Research Article

Refractometer Immunoglobulins and Glucose Values in Colostral/ Milk and Urine of Majaheem and Waddah Camels and their Respective Calves

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Abstract | Adequate passive transfer of immunoglobulins from dams' colostrum to their respective newborns has been confirmed in blood serum after parturition of ruminant species. This study aimed to evaluate the concentrations of immunoglobulins (Igs), and glucose in colostrum/milk and urine of Majaheem and Waddah she-camels and their transfer to calves' urine across two weeks of normal suckling. Colostral/milk and urine samples were collected from 20 she-camels (10 Majaheem and 10 Waddah) and their respective calves' urine across days 1, 2, 3 and 15 postpartum. The colostral/milk and urine samples of she-camels and their respective calves underwent refractometer immunoglobulins, and glucose evaluation to identify their transfer and metabolism to calves' urine over suckling Majaheem and Waddah colostral/milk during two weeks postpartum. Furthermore, total protein and uric acids values of Majaheem and Waddah urine in addition to uric acids of their urine respective calves were evaluated. The concentrations of immunoglobulins (Igs) in the mammary secretions of both Majaheem and Waddah camels showed a significant and progressive decline from the first day of parturition till day 15 of lactation versus calves' urine immunoglobulins values ($P < 0.001$). Majaheem exhibited significantly higher immunoglobulins values of colostral/milk or urine compared to Waddah across days 1, 2, 3 and 15 postpartum ($P < 0.001$). In contrast, Majaheem exhibited lower glucose values of colostral/milk or calves' urine compared to Waddah across days 1, 2, 3 and 15 postpartum ($P < 0.009$). Furthermore, total protein and uric acid values were higher in Majaheem urine if compared to those of Waddah ones whereas uric acid values in calves' urine were undetected. In conclusion, Majaheem breed prioritizes colostral/milk immunological quality while Waddah camels prioritizes energy availability through high glucose values in colostral/milk. The strong correlation between colostral/milk immunoglobulins values and calf urinary excretion highlights the immediate impact of maternal nutrition on neonatal health immunity.

Keywords | Camels, Colostrum, Immunoglobulins, Passive immunity, Glucose, Uric acid

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INTRODUCTION

The dromedary camel (*Camelus dromedarius*) is a cornerstone of livestock production in arid regions, specifically in the Arabian Peninsula, where it has evolved unique physiological mechanisms to thrive under extreme environmental stress. Among the various breeds, the Majaheem and the Waddah represent two of the most significant genetic lineages in Saudi Arabia (Alshaibani *et al.*, 2026). Beyond their importance as sources of transportation and nourishment, camel milk and urine have been utilized for centuries in ethnomedicine across the Middle East and North Africa (Amina *et al*., 2024). Camel milk and urine has been historically administered for the treatment of various conditions, ranging from gastrointestinal disorders and skin infections to more complex metabolic and oncological diseases (Tharwat *et al*., 2023; Mohammed and Alshaibani 2025a, b). While traditional claims are abundant, modern pharmacology is only recently beginning to decipher the molecular basis for these purported therapeutic effects (Mohammed *et al*., 2025a, b, c; Alshaibani and Mohammed, 2026; Alshaibani *et al*., 2026). Despite their cultural and economic importance, breed-specific differences in their metabolic and immunological profiles during the periparturient period remain insufficiently explored.

The transition from pregnancy to lactation, known as lactogenesis, is a complex physiological phase characterized by dramatic hormonal shifts, primarily the withdrawal of progesterone and the surge of prolactin and cortisol hormones (Neville *et al*., 2001). This period is marked by the production of colostrum, a nutrient-dense fluid essential for the survival of the calves (Salamończyk and Krysiak, 2024; Yang *et al*., 2025). Unlike many other mammals, camel calves are born agammaglobulinemic and rely entirely on the passive transfer of immunity through colostral immunoglobulins (Igs) to survive the first weeks of life (Kamber *et al*., 2001).

Simultaneously, the metabolic demand for glucose spikes during early lactation (Cattaneo *et al*., 2023). Glucose serves as the primary precursor for lactose synthesis, which in turn regulates milk volume via osmotic pressure (Lin *et al*., 2016). Interestingly, the glucose appears not only in the camel mammary secretions but also in the maternal urine. Hydrated camels maintained glycemic stability by readily voiding surplus glucose in their urine. However, during water deprivation, urinary glucose excretion was suppressed, leading to a substantial rise in blood glucose levels (Yagil and Berlyne, 1977).

