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Effect of Some Factors on Colostrum composition of Friesian Cows in Egypt

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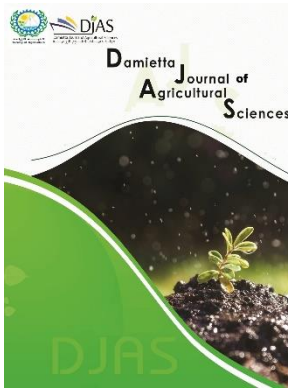

ABSTRACT

This study aimed to investigate the factors affecting composition of colostrum. This work was carried out at El-Karada farm belonging to Animal Production Research Institute. The means for percentages of fat (F %), protein (P %), lactose (Lac %), solid non-fat (SNF %) and total solids (TS%) were 6.27±0.20, 14.04±0.44, 2.7±0.12, 19.69±0.57 and 25.92±0.69, respectively. Parity had highly significant (P<0.05) effects on the above studied traits, which the highest of colostrum composition was in first lactation. Also, season of calving was highly significant (P<0.05) effects on F %, P%, SNF % and TS%. The opposite is true for the effect of season of calving on Lac%. Likewise, the postpartum time has highly significant (P<0.05) effects on aforementioned traits as postpartum time increases F%, P%, SNF% and TS% decreased, vice versa for Lac%. Therefore, it is important to quickly give newborn calves colostrum in order to increase the speed of benefits and raise the immunity of newborn Friesian calves.

Key words: newborn Friesian calves, colostrum composition, parity and postpartum time

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INTRODUCTION

Friesian cows in Egypt play a vital role in enhancing the productive performance of Egyptian Baladi cows, ultimately leading to increased profitability in the dairy industry. Over the past years, the importance of Friesian cows in Egypt for both milk and meat production has been underscored (Ghazy et al., 2024). Colostrum is the initial secretion from the mammary glands of mammals immediately following parturition (calving). It differs significantly from regular milk in its composition, being particularly high in immunoglobulins (antibodies). These antibodies are vital for protecting the newborn, it's crucial for providing passive immunity and promoting the newborn's health and development (Playford and Weiser, 2021). The first weeks of life are a critical period in the development of the newborn calf as it is very susceptible to various pathogens. Which, newborn calves are agammaglobulinemic and rely for their first immune protection almost entirely on the transfer of immune constituents through the first ingested colostrum. These are due to the cows, just like other ruminants, have an epitheliochorial placenta which prevents the transfer of passive immunity to the neonate during gestation (Godden et al., 2019). Continuity, Westhoff et al. (2024) indicated that the individual and seasonal, variability of colostrum production showed the association between individual animal factors such as parity, as well as indicators of the dairy cow's metabolic status and the production and composition of colostrum. Palczynski et al. (2020) reported that many studies have been conducted to define optimal management strategies for colostrum feeding. Farmers, veterinarians and feed advisors have adopted the "Three Q's" as a general guideline for providing colostrum: Quantity, Quality and Quickness of feeding. In addition, sometimes two "Q's" are added: "Quantifying the transfer of immunoglobulins" and "s Quealy clean. The optimal colostrum (IgG) can be achieved by milking colostrum directly after calving. Aright, measuring the colostrum quality and/or weighing the newborn calf and adjust the volume of feeding accordingly to

