arabia, located primarily in the western Hijaz region. Unlike the larger-framed Ardi, the Harri goat is generally characterized by its medium body size and a coat that is predominantly pure white, though variations in black or brown can occur. Their hair is notably finer and denser, providing a degree of protection against both the intense solar radiation and the cooler night temperatures of the mountainous plateaus (Al-Owaimer *et al*., 2019). Physiologically, Harri goats are celebrated for their high prolificacy and exceptional maternal traits, frequently producing twins and exhibiting a rapid growth rate in their offspring (Al-Amri and Al-Khalaf, 2014; Al-Atiyat 2017). In the Saudi market, they are highly sought after for the superior quality of their meat, which is prized for its tenderness and distinct flavor, making them a primary choice for traditional culinary dishes. Their agility and ability to forage in rocky, uneven terrain distinguish them as a hardy mountain breed, perfectly suited for the specific ecological niche of the Arabian Shield.

The environmental context of the Al-Ahsa region provides a unique landscape for studying these dynamics (Alkhaldi *et al*., 2025). While camels are adapted to heat, extreme fluctuations in the Temperature-Humidity Index (THI) can alter blood metabolic parameters (Čukić *et al*., 2023). Previous observations suggest a climate effect for biological performances of livestock animals (Anuta *et al*., 2025). In Al-Ahsa, October typically offers a window characterized by moderate temperatures (average high of 36°C) and stable humidity (32%), which may support higher immunoglobulin concentrations compared to the more challenging summer or winter months (Rijkers *et al*., 2026). Despite Ardi and Harri cultural and economic importance, breed-specific differences in their metabolic and immunological profiles during the transition period remain insufficiently explored.

This study is designed to explore the concentrations of immunoglobulins (Igs) in colostrum and milk of Ardi and Harri goats across the four days postpartum. The data were presented according to impacts of Ardi and Harri goat breeds, Months of parturition, parity, and kids' sex either single or twin on colostrum and milk immunoglobulins secretion dynamics postpartum. Therefore, the study shows the relationship between genetic and environmental factors on colostrum and milk immunoglobulins of Ardi and Harri goats during the peak delivery season in Al-Ahsa.

MATERIALS AND METHODS

Experimental design and ethical approval

The present study aimed to evaluate the changes in immunoglobulins secretion dynamics across four days postpartum of Ardi and Harri goats according to breeds, sex of single and twin kids, months of deliveries, and parities (Figure 1). One hundred Ardi and Harri goats in their first to fifth lactation were chosen during the experimental period under semi extensive management grazing system and in addition to feeding Berseem hay. The environmental conditions during experimental period were an average low temperature of 14.25 ± 7.02°C, high temperature of 27.0 ± 6.68 °C, and a relative humidity of 43.25 ± 09.42%. The study protocol was approved by the King Faisal University ethical committee [KFU-REC-2025-SEP-EA256]. The colostrum and milk samples of 60 Ardi and 40 Harri goat breeds were collected from October 2025 to January 2026 and were analyzed in the department of animal and fish production, college of Agriculture and Food Sciences, University of King Faisal.

Average temperature and humidity environmental conditions

Al-Ahsa region followed its typical hot desert climate pattern, characterized by extreme summer heat and low humidity, with mild, slightly more humid winters in 2025 till January 2026. Below is the monthly average data for Al-Ahsa (Al-Hofuf region) based on the observations.

Colostrum and milk collection

Colostrum and milk samples of Ardi and Harri goats were collected after parturition, before suckling of kids for days 1, 2, 3 and 4 days. Colostrum and milk was collected using a sterile hand-milking technique into pre-labeled, plastic containers. The recorded labeled data on plastic containers were goat breed (Ardi vs. Harri), kids' sex (single and twin sex either male and/or female), month of parturition (October, November, December and January), and parity (parity 1 to parity 5). The goats were calmly restrained to ensure the safety of the handlers. Pre-milking hygiene procedures involved washing the udder and teats with warm water and drying them with a clean towel. The first few drops of colostrum and milk were discarded and 50 ml of colostrum and milk samples were collected from the first milking postpartum and subsequently for days 2, 3 and 4 days. The collected colostrum and milk samples were monitored immediately for determination of refractometer immunoglobulins (Igs) values. Thereafter, the colostrum samples were labeled, sealed, and freezed to preserve their quality for further analyses.