While the general composition of camel colostral/milk has been studied (Alhassani, 2024; Faustini *et al*., 2025), there is a lack of comparative data regarding how different breeds distribute resources between immunity (proteins/Igs) and energy (glucose). Furthermore, the correlation between what is secreted in the colostral/milk and what is excreted in the urine of the calf provides a unique "metabolic window" into the efficiency of nutrient absorption and neonatal renal maturation and immunity. Therefore, this study was designed to investigate the changes in immunoglobulins and glucose across three compartments; the colostral/milk, the maternal urine, and the calf urine. By comparing the Majaheem and Waddah breeds over the first 15 days of life, we aim to establish whether breed-specific strategies exist for calf support and to determine if urinary markers can serve as a non-invasive proxy for assessing colostrum quality and calf health.

MATERIALS AND METHODS

Experimental design and ethical approval

This study was designed to investigate the changes in immunoglobulins, glucose and uric acid values across three compartments; the colostral/milk, the maternal urine, and the calf urine between Majaheem and Waddah camel breeds (Figure 1). Majaheem and Waddah she-camel of multiparous, 3–4 lactations were raised under extensive management system and they were fed on extensive grazing system in addition to berseem hay. During the observation period, environmental conditions remained relatively stable, with an average temperature of 29.0 ± 2.30°C and a relative humidity of 35 ± 8.0%. The protocol of study was approved by the King Faisal University ethical committee [KFU-REC-2026-SEP-EA255]. The colostrum and urine samples of Majaheem and Waddah she-camels and their respective calves were collected from October to November 2025 and were analyzed in the animal and fish production department of Agriculture and Food Sciences College, King Faisal University.

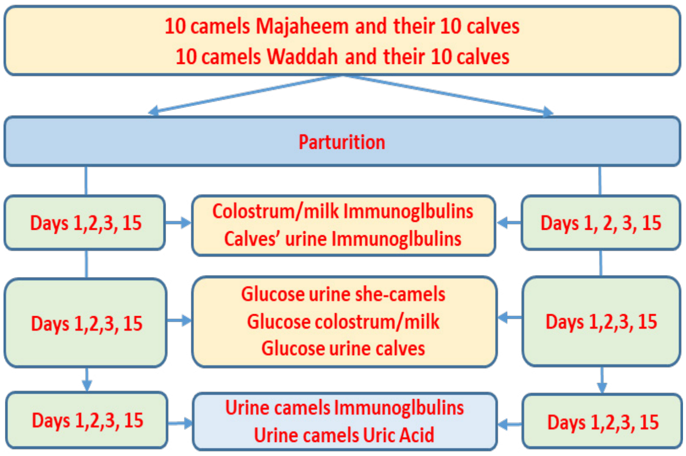

Figure 1: Experimental design, colostrum and urine collection, colostrum and urine chemical analyses.

Colostrum and urine collection

Camel colostral/milk samples of Majaheem and Waddah she-camels were collected after parturition, before suckling of calves for days 1, 2, 3 and 15 days. Colostral/milk was collected using a sterile hand-milking technique into pre-labeled, plastic containers. To ensure the safety of the handlers, the she-camels were calmly restrained. Pre-milking hygiene involved washing the udder and teats with warm water and drying them with a fresh towel. The first few colostral/milk drops were discarded and colostral/milk samples (50 ml) were collected from the first milking postpartum and subsequently for days 2, 3 and 15 days. Camel urine samples of Majaheem and Waddah she-camels and their calves were collected through skilled attendants to monitor the camel, especially in the early morning or during feeding for days 1, 2, 3 and 15 days. When the camel begins to urinate, the attendant quickly places a sterilized plastic container underneath to catch the stream. The collected colostral/milk and urine samples were monitored immediately for determination of refractometer immunoglobulins (Igs), and glucose values. Thereafter, the colostrum and urine are labeled, sealed, and freezed to preserve their quality for further analyses.

Immunoglobulins analysis of colostral/milk and urine

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

Glucose, total protein, and uric acid of colostral/milk and urine

The colostral/milk and urine glucose values were recorded using blood glucose meter (ICare, Taiwan). Ten µl of colostral/milk or urine sample put on ICare glucose strips for recording colostral/milk and urine glucose values (Mohammed *et al*., 2025). Values of total protein of she-camels' urine were evaluated using refractometer using 2–3 drop aliquot was applied to the prism via a disposable pipette (Clinical Refractometer, SCHUCO Japan 5711-2020). The uric acid values of urine she-camels and their respective calves were determined through uric acid meter (BeneCheck). Ten µl of urine sample put on BeneCheck uric acid strips for recording urine uric acid values.