indemnify optimal colostrum intake for each calf (Robbers et al., 2021). The variation of colostrum quality was depending on some factors such as age of cow, race and colostrum volume. As well, when the producer's application of certain agents (Godden, 2008 and Gulliksen et al., 2008). Some recent studies reported the importance of colostrum in raising healthy calves (Lombard et al., 2020; Abuelo et al., 2021 and Sutter et al., 2023). Because cotyledonary epithelial bovine placenta inhibits the transfer of dairy cow antibodies into the fetal circulation, newborn calves depend on timely intake of high-quality colostrum with low bacterial contamination for passive immune transfer, as well as for nutrients and other bioactive components (Lopez and Heinrichs, 2022). Environmental factors, such as the season of calving and the temperature–humidity index, have been proven to have an impact. There are contradictory results regarding immunoglobulin concentrations, whereas other factors (e.g., management-related and cow-related factors) seem to have stronger effects (Gulliksen et al., 2008 and Zentrich et al., 2019). Seasonality was also observed for colostrum fat, protein and lactose components in samples collected with greater concentrations of fat in spring (March–May), and protein in autumn (September–November) and winter (December–February) lactose in autumn, winter and spring (Soufleri et al., 2021). Roy et al. (2020) suggested that the colostrum is define on the initial mammary secretion post-parturition, bestowing a complete nutritional profile and bioactive compounds vital for best nutrition and promoting the growth, development, and immunological defense of newborns calves. Besides, that the composition, structure and physicochemical properties of colostrum fluctuate significantly across vary species. Linehan et al. (2023) explicated that the bovine colostrum contains a variety of bioactive components suitable for the development of functional foods, nutraceuticals and drugs with veterinary and human health applications. Werner (2003) colostrum composition effect by many factors, such as the time passed from calving, parity, age of the animal, feeding, and dry period of cows. Newborn calves require fat and protein for energy and muscle development, likewise, growth factors and many other nutrients that are available in colostrum (Quigley and Drewry, 1998). The newborn calves have relatively low of energy reserves (Morrill et al., 2012). The fat percentage of colostrum is major than that of milk (Abd El-Fattah et al., 2012 and Wieczorek, 2013). Johnsen et al. (2019) showed that the newborn calves can ably finding the udder of dam and suckling independently, there is no direct advantage of routinely hand feeding colostrum although level of herd factors (e.g. management, feeding etc.) on organic dairy farms may be play an important role. The present study aimed to identify some factors affecting colostrum composition of Friesian cows in Egypt.

MATERIALS AND METHODS

Data and Management

The current work was carried out at El-Karada Animal Production Research Station belonging to Animal Production Research Institute (APRI), Agricultural Research Center, Ministry of Agriculture in co-operation with Department of Animal Production, Faculty of Agriculture, Damietta University during years 2018 and 2019. Cows were fed to cover the recommended requirements according to NRC (2001). Animals were fed in groups that were assigned according to life body weight and pregnancy stage. Water was available for animals all time day round. None of the calves suckled from their dam before they were separated after birth. Calves were weighed and housed in individual rice straw bedded pens. The dams were milked and the time from calving until the first milking was recorded, also dam parity and the calving date were recorded. The calves were fed colostrum through a nipple bottle (colostrum produced from their Dams). The time from birth until the first feeding and colostrum volume were recorded. After that all calves were fed individually on milk at a rate of 10% of body weight given in two meals for six weeks. The milk allowances were reduced gradually until weaning at about 15 weeks of age. Calf starter and berseem hay (high quality) were available in front of calves from the beginning of the third week of age. While fresh and clean drinking water was available in front of them from the third day of age.

Colostrum samples and analysis

Colostrum samples of each dam were taken from the first milking used for the first feeding of the calf (first day), the second sample was taken at 24h (second day) and third d samples at 48 h (third day) for 120 cows, but the samples analyzed from 36 animals during the years (2018 and 2019). Colostrum samples stored frozen at -20 C until analyzed. Before analysis, all samples were thawed at room temperature and then were diluted by adding distilled water to reduce sample viscosity and prevent technical difficulties encountered with highly viscous samples. After analysis, the dilution was multiplied by the dilution factor to convert the concentration to the pre-dilution value. Colostrum compositions were determined by using Milko-Scan.

Statistical analysis:

The study data were organized by the software Excel® (Microsoft Corporation, USA) and analyzed

by General Linear Model (GLM) using SAS software (2002) to determine the effect of calving season (spring, winter, fall, and summer) and parity (1 to ≥3), time of postpartum colostrum sample collection, year of year (2018 and 2019), Gender of newborn calf (male and female), weight of newborn calf (≤25 kg, 26- 35 and ≥36) and cow weight at calving (≤450, 451- 500 and ≥501) on studied traits (percentage of fat, protein, total solids, solid nonfat and lactose). Duncan's new multiple range test (Duncan, 1955) was used at a significance level of (P≤ 0.05) to compare between pairs of means. Values are presented as mean ± standard error.