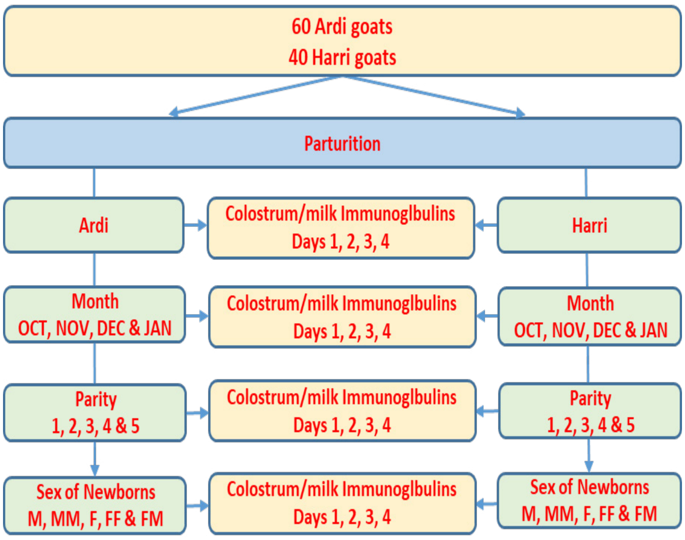

Figure 1: Experimental design of the study.
OCT, October; NOV, November; DEC, December; JAN, January; FEB, February; M, Male; MM, twin male; F, Female; FF, twin female; FM, Twin male and female.

Immunoglobulins analysis of colostral/milk

The digital Brix refractometer (Soonda Official Store, China) was used to measure immunoglobulins (Igs) values in colostrum and milk samples after immediate collection. The refractometer was cleaned and calibrated to 0.0% Brix value using deionized water. Colostrum and milk samples were thoroughly mixed before a 2–3 drop aliquot was applied to the prism via a disposable pipette. The cover was closed to ensure accuracy and to eliminate air bubbles, and a 15–30 second temperature equilibration period was observed before recording the digital Brix value. Between each measurement sample, the prism and cover were cleaned with distilled water and dried using clean cloth/ tissue to avoid cross-contamination.

Data statistical analysis

The immunoglobulins (*Brix refractometer*) values for colostrum and milk samples at day 1, day 2, day 3, and day 4 postpartum of Ardi and Harri goat breeds were compared (SPSS version 27.0). The data were subjected to statistical analysis of ANOVA repeated measures for breed (Ardi vs. Harri), kids' sex (single and twin sex either male and/or female) month (October, November, December and January), and parity (parity1 to parity 5), and using the General Linear Model (SPSS version 27.0). Comparison between the groups were considered statistically significant at $p < 0.05$.

RESULTS

Variables distribution throughout the study

The impacts of Ardi vs. Harri goat breeds, kids' sex, month of parturition, and parity, and kids' sex on immunoglobulins secretion dynamics postpartum in colostrum and milk are presented in Figures 2-3 and Table 2. There is a significant upward trend in deliveries as winter progresses, peaking with 46 deliveries in January (Figure 2D). This confirms that the majority of newborns are arriving during the coolest part of the year in Al-Ahsa region. The herd maintains an almost higher balance between the Ardi (60) and Harri (40) goat breeds, as well as an almost 50.70/49.30 split between male and female offspring (65 males and 63 females). The parity bar chart shows a healthy herd structure, with the majority of dams in their prime (parity 2, 3 and 4). However, the 24 first-time dams (parity 1) represent a critical group that requires the most attention for colostrum management, especially during the January peak.