Data statistical analysis

The immunoglobulins (*Brix refractometer*), glucose and uric acid values for colostral/milk and urine samples of Majaheem and Waddah she-camels and their respective calves were compared (SPSS version 27.0). The data were subjected to statistical analysis of ANOVA repeated measures for breed (Majaheem vs. Waddah) and days (days 1, 2, 3, 4 and 15) using the General Linear Model (SPSS version 27.0). Comparison between the two groups considered statistically significant at $p < 0.05$.

RESULTS

The results of immunoglobulins (Brix refractometer %), and glucose values for colostral/milk and urine samples of Majaheem and Waddah she-camels and their respective calves were presented in tables (Tables 1-3).

Immunoglobulins secretion dynamics in colostral/milk and urine

Immunoglobulins (Brix refractometer, %) secretion dynamics at days 1, 2, 3 and 15 in Majaheem and Waddah colostral/milk and urine of dams and their respective calves are presented in Table 1. The concentrations of immunoglobulins (Igs) in the mammary secretions of both Majaheem and Waddah camels showed a significant ($P < 0.001$) and progressive decline from the first day of parturition till the first two weeks of lactation. Throughout the two weeks period, the Majaheem breed maintained significantly higher concentrations of Igs compared to the Waddah breed. Majaheem colostrum exhibited a peak Igs concentration of 29.50%, whereas Waddah colostrum recorded 25.70% at day 1. By the end of the observation period (day 15), Majaheem Igs colostrum remained higher (08.40%) than those of the Igs colostrum Waddah (7.10%). The most dramatic reduction in Igs occurred within the first 72 hours, marking the transition from colostrum to transitional milk. Between day 1 and day 3, Igs dropped by approximately 36% in Majaheem and 37% in Waddah colostral/milk. By day 15, the levels in both breeds had decreased to roughly one-fourth of their initial day 1 values, representing the shift toward mature milk production. While both breeds follow an identical physiological trend of decreasing Igs concentration over time, the Majaheem dams provides a significantly higher "immunological dose" to their calves at every stage of early lactation.

In addition, the study monitored the excretion of immunoglobulins (Igs) in the urine of calves from day 1 to day 15. The data revealed a significant ($P < 0.001$) and steady increase in urinary Igs concentrations as the calves matured, with notable differences between the two breeds at every sampling point (Table 1). Unlike the colostrum concentrations which peaked at birth, urinary Igs in both Majaheem and Waddah calves started at very low levels and increased significantly over the 15-days period. At day 1, Igs excretion was minimal, with Majaheem calves at 0.31 mg/mL and Waddah at 0.25 mg/mL. At days 2 and 3, Majaheem calves' urine also showed significantly higher Igs levels compared to Waddah ones, likely reflecting the higher Igs intake they received from Majaheem colostral/milk. At day 15, Igs levels rose sharply to 5.40 mg/mL in Majaheem calves' urine and 4.54 mg/mL in Waddah ones.

Majaheem calves excreting approximately 19.0% more Igs in their urine than Waddah calves at day 15.

Urine total protein and uric acids

The results of urine total protein and uric acid values revealed distinct patterns between the she-camels and their respective calves, with significant breed-specific variations observed in the she-camels (Table 2). There was a significant difference in total protein and uric acid concentrations between the two breeds. Majaheem she-camels exhibited significantly higher total protein ($P < 0.01$) and uric acid ($P < 0.02$) levels compared to Waddah ones. In contrast to the she-camels, the uric acid levels in the calves' urine of both breeds were markedly lower, falling below the detection threshold (< 0.18 mg/dL).

Table 1: Immunoglobulins (Brix, %) secretion dynamics of Majaheem and Waddah colostral/milk across days 1, 2, 3 and 15 postpartum.

Parameter	Breed	Time				SEM	P value		
		Day 1	Day 2	Day 3	Day 15		Breed	Time	Breed × Time
Colostral/milk	Maj	29.5^{a}	24.4^{b}	18.9^{c}	8.4^{d}	1.02	0.001	0.001	0.163
	Wad	25.7^{a}	21.2^{b}	16.3^{c}	7.1^{d}				
Calves' urine	Maj	0.31^{c}	0.69^{c}	1.83^{b}	5.40^{a}	0.28	0.021	0.001	0.580
	Wad	0.25^{c}	0.56^{c}	1.69^{b}	4.54^{a}				

^{a,b} Values between Majaheem and Waddah camel groups in the same row with different superscripts significantly differ at $P < 0.05$. Maj, Majaheem; Wad, Waddah; SEM, standard error of means.