RESULT AND DISCUSSION

Unadjusted means

The present means of F%, P%, Lactose%, SNF% and TS were 6.27%, 14.04%, 2.7%, 19.69%, 25.92%, respectively, are given in Table (1). The present results close to antecedent studies, Soufleri et al. (2021) in Holstein dairy cows, indicated that the means of F%, P%, Lactose% and TS% in colostrum were 6.37%, 17.83%, 2.15% and 25.8, respectively. Soufleri et al. (2023) reflected the means for TS%, P%, F% and Lactose % in colostrum of Holstein cows were 25.8%, 17.8%, 6.4% and 2.1%, respectively. As well as, Dunn et al. (2017) declared the means of F%, P% and Lactose % were 6.40%, 14.0% and 2.7%, respectively in colostrum of cows in Northern Ireland. Godden (2008) denoted that the mean of F%, P%, Lactose % and TS% in colostrum of Holstein cows was 6.70, 14.0, 2.7 and 23.90, respectively. Kehoe et al. (2007) reported that the mean of F%, P%, Lactose % and TS% in colostrum were 6.70, 14.92, 2.49 and 27.64, respectively.

Table 1. Means and standard error (SE) for studied traits under investigation in Friesian cows

Items	Colostrum		
Traits	Mean ±SE	Max.	Min.
F %	6.27±0.20	8.30	3.23
P %	14.04±0.44	24.06	4.95
Lact %	2.7±0.12	6.90	0.87
SNF %	19.69±0.57	32.60	7.44
TS %	25.92±0.69	41.86	11.7

Fat percentage (F %), Protein percentage (P %), Lactose percentage (Lact %), Sold nonfat (SNF %), Total solids percentage (TS %).

Some recent researchers explained that the means for the same traits in colostrum were lower than the current study, such as, Salar et al. (2021) showed that the mean of F%, P % and TS% were 6.11%, 12.91% and 23.33%, respectively in Holstein cows. Continuity, the present mean of total solid was higher than finding of Yaylak et al. (2017) on Holstein cows (21.74%) and Georgiev (2005) (18.7- 19.3%). While, the current results were lower than findings Kehoe et al. (2007) was (26.6). Also, the current mean of fat % was lower than findings by Abd El-Fattah et al. (2012) (9.4%) and Yaylak et al. (2017) (6.89±0.424). Dimitrovska (2021) in Holstein Friesian, the means of milk protein, fat, lactose and dry matter in the milk of first lactation were 3.14%, 3.25%, 4.46 %, 11.48%. But in second lactation were 3.21%, 3.29%, 4.39% and 11.68%%, respectively. Milk in second lactation had a higher concentration of protein, more fat and total solids than milk in first lactation. The means of composition milk of cows in Egypt includes roughly 3.48% P% and 4.14% fat (Soliman, 2005).

Factors affecting colostrum composition

Parity (number of lactation)

The current study cleared that the fat, protein, total solids and solid non-fat percentages in colostrum measured were significantly higher in the first parity than in others parity are given in table (2). The present results agree with observed by Zarei et al. (2017) who found that fat percentage was significantly higher in the first parity than in others parity in Holstein cows. Contrariwise for the highest protein content was recorded with older cows. However, Abdoon Mohamed (2015) reported the significant impact of parity on colostrum components. Salama et al. (1997) indicated that colostrum protein and total solids were higher in primiparous buffalo cows compared with multiparous buffalo cows. Conversely, the current results are not consistent with the findings by Morrill et al. (2012) the protein content in colostrum samples collected from different breeds did not significantly across the parities. Also, Yaylak et al. (2017) indicated that parity had no effects on colostrum components.

The present results indicated that the parity significant effect on lactose percentage, which the Lactose% increase with increased parity. Zarei et al. (2017) indicated that lactose percentage was significantly higher in the first and second lactations.

Table 2. Effect of parity on studied traits under investigation

Items	Parity			P value
	1St	2cd	3rd	
F %	6.85^{a} ±0.70	5.98^{b}±0.46	5.50^{b}±0.32	<.0001
P%	14.80^{a}±0.71	14.19^{b}±0.87	13.48^{c}±0.70	<.0001
Lact %	2.88^{b} ±0.20	2.98^{ab} ±0.25	3.01^{a}±0.16	0.0244
TS%	27.94^{a} ±1.05	26.70^{b} ±1.80	25.53^{c}±0.95	<.0001
SNF %	21.09^{a}±0.86	20.16^{b}±0.99	19.73^{c}±0.75	<.0001

Fat percentage (F %), Protein percentage (P %), Lactose percentage (Lact %), Sold nonfat (SNF %), Total solids percentage (TS %).