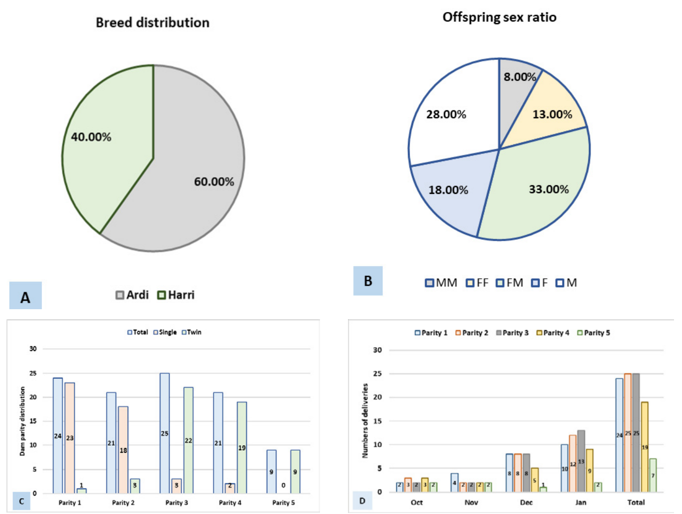

Figure 2: Goat herd population, deliveries, and sex from October 2025 to January 2026.
OCT, October; NOV, November; DEC, December; JAN, January; FEB, February; M, Male; MM, twin male; F, Female; FF, twin female; FM, Twin male and female.

The Figure 3 illustrates the distribution of Ardi and Harri goats based on parity (from 1 to 5) and birth type (single vs. twin). Overall, the data reveals a clear shift in reproductive

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trends as parity increases, with twin births becoming the dominant trait in later stages for both breeds. The study included that Ardi goats had 25.0% single and 75.0% twin versus Harri goats gave 40.0% single and 60.0% twin, indicating that twinning is a prevalent characteristic in both Saudi indigenous breeds, particularly in the Ardi.

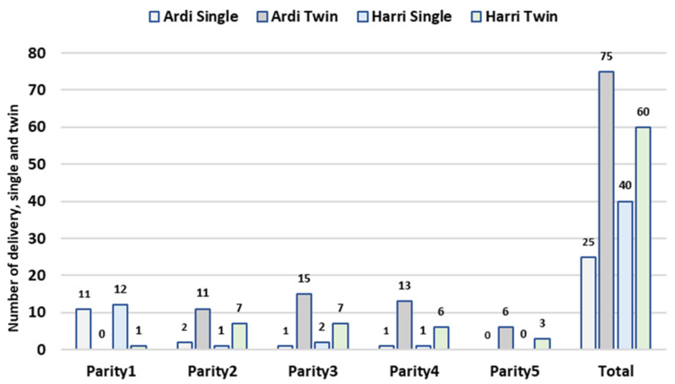

Figure 3: Single and twin over parities of Ardi and Harri goats.

Births are almost exclusively single for both breeds at parity 1. Ardi goats recorded 11 single births and 0 twins, while Harri goats recorded 12 single births and only 1 twin birth. A significant shift occurs at the second parity. For Ardi goats, twin births (11) sharply overtake single births (2). Harri goats show a similar trend, with twins (7) exceeding singles (1). Ardi goats reached their highest frequency of twin births at parity 3, with 15 sets of twins compared to only 1 single birth. Harri goats maintained a steady twinning rate through parity 2 and 3 (7 births each) before tapering off slightly. In the later reproductive stages (parities 4 and 5), single births become rare or non-existent. By parity 5, no single births were recorded for either breed, although total birth numbers decreased, likely due to a smaller sample size of older animals in the study.

The most prominent finding is the highly significant effect of days postpartum ($P < 0.001$) on the measured immunoglobulins levels. Regardless of breed, gender, or month, there is a consistent and sharp linear decline from day 1 to day 4. At day1, the immunoglobulins values are at their maximum ranging from 25.00 to 27.01 versus values at day 4, which reach their minimum ranging from 9.343 to 10.814.

The month of parturition exerted a highly significant impact ($P < 0.001$) on the immunoglobulins concentrations. Colostrum and milk samples measured in October started with significantly higher immunoglobulins levels (29.333 on day 1) compared to all other months. From November to January months, these months showed lower Igs levels (25.300–25.866 on day 1) and were statistically similar to one another ($P > 0.05$) but significantly lower than October Igs levels. These trends for months' effect on Igs levels occurred throughout the four-day period (day 1, 2, 3 and 4) of colostrum and milk samples.

Parity significantly ($P = 0.000$) influenced the Igs values. There is a significant gradual increase of Igs values from parity 1 to parity 5. The fifth parity yielded the highest Igs values throughout the four-days period. This suggests a physiological peak in Igs production or quality during the fifth lactation season.