Table 2: Urine total protein, and uric acids of Majaheem and Waddah camels and their respective calves across days 1, 2, 3 and 15 postpartum.

Parameter	Breed	Time				SEM	P value		
		Day 1	Day 2	Day 3	Day 15		Breed	Time	Breed × Time
Total protein, g/dL	Maj	3.76^{a}	3.80^{a}	3.72^{a}	3.85^{a}	0.31	0.01	0.52	0.653
	Wad	3.50^{b}	3.40^{b}	3.62^{b}	3.42^{b}				
Camels uric acids, mmol/L	Maj	0.41^{a}	0.39^{a}	0.42^{a}	0.43^{a}	0.05	0.02	0.41	0.542
	Wad	0.37^{b}	0.34^{b}	0.36^{b}	0.35^{b}				
Calves uric acids, mmol/L	Maj	< 0.18	< 0.18	< 0.18	< 0.18	-	-	-	-
	Wad	< 0.18	< 0.18	< 0.18	< 0.18				

^{a,b} Values between Majaheem and Waddah camel groups in the same row with different superscripts significantly differ at $P < 0.05$. Uric acid standard detection range, 0.18- mmol/L; Maj, Majaheem; Wad, Waddah; SEM, standard error of means.

Table 3: Glucose secretion dynamics (mg/dl) of Majaheem and Waddah colostral/milk and urine across days 1, 2, 3 and 15 postpartum.

Parameter	Breed	Time				SEM	P value		
		Day 1	Day 2	Day 3	Day15		Br.	Time	Br.× Time
She-camels' urine (No. of samples)	Maj	26.50^{b}	30.83^{a}	25.33^{b}	21.55^{c}	1.29	0.009	0.001	0.446
		(6/10)	(6/10)	(6/10)	(6/10)				
	Wad	28.33^{b}	34.33^{a}	31.00^{b}	23.51^{c}				
		(6/10)	(6/10)	(6/10)	(6/10)				
Colostral/milk (No. of samples)	Maj	19.12^{a}	14.62^{b}	14.12^{b}	10.78^{c}	3.78	0.001	0.003	0.466
		(3/10)	(3/10)	(4/10)	(3/10)				
	Wad	27.97^{a}	18.62^{b}	16.62^{b}	13.42^{c}				
		(4/10)	(3/10)	(3/10)	(3/10)				
Calves' urine (No. of samples)	Maj	14.950^{a}	13.62^{ab}	12.45^{ab}	11.40^{b}	2.02	0.05	0.012	0.658
		(3/10)	(4/10)	(4/10)	(3/10)				
	Wad	16.800^{a}	14.45^{ab}	14.28^{ab}	10.76^{b}				
		(4/10)	(4/10)	(3/10)	(3/10)				

^{a,b} Values between Majaheem and Waddah camel groups in the same row with different superscripts significantly differ at $P < 0.05$. Br. Breed. SEM standard error of means. Maj, Majaheem; Wad, Waddah; Glucose standard detection range, 10–600 mg/dL.

Glucose secretion dynamics in colostral/milk and urine

The analysis of glucose presence in the colostral/milk and urine of Majaheem and Waddah she-camels and their respective calves' urine across the experimental period revealed significant fluctuations influenced by both postpartum days and the camel breed (Table 3).

She-camels urine glucose

There was a significant ($P < 0.001$) temporal effect on urinary glucose levels for both Majaheem and Waddah breeds. While both breeds followed a similar physiological trend, the Waddah breed appeared to exhibit a more pronounced glycosuric response during the peak days (day 2 and day 3) than the Majaheem breed. A significant decrease was observed by day 15, where levels dropped to their lowest values (21.60 for Majaheem and 23.6 mg/dL for Waddah). The number of detected samples also decreased over time, from 12/20 on days 1-3 to 6/20 by day 15 for both breed.