Season of calving

The current results indicated that the percentage of fat, protein, total solids and sold non-fat were highly significantly affected by season of calving. Vice versa, lactose percentage was not affected by season of calving. Moreover, the current results indicated that the greatest mean value of F% and P% was observed in spring, and winter months. While Lactose%, TS%, SNF% were found in autumn months. For the least mean of P%, Lact%, TS% and SNF% was observed in autumn months and least mean value of P% was in winter month (Table 3). The calving season affects colostrum composition mainly through nutrition, environmental stress, and metabolic changes. Winter calving may increase fat but reduce some immune factors. Heat stress in summer can negatively impact overall quality. The present results agree with observed by Dunn et al. (2017) clarified that the season of calving had significant effect in fat, protein and lactose in commercial dairy farms across Northern Ireland. Likewise, Abdoon Mohamed (2015) specified significant effect of calving season on colostrum components. He added that the greatest protein and lactose concentrations were observed on autumn, while the least concentrations were on summer, contrariwise for fat was highest on summer and the least on winter. The effect of season was confirmed by Pritchett et al. (1991), Gulliksen et al. (2008) and Coroian et al. (2013), which, the impact potential of season depends on changes in feeding and housing.

Table 3. Effect of season of calving on colostrum composition

Items	Season of calving				P value
	Autumn	Summer	Spring	Winter	
F %	6.34^{a} ±0.37	6.33^{a}±0.44	6.73^{a}±0.38	5.42^{b}±0.37	0.0065
P%	14.86^{b}±0.75	11.82^{c}±0.80	14.0^{b}±0.38	15.89^{a}±1.04	<.0001
Lact%	2.8±0.27	2.74±0.18	2.73±0.22	2.79±0.29	0.9922
TS %	28.10^{a}±1.27	22.55^{d}±1.35	26.96^{b}±1.27	25.40^{c}±1.58	<.0001
SNF%	21.72^{a}±0.94	16.25^{d}±1.17	20.22^{b}±0.98	20.20^{c}±1.30	<.0001

Fat percentage (F %), Protein percentage (P %), Lactose percentage (Lact %), Sold nonfat (SNF %), Total solids percentage (TS %).

Soufleri et al. (2021) stated that the season of calving had significant effect on colostrum composition of Holstein dairy cows. The colostrum quality was affected by the calving season. Cows calving in the summer have lower quality colostrum than cows calving in the autumn (Morin et al., 2001). However, Yaylak et al. (2017) declared that calving season had no effects on components of colostrum.

Postpartum time

The composition of colostrum, including fat%, protein (P %), solids-not-fat (SNF %), lactose (Lact%), and total solids (TS%), has highly significant affected by the time elapsed since calving (postpartum time). Specifically, as postpartum time increases, the concentrations of fat, protein, SNF, and total solids generally decrease, vice versa for lactose concentration as shown in Table (4). The present results agree with found by previous studies Godden (2008), Dunn et al. (2017) and Soufleri et al. (2021). Kul et al. (2025) indicated that the postpartum time was a major factor influencing the composition of buffalo colostrum. Consequently, providing high-quality colostrum is recommended for calf health.

Table 4. Effect of Postpartum collection time on colostrum composition

Items	Time after calving (day)			P value
	1ST	**2cd**	**3d**	
F %	7.98^{a}±0.36	5.86^{b}±0.25	4.97^{c}±0.21	<.0001
P%	18.13^{a}±0.63	13.90^{b}±0.50	10.20^{c}±0.36	<.0001
Lact %	2.22^{b}±0.15	2.84^{a}±0.20	3.22^{a}±0.25	0.0002
TS%	32.9^{a}±1.05	23.70^{b}±0.72	21.17^{c}±0.67	<.0001
SNF %	25.04^{a}±0.89	17.83^{b}±0.64	16.19^{c}±0.59	<.0001

Fat percentage (F %), Protein percentage (P %), Lactose percentage (Lact %), Sold nonfat (SNF %), Total solids percentage (TS %).

Dunn et al. (2017) and Soufleri et al. (2021) cleared that the relation between time interval between calving and milking with both colostrum fat and protein contents was inverse, while the relationship between the lactose and fat colostrum content take the same inverse trend. Linehan et al. (2023) reported that the bovine colostrum of F%, P% and Lact% were varied between mature milk and colostrum. Wittum and Perino (1995) reported that colostrum feeding, immediately after birth, is critical to the health of calves because the ability of calves to absorb colostrum immunoglobulin declines as early as six hours after birth. Godden (2008) pointed out that there are differences between the composition of colostrum and milk of Holstein cows. Which the TS%, F%, P% and Lact% in colostrum were 23.9, 6.7, 14.0 and 2.7 respectively. While they found TS%, F%, P% and lactose% in milk were 12.9, 4, 3.1 and 5.0, respectively. Moreover, they added that the colostrum bovine is the single most important management factor in determining calf health and survival.