The data suggests that the Igs profile being measured is relatively stable across Ardi and Harri goat breeds. The Ardi goats gave higher ($P > 0.08$) Igs (27.018) compared to those of Harri goats (25.00) on day 1, and they followed identical patterns through day 4. Although single male kids showed slightly higher Igs values in colostrum and milk on day 1 if compared to single female kids (25.583 vs 25.285), the difference was not statistically significant ($P = 0.080$). The twin kids showed higher ($P < 0.05$) Igs values in colostrum and milk on if compared to single female calves. The highest Igs values in colostrum and milk showed with MM twin (28.750) followed by FF twin (28.10) and FM (27.85), respectively. There is a significant interaction of parity of month ($P = 0.000$), gender ($P = 0.005$), month ($P = 0.27$), and parity ($P = 0.000$) with time whereas no significant interaction of breed with time ($P = 0.060$).

DISCUSSIONS

The effects of Ardi and Harri goat breeds, parity, birth month, and litter size on colostrum and milk immunoglobulins secretion dynamics across four days postpartum are showed in Figures 2-3 and Table 2. The findings of this study provide compelling evidence that colostrum and milk immunoglobulins secretion dynamics across four days postpartum were influenced by goat breeds and environmental factors. While our previous research has focused on immunoglobulins secretion dynamics in colostrum and milk of Majaheem and Waddah camel breeds (Alshaibani *et al*., 2026), our current study utilized data from 100 does to decipher the impacts of both goat breed (Ardi and Harri) and environmental factors on immunoglobulins secretion dynamics postpartum. Therefore, this section discusses the differences that occur in immunoglobulins secretion dynamics across four days postpartum due to goat breeds, month, parity, and kids' sex and how these insights refine our current understanding of immunoglobulins secretion dynamics postpartum and addresses the practical applications for these results.

Breed effects

The impact of breed on immunoglobulins secretion in goat colostrum and milk is a critical factor in determining the success of passive immunity transfer (Table 2). While both the Ardi and Harri are well-adapted to the Al-Ahsa environment, the higher concentration of immunoglobulins (Igs) in the colostrum and milk of Ardi goats compared to Harri goats can be attributed to a combination of genetic, physiological, and reproductive factors. Research suggests that breed-specific physiological traits can lead to significant differences in colostrum quality (Agradi *et al*., 2023; Pérez-Marín *et al*., 2023). The Ardi is the most prominent indigenous breed in the Najd region, evolved to survive extreme desert conditions. This resilience is often reflected in their milk quality, as they produce a reliable yield rich in solids and immune factors to protect kids against harsh environmental stressors. The Ardi goat is a larger-framed animal compared to the medium-sized Harri goat. Larger breeds typically have a higher metabolic capacity to synthesize and transport bioactive components, including immunoglobulins, into the milk-secreting cells (Wilde *et al*., 1986). The goat breeds known for high milk yield and milk flow parameters have a well-developed udder (Guyo and Tareke, 2025). Ardi goats, being larger-framed animals than Harri goats, often possess a larger mammary epithelial surface area, allowing for a greater density of receptors that capture immunoglobulins. A significant factor for Igs values in colostrum and milk is the difference in twinning rates between the two breeds. The data indicates that the Ardi goat has a much higher prevalence of twin births (75.0%) compared to Harri goats (60.0%). High twinning rates are often correlated with increased maternal resource allocation to ensure the survival of multiple offspring (El-Raghi and Hashem 2022). Ardi goats may have a more efficient "pull" mechanism, mediated by steroid hormones and neonatal Fc receptors (FcRn), to transport a higher volume of IgG from the bloodstream to the mammary gland to support two kids rather than one (Barrington *et al*., 2001; Mayer *et al*., 2002; Hinde *et al*., 2014).

Month of parturition

The differences in immunoglobulin (Ig) concentrations between Ardi and Harri goats across different months of parturition are largely driven by seasonal environmental stressors, nutritional availability, and the specific physiological resilience of each breed is presented in Figure 2 and Table 1. The seasonal effects of parturition on colostrum and milk composition and immunity have been confirmed in several studies of other species (Todaro *et al*., 2023; Abdelrahman *et al*., 2025). This could be related to the nutritional status of the does. Does kidding in October would have been in late gestation during the late summer, possibly on different (or supplemented) nutrition compared to does kidding in January, who gestated during the fall. The lower number of deliveries in October also suggests these could be a subset of does managed differently or bred out of the main season. Furthermore, in Al-Ahsa, the observed peak in immunoglobulin levels during October could be primarily driven by favorable climatic conditions and reduced physiological stress in goats. During this month, temperatures typically range between 21.0 °C and 36.0 °C, placing the animals within their thermoneutral zone and allowing metabolic energy to be directed toward high-quality colostrogenesis rather than thermoregulation. The stable, dry air (32% humidity) further protects maternal antibody reserves by minimizing subclinical infections, while the lower volume of deliveries in October (12) reduces competition for nutritional resources compared to the January peak (46). In contrast, the high humidity of January (42–55%) increases the effective thermal load and potential cortisol-induced stress, which can impair the efficient transport of immunoglobulins from the bloodstream to the mammary gland.