Colostral/milk glucose

The concentrations of glucose in the colostral/milk of she-camels showed significant variations influenced by days ($P < 0.003$) of lactation and the Majaheem and Waddah breeds ($P < 0.001$). The highest glucose concentrations were recorded on day 1 (colostral phase), with an overall mean of 32.65. Thereafter, glucose levels dropped significantly by day 2 (23.30) and continued to decline steadily. By day 15, glucose levels reached its lowest concentration, with an overall mean of 16.65. The Waddah breed exhibited significantly higher colostral/milk glucose levels compared to the Majaheem breed throughout the study. The number of positive samples (glucose detection) remained relatively stable but low, ranging from 6/20 to 7/20 of total samples per day. This suggests that while the concentration of glucose is high in some individuals, it is not detected in all she-camels across the group.

Calves' urine glucose

The analysis of urinary glucose in calves demonstrated a general downward trend over the first 15 days, with minimal variation observed between the two breeds. There was a significant effect of days postpartum on the concentration of glucose in the calves' urine.

The highest calves' urine glucose levels were recorded on day 1 for both Majaheem and Waddah groups. A steady decrease of calves' urine glucose was observed as the calves aged. By day 15, the calves' urine glucose levels had dropped significantly to their lowest recorded values (14.3 for Majaheem and 14.6 for Waddah). The frequency of glucose detection in the calves' urine remained remarkably constant throughout the study. On almost every sampling day, glucose was detected in 7 out of 20 calves (35% of the total samples), indicating that glycosuria in neonatal calves is a consistent physiological feature for a specific subset of the group during the early postnatal period.

DISCUSSIONS

The results presents the physiological relationship between immunoglobulins and glucose colostral/milk secretion dynamics and calves' urine excretion in Majaheem and Waddah camels, focusing on the first 15 days postpartum (Tables 1-3). The results clearly show that Majaheem camels prioritize protein and immune components (Tables 1-2), while Waddah camels show a higher glycemic profile in colostral/milk and urine (Table 3). The significantly higher levels of protein and immunoglobulins in Majaheem suggest a superior colostrum quality regarding passive immunity (Alshaibani and Mohammed, 2025). This may be due to genetic selection or the breed's adaptation to different environmental stressors, requiring a more robust initial immune transfer to the calves. The Waddah breed showed significantly higher glucose in colostral/milk and urine. This suggests either a higher rate of gluconeogenesis in Waddah she-camels or a more permeable mammary barrier during the first 15 days of lactation.

The passive immunity of camel calves is a fascinating biological process that is strictly colostrum-dependent, as the unique structure of the camel epitheliochorial placenta prevents the transfer of antibodies from the mother to the fetus during pregnancy (James *et al*., 2022). Camel calves are born agammaglobulinemic and they rely entirely on the ingestion of colostrum within the first 12–24 hours of life (Kamber *et al*., 2001). Diseases of the gastrointestinal tract account for approximately one-third of dairy calf all deaths and over half of all clinical illnesses, with symptoms typically emerging within the first two weeks of life (Urie *et al*., 2018). Thiakunu *et al*. (2025) found that gross camel calf mortality was found to be 44.11% including microbial diseases. They recommended that increasing the suckling period and the amount of milk consumed were associated with reduced morbidity and mortality from microbial diseases. This is attributed to improved calf immunity. Consequently, identifying bioactive compounds that support neonatal intestinal health represents a critical strategy for reducing the high morbidity and mortality rates (Kamber *et al*., 2001; Albarrak and Al-Sobayil, 2024).

Immunoglobulins secretion dynamics in colostrum/milk and urine

Immunoglobulins secretion dynamics in colostral/milk and urine is presented in Table 1. There is a gradual decrease in immunoglobulins values of camel colostral/milk from day 1 to day 15 postpartum. The immunoglobulins values

(Brix %) were higher of Majaheem colostral/milk if compared to Waddah ones. The highest concentration of camel colostrum immunoglobulins is found immediately after birth and gradually decreased till day fifteen postpartum in Majaheem and Waddah breeds (Alshaibani *et al*., 2026). As the mammary gland transitions from producing colostrum to mature milk, the concentration of proteins, specifically IgG, is diluted by increasing milk volume (Akhter *et al*., 2020). The camel calf is born agammaglobulinemic without antibodies. These results underscore the importance of feeding colostrum within the first 24 hours, as the quality drops significantly by day 3, potentially leaving the calf vulnerable to pathogens. The finding that Majaheem camels produce colostrum with significantly higher immunoglobulins values than Waddah camels is a significant observation for herd management and "colostrum banking." This suggests that the Majaheem breed may have a superior genetic predisposition for immunoglobulin transfer into colostrum (Alshaibani *et al*., 2026).