Year of calving

Table (5) indicated that year of calving was significant on protein percentage, protein

percentage, total solid percentage, solid nonfat percentage. Most colostrum components vary between years, possibly due to differences in nutrition during the study years, differences in temperature and humidity, farm management, or farm labor. Chamekh et al. (2020) noted that significant variations were observed between years in the content of fat, protein, and total solids, in contrast to the ash content, which remained unchanged. Cobanoglu and Kul (2019) stated that F% and P% were affected by calving year in Holstein and Jersey cows. Quaresma et al. (2020) obtained that the annual variations in protein and fat content, were significant (P<0.0001) in Holstein cows.

Table 5. The effect of year calving on colostrum composition

Items	Year of calving		P value
	Year 2018	Year 2019	
F %	6.37±0.35	6.23±0.25	0.0675
P%	13.37^{b}±0.73	14.44^{a} ±0.55	<.0001
Lact%	2.62±0.19	2.84±0.15	0.2782
TS%	24.75^{b} ±1.23	26.53^{a} ±0.83	<.0001
SNF%	18.37^{b} ±0.99	20.37^{a} ±0.68	<.0001

Fat percentage (F %), Protein percentage (P %), Lactose percentage (Lact %), Sold nonfat (SNF %), Total solids percentage (TS %).

Gender of newborn calf

Table (6) indicated that the sex of newborn had significant effect on protein percentage, total solid percentage and solid non-fat percentage .The colostrum from dams of newborn male calves was composed with higher of F%, P%, TS% and SNF% expect for lactate contents.

Table 6. The effect of gender newborn calf on colostrum composition

Items	Gender of newborn calves		P value
	Female	Male	
F %	6.08±0.28	6.47±0.28	0.0736
P%	13.83^{b} ±0.63	14.31^{a} ±0.62	0.0049
Lact%	2.95±0.15	2.59±0.18	0.0585
TS%	25.07^{b} ±0.95	26.81^{a} ±1.0	<.0001
SNF%	19.06^{b} ±0.81	20.34^{a} ±0.81	<.0001

Fat percentage (F %), Protein percentage (P %), Lactose percentage (Lact %), Sold nonfat (SNF %), Total solids percentage (TS %).

Quaresma et al. (2020) observed that the sex of calf had significant effect on F% present and had significant effect on P% in Holstein dairy. Kul et al. (2025) obtained that the impact of calf sex on colostrum composition was not significantly effect in Anatolian buffaloes. . Difficult calving in buffalo cows may potentially reduce each the quality and quantity of colostrum. Furthermore, cesarean-section calving could potentially affect the quantity and quality of mammary gland secretion, potentially even halting its production. Difficulty during parturition is important in relation to the daily gains achieved during the colostrum feeding period (Puppel et al., 2019).

Weight of newborn calf

The current results showed that the weight of new calves was highly significant effect on P%, TS% and SNF. While non-significant effect on F% and Lact% are given in Table (7).

Table 7. The effect of weight newborn calf on colostrum composition

Items	Weight of newborn calves			P value
	≤25 kg	26- 35	≥36	
F %	6.48±0.32	6.32±0.28	5.81±0.50	0.0675
P%	14.43^{a}±0.72	13.41^{b}±0.68	14.60^{a}±1.00	<.0001
Lact %	2.82±0.22	2.83±0.14	2.55±0.27	0.4644
TS%	27.08^{a}±1.08	26.15^{b}±1.11	23.40^{c}±1.50	<.0001
SNF %	20.61^{a}±0.90	19.83^{b}±0.88	17.78^{c}±1.26	<.0001

Fat percentage (F %), Protein percentage (P %), Lactose percentage (Lact %), Sold nonfat (SNF %), Total solids percentage (TS %).

Previous studies indicated that milk composition was not related to average daily gain of the calf (Mondragon et al., 1983). Results in Table (7) indicated that colostrum produced by dams of newborn calves weighing ≥25 kg was more than for TS% and SNF%. While colostrum produced by dams of new newborn calves weighing 26-35 was more than for Lact% and colostrum produced by dams of new newborn calves weighing ≥36 was P%. Rahbar et al. (2016) indicated that birth weight of calves could be considered as an important trait in dairy cattle breeding programs of Holstein cow in desert climate.