Table 1: Average high and low temperature (°C) and relative humidity (%) during the study.

Variables	Average high temperature, °C	Average low temperature, °C	Average relative humidity, %
October	36.0	21.0	32.0
November	28.0	16.0	44.0
December	23.0	11.0	55.0
January	21.0	09.0	42.0

Parity effects

The effect of maternal parity is a primary determinant of colostrum quality and the subsequent success of passive immunity transfer in goat kids (Figure 2A, B, C, D and Figure 3 and Table 2) as has been demonstrated in other species (Mendoza *et al*., 2024). In our study of 100 deliveries, they were distributed across parities 1 to parity 5 and they showed significant implications for the resulting colostrum and milk immunoglobulin values (Figure 2C and Table 2). Data from the herd indicates that nearly 76.0% of the animals are in parity 2 or higher, with a substantial core in parity 3 (25 animals out of 100).

Parity serves as a significant determinant of colostral and milk immunoglobulin (Ig) concentrations in goats, with multiparous goats generally exhibiting superior IgG content compared to primiparous goats (Buranakarl *et al*., 2021). This enhancement is primarily attributed to the cumulative antigenic exposure of older goats over successive lactations, which expands their systemic memory B-cell population and results in a more diverse and concentrated pool of circulating antibodies available for mammary transport (Ezzat-Alnakip *et al*., 2014). Furthermore, as goats progress through multiple parities, the mammary gland undergoes extensive remodeling and increased epithelial development, leading to a higher density of neonatal Fc receptors (FcRn) that efficiently pull IgG from the bloodstream (Kacskovics, 2004; Butler *et al*., 2015). While primiparous dams often prioritize their own late-stage growth, multiparous dams can allocate

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Table 2: Effects of Ardi and Harri breed, month, gender, and parity on immunoglobulins secretions dynamics across four days postpartum.

Variables	Level	Time				SEM	P value		
		Day1	Day2	Day3	Day4		Breed	Day	Interaction
Breed	Ardi	27.018^{a}	22.277^{b}	16.944^{c}	10.814^{d}	3.423	0.08	0.001	0.150
	Harri	25.000^{a}	20.281^{b}	14.937^{c}	9.343^{d}	3.406			
Month	OCT^{a}	29.333^{a}	24.583^{b}	19.750^{c}	14.833^{d}	3.784	Month	Day	Interaction
	NOV^{b}	25.866^{a}	21.066^{b}	15.500^{c}	9.266^{d}	3.772			
	DEC^{b}	25.823^{a}	21.088^{b}	15.647^{c}	9.705^{d}	3.687	0.001	0.001	0.230
	JAN^{b}	25.300^{a}	20.000^{b}	15.900^{c}	9.700^{d}	3.466			
	M^{b}	25.583^{a}	20.750^{b}	15.333^{c}	09.750^{d}	3.876	Gender	Day	Interaction
	MM^{a}	28.750^{a}	23.250^{b}	19.000^{c}	14.000^{d}	3.864	0.05	0.001	0.213
Gender	F^{b}	24.285^{a}	19.750^{b}	14.321^{c}	8.785^{d}	3.746			
	FF^{a}	28.100^{a}	22.700^{b}	16.600^{c}	09.100^{d}	3.663			
	FM^{ab}	27.785^{a}	23.071^{b}	17.857^{c}	11.750^{d}	3.854			
Parity	$Parity1^{c}$	23.409^{a}	19.227^{b}	13.727^{c}	8.727^{d}	3.743	Parity	Day	Interaction
	$Parity2^{bc}$	26.000^{a}	21.157^{b}	16.157^{c}	9.864^{d}	3.792			
	$Parity3^{b}$	27.045^{a}	22.227^{b}	16.909^{c}	10.545^{d}	3.842	0.001	0.001	0.225
	$Parity4^{ab}$	27.812^{a}	22.625^{b}	17.312^{c}	11.437^{d}	3.834			
	$Parity5^{a}$	30.600^{a}	25.400^{b}	20.000^{c}	14.600^{d}	3.982			