The presence of immunoglobulins (Igs) in the urine of camel calves is a fascinating physiological phenomenon often referred to as transient neonatal proteinuria (Skrzypczak *et al*., 2021). While in adults, protein in the urine often signals kidney issues, in newborns, it is a hallmark of successful colostrum absorption and renal adaptation (Smith and Little, 1924). A gradual increase in immunoglobulins in camel calves' urine from day 1 to day 15 postpartum is a significant finding that typically indicates the maturation of the immune system and the transition from passive to active immunity. In the first 24–48 hours, the camel calf is "passive." It only has the antibodies it absorbed from the dam's colostrum. The gradual increase in urine immunoglobulins observed from day 1 to day 15 postpartum in both Majaheem and Waddah calves suggests a transition from the passive acquisition of maternal immunity to the initiation of the calf's own immunological surveillance (Yang *et al*., 2025). In addition, the sustained immunoglobulins rise in urine calves may be attributed to the unique secretion of low molecular weight antibodies, which are filtered more efficiently as the glomerular filtration rate increases during the first two weeks of life (Skrzypczak *et al*., 2021).

Uric acid secretion

Uric acid secretion in urine of Majaheem and Waddah she-camels and their respective calves is presented in Table 2. While she-camels excrete measurable amounts of uric acid as a byproduct of microbial protein synthesis and purine metabolism, the calves have not yet developed these metabolic levels likely due to their relying on a colostrum/milk. The higher uric acid in Majaheem she-camels correlates with their serum higher protein levels if compared to Waddah ones (Alshaibani and Mohammed, 2025). Uric acid is a byproduct of purine metabolism; its elevation, combined with high total protein, suggests that Majaheem camels have a higher rate of protein synthesis and turnover during the colostral phase than Waddah camels. The low uric acid in calves (< 0.18 mmol/L) indicates that despite the high protein intake from colostrum, the calves' internal protein metabolism has not yet ramped up, as they are primarily in a growth state.

Glucose secretion dynamics in colostrum/milk and urine

Glucose secretion dynamics in colostrum/milk and urine of Majaheem and Waddah she-camels and their respective calves is presented in Table 3. The glucose values in colostral/milk and calves' urine demonstrated a general downward trend over the first 15 days of life. Around the time of parturition, camels experience a surge in cortisol. This triggers hyperglycemia (Hussen and Althagafi, 2025). When blood glucose exceeds the renal threshold, it spills into the urine. Simultaneously, during "lactogenesis II" the tight junctions in the mammary gland are not yet fully sealed (Geddes *et al*., 2021). This allows the high systemic blood glucose to pass directly into the colostrum/milk. The results suggest that maternal urinary glucose levels can serve as a physiological mirror of the energy available in the colostrum.

The detection of glucose in 37.5% (13/40) of colostrum/milk samples and 40.0% (14/40) of calves' urine samples 60.0% (24/40) of she-camels urine and 32.5% (13/40) colostrum/milk samples is not a coincidence. The presence of glucose values in calves' urine samples is a direct consequence of colostrum/milk intake. The findings of Fischer-Tlustos et al. (2020) demonstrate that colostrum and transition milk contain elevated concentrations of certain oligosaccharide compared with mature milk.

CONCLUSIONS

In conclusion, this study demonstrates that the first 15 days postpartum represent a critical physiological transition for both the Majaheem and Waddah she-camels and their respective calves. The Majaheem camel breed exhibits an "immunological priority," providing superior colostrum quality/milk with high immunoglobulin concentrations essential for the successful transfer of passive immunity. The Waddah camel breed displays a "glycemic priority," characterized by significantly higher glucose levels in mammary secretions, suggesting a more robust gluconeogenic response to meet the immediate energy demands of the calf. Further research is still required to explore the long-term impacts of these breed-specific metabolic strategies on the growth performance and future milk production of the offspring.

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NOVELTY STATEMENT

The article presents, for the first time, the dynamics of immunoglobulins secretion in urine of Majaheem and Waddah camel breeds reared under extensive management system.

AUTHORS CONTRIBUTION

NA conducted the study. AAM carried out the experimental design and statistical analysis of data. NA and AAM prepared the manuscript for publication.

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Generative AI and AI-assisted technology statement

No generative AI tools were used for the data analysis, writing, or conceptual development of this manuscript.

Conflict of interest

No conflict of interest for authors to declare.

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