Cow weight at calving

The results indicated that cow weight at calving classification had affected F%, P%, Lac %, SNF% and TS% in table 8. Soufleri et al. (2021) indicated that the body condition score was significant on colostrum yield and no effect on colostrum composition in Holstein cows.

The results in table (8) showed that the highest colostrum constituents were observed at cow calved at weights ≤450). The results exhibited that lighter weight animals produced colostrum containing higher components than the colostrum produced by heavier weight animals. This may be due to heavier cows produce more colostrum than lighter cows. While, Williams et al. (2018) indicated that milk lactose content was affected by the interaction between cow weight and the ratio of calf weight weaned to cow weight classification, suggesting that heavy cows classified as high the ratio of calf

weight weaned to cow weight tend to produce more milk lactose.

Table 8. The effect of cow weight at calving on colostrum composition

Items	Cow weight at calving			P value
	≤450	451- 500	≥501	
F %	6.82^{a}±0.37	6.68^{a}±0.36	5.38^{b}±0.23	<.0001
P%	14.82^{a}±0.84	13.95^{b}±0.78	13.67^{b}±0.66	<.0001
Lact %	3.11^{a}±0.21	2.78^{ab}±0.20	2.48^{b}±0.19	0.0454
TS%	28.92^{a}±1.42	25.46^{b}±1.11	24.28^{c}±1.04	<.0001
SNF %	22.09^{a}±1.11	18.83^{b}±0.88	18.96^{c}±0.87	<.0001

Fat percentage (F %), Protein percentage (P %), Lactose percentage (Lact %), Sold nonfat (SNF %), Total solids percentage (TS %).

CONCLUSION

The current results clarified that the Friesian cows have a good and natural range of the means for colostrum composition under the better of management and environmental conditions. Moreover, the results showed that the percentage of fat, protein, solid nonfat and total solids were higher than in young cows in comparison with older cows, and vice versa for the percentage of lactose was lowest in young cows. The results also indicated that the components of colostrum including percentage of fat, protein, solid nonfat and total solid were decrease with increasing time after postpartum, contrast to lactose percentage, which increases with increasing time after calving. Therefore, it is recommended to suckling newborn calves immediately after birth to increase the calves' benefit from colostrum and raise immunity against diseases spread in the area.

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CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest.

AUTHORS CONTRIBUTION

All authors contributed to the preparation and writing of the manuscript, starting with preparing the original draft, writing, reviewing, and editing it. All authors have read and agreed to the published version of the manuscript.

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الملخص العربى

تأثير بعض العوامل على مكونات السرسوب فى الأبقار الفريزيان فى مصر

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تهدف هذه الدراسة إلى دراسة العوامل المؤثرة علي تركيب السرسوب. اجريت هذه الدراسة في محطة القرضا التابعة لمعهد بحوث الإنتاج الحيواني. كانت متوسطات نسب الدهون والبروتين واللاكتوز والمواد الصلبة اللادهنية والمواد الصلبة الكلية فى السرسوب 6.27 و14.04 و2.7 و19.69 و25.92 على التوالي. كان لموسم الحليب تأثير عالى المعنوية على الصفات المدروسة سالفة الذكر، حيث كانت أعلى نسبة لتركيب السرسوب في أول موسم حليب. كما كان لموسم الولادة تأثير عالى المعنوية على نسب الدهون والبروتين والمواد الصلبة اللادهنية والصلبة الكلية. والعكس صحيح بالنسبة لتأثير موسم الولادة على نسبة اللاكتوز. كذلك فإن فترة ما بعد الولادة لها تأثير عالى المعنوية على الصفات المدروسة حيث تزيد نسبة الدهون ونسبة البروتين ونسبة المواد الصلبة اللادهنية ونسبة المواد الصلبة الكلية والعكس صحيح بالنسبة لتركيز اللاكتوز. لذلك من الضروري الإسراع في إعطاء العجول حديثة الولادة السرسوب لزيادة سرعة الاستفادة ورفع مناعة العجول حديثة الولادة من الأبقار الفريزيان.

الكلمات الدالة: عجول فريزيان حديثة الولادة ، مكونات السرسوب، موسم الحليب ، فترة ما بعد الولادة