$^{a-d}$; values with small superscripts within the same row differ significantly at $P < 0.05$. $^{a-c}$; Levels with superscripts within the same column differ significantly at 0.05. OCT, October; NOV, November; DEC, December; JAN, January. M, Male; MM, twin male; F, Female; FF, twin female; FM, Twin male and female.

greater metabolic resources toward colostrogenesis, often resulting in higher Ig volumes, particularly in breeds like the Ardi that show a significant shift toward twin births and increased maternal investment in later parities (Akhter *et al*., 2021).

Kids sex effects

The influence of twin versus single delivery and male kid versus female kid on the concentration of immunoglobulins (Igs) in colostrum and milk is indicated in Table 2. In the study, the perfectly balanced sex ratio of 65 (50.70%) males and 63 (49.30%) females provides an ideal data set to examine whether the dam's body responds differently to the sex of the offspring it is preparing to nourish. The concentration of immunoglobulins (Igs) in goat colostrum and milk is significantly influenced by both litter size and the sex of the offspring, reflecting a complex biological strategy for maternal resource allocation. The physiological "demand" placed on the dam by twins often results in a more efficient "pull" mechanism of antibodies from the bloodstream into the mammary gland. High twinning rates are positively correlated with increased maternal resource allocation to ensure the survival of multiple offspring. Goats may exhibit a more robust transport of IgG mediated by steroid hormones and a higher density of neonatal Fc receptors (FcRn) to support two kids rather than one (Castro *et al*., 2009; Ortiz-Alegría *et al*., 2025). The higher prevalence of twin births (75.0%) in Ardi compared to the Harri (60.0%) might result in the increased drive for colostrogenesis that contributes to higher recorded Igs concentrations.

Research indicates that the sex of the newborn can program the mammary gland's output even before birth (Macias and Hinck, 2012). Interestingly, some studies in dairy animals have shown that dams producing female offspring decreased colostral protein after the first hour postpartum, and the Igs concentration had a tendency to decrease after 4 h (Angulo *et al*., 2015). In our study, the male kids resulted in higher Igs in colostrum and milk versus female kids. In many ruminant species, male newborns are often larger at birth and have higher growth rates, which can lead to a greater demand for energy and immune protection (Silva *et al*., 2024). In addition, the sex of the fetus influences the hormonal environment of the dam during late gestation, which is the critical period for colostrogenesis (Bigler *et al*., 2023). The fetal-placental unit produces different steroid hormone profiles depending on whether the fetus is male or female (Schuler *et al*., 2018). These hormones regulate the receptors in the mammary gland that "pull" immunoglobulins from the dam's bloodstream (Larson *et al*., 1980; Barrington *et al*., 2001; Mayer *et al*., 2002).

CONCLUSIONS

This study demonstrates that colostrum and milk immunoglobulins (Igs) concentrations in Ardi and Harri goat breeds are significantly influenced by a complex interplay of physiological and environmental factors. Our findings reveal that Ardi goat exhibits higher immunoglobulins secretion profiles ($P > 0.05$) in colostral/milk. Furthermore, the significant impact of sex and parity indicates that twin and multiparous goats produce more immunologically robust colostrum and milk compared to single and primiparous ones, likely due to a more developed immune memory. The observed monthly/seasonal variations highlight the importance of environmental management. Ultimately, these dynamics underscore the necessity of monitoring colostrum and milk quality during the first four days postpartum to ensure kids' survival. These insights provide a foundation for goat breeders to optimize health management protocols, particularly in harsh environments where neonatal immunity is the primary defense against diseases.

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NOVELTY STATEMENT

The article presents, for the first time, the dynamics of immunoglobulins secretion of Ardi and Harri goat breeds reared under extensive management system.

AUTHOR'S CONTRIBUTION

Habib Alkhalifah and Abd El-Nasser Ahmed Mohammed conducted the study, Habib Alkhalifah and Abd El-Nasser Ahmed Mohammed carried out the experimental design and statistical analysis of data, Habib Alkhalifah and Abd El-Nasser Ahmed Mohammed prepared the manuscript for publication.

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Generative AI and AI assisted technology statement

The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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