Mesopotamia Journal of Agriculture

https://magrj.uomosul.edu.iq

THE INFLUENCE OF FEEDING FREQUENCY AND NANO-SELENIUM DRENCHING ON MILK PRODUCTION AND BLOOD TRAITS OF AWASSI EWES

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Article information
Article history:
Received: 20/11/2025
Accepted: 30/03/2026
Available: 31/03/2026

Keywords:
Awassi, feeding system, milk, Nano-selenium.

DOI:
10.33899/mja.2026.167266.1801

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ABSTRACT

An investigation was carried out to determine the impact of feeding frequency (FF) and Nano selenium (Na-S) drenching on milk yield and its ingredients and biochemical traits in Awassi ewes' blood. Sixteen Awassi ewes (52.28±1.37 kg body weight) aged 3–4 years with newborn lambs (n = 4) were randomly divided into one of the four experimental groups (n = 4). Ewes in the 1st and 2nd groups were fed the basal ration of two meals (2M) daily and drenched with Nano selenium (Na-S) (2 and 4 mg daily), respectively. While the 3rd and 4th groups, were fed the basal ration three meals (3M) daily and received Na-S (2 and 4 mg daily) orally. Milk yield, fat%, and protein% increased significantly in 2M groups at most weeks, consistent with the significant increase in milk yield of ewes receiving 4 mg of Na-S. In regard to the interaction between FF and Na-S, 2M and 4 Na-S recorded a significant increase in milk yield at most weeks of the study. Feeding ewes 2M daily caused a significant increase in TP, ALB, GLO, GLU, and cholesterol levels; no effects showed for N-Se in blood serum at the 1st month of the study. Finley, CHO level increased significantly in the 2M and 2 Na-S ewe groups, while TRI level decreased significantly ($P \leq 0.05$) in the blood serum of the 2M and 2 Na-S groups. In general, feeding systems and Nano-selenium cause an increase in milk yield and fat percentage of Awassi ewes.

INTRODUCTION

Agriculture, which is based on both plants and animals, is one of the main pillars around which each country's economy is constructed. Animal products are also the world's capital and the exploitation of the earth's wealth since they contain animal protein, which is essential for human health and safety and human activity, vigor, growth, and the development of the body and intelligence. Animal farming provides the majority of animal protein, one of the most essential elements for human nutrition, and accounts for 20–30% of the agricultural economy in the Arab world. (Al-Jorani *et al*., 2020). It is clear that there are many diverse genetic impacts on complex features, necessitating thorough research in a variety of breeds and situations (Esen *et al.,* 2024). Breed, age and grazing pattern also affect the health status and vaccination of the herd (Alhayali *et al.,* 2024 and Huthawer and Al-saadi*.,* 2024)

For the importance of this subject to both the producer and consumer, many authors try to use alternatives to concentrated feeds that are economically expensive with available feeds that are considered by-products of the human food industry (Hame and Allawi., 2023). Using non-traditional feed materials, such as inexpensive agricultural leftovers, will lower production costs. Feeding residual olive oil is unusual (Taheri *et al*., 2012). Awassi sheep are considered the largest breed in these countries. (Haddad and Ala., 2009). Awassi sheep have a brood tail and are well suited to semi-arid environments. However, providing food in these areas represents a significant obstacle for sheep breeders. (Jaber *et al*., 2004). In the past, the primary source of nutrition was pastures for sheep. Due to the lack of rainfall, these pastures were affected and now do not meet the animal's nutritional needs, which led to thinking about alternative sources of traditional fodder to provide a large protein of animal feed, which caused the high cost of feeding (Obeidat., 2022).

Many authors studied the factors affecting Awassi lambs' fattening to improve meat production (Alzidan *et al*., 2022; Sultan and Abdul-Rahman., 2023). Rams' reproductive activity is also influenced by their immediate environment, including their diet (Abdullah *et al*., 2022). Olive leaves can be collected as an agricultural product from two sources: the first is the harvested fruits for the oil extract, which represents about 10% of the total weight of the harvested fruits, and the second is from pruning the olive tree, which is estimated at 25kg per olive tree each year. The production of olive leaves is estimated at 21 million tons annually in the world (Paiva Martins.,2009). Olive leaves are suitable for feeding ruminants and can be used directly (Tzamaloukas, Neofytou, and Simitzis.,2021). It has been observed that, in comparison to hand harvesting, automated harvesting—which has become more common as olive production has intensified—may enhance the number of leaves that reach the presses by up to ten times. (Abu-Rumman, Khadir, and Khadir, 2018). According to (Alomar *et al*. 2022), adding dried olive leaves to a 50:50 straw-concentrate mixture in place of 30 or 60% wheat straw and modifying the rations overall to be isocaloric and isonitrogenous had no discernible impact on the performance of rams. Therefore, olive leaves may be an essential ration source in large-scale animal production systems in arid regions. (Al-Masri *et al*. 2023), recorded that, feeding Awassi rams dried olive leaves, even at a 60% level, did not alter the rams' reproductive traits. As a result, the leaves could be utilized as a supplemental feed source for small ruminants. (Hussein *et al*., 2017), studied the effect of using olive tree pruning products in the rations of Awassi ewes on milk production, its components, the amount of feed consumed, and weight gain, using 24 Awassi ewes in the third and fourth season of milk production. The results showed that there were no significant differences between the olive leaves group (35% of the diet) in the consumed feed, and it was found that there was a substantial difference in the feeding costs for producing 1 kg of milk in favor of the olive treatment. In the (Alkhtib *et al*. 2021) study, the traditional fattening ration of a male Shami goat was replaced, resulting in a 19.8% and 20% decrease in feeding costs, respectively, with no adverse effects on the goat's health, growth performance, feed conversion ratio, or efficiency of nutrient use. Therefore, it can be suggested that olive tree leaves be used instead of the traditional Shami male goats. According to (Anter *et al*. 2011), olive leaf extract has the potential to both enhance human health and shield cells from oxidative damage induced by hydrogen peroxide without causing genotoxicity. According to (Sabry 2014), most people find olive leaves safe, non-toxic, and well-tolerated. No reports of toxicity or adverse events have been reported, and no medication interactions are currently recognized; olive leaves boost the effects of blood pressure-lowering medications because of their properties. The objective of the current study is to find out whether olive leaves (25–50–75 g/kg diet) affect the biochemical and productive characteristics of Awassi lambs.

MATERIALS AND METHODS

Ethical Approve

The ethical and animal welfare committee of the University of Mosul's College of Veterinary Medicine approved its clearance for the study and sample collection, which took place on November 16, 2024, under the number UM.VET.2024.124.

Design and animals of the study

Sixteen healthy Awassi ewes (52.28±1.37 kg body weight) aged 3-4 years with newborn lambs (2 males and 2 females, 4.61±0.14 kg body weight) were randomly divided into one of the four experimental groups (n=4). The ewes in the 1st and 2nd groups were fed the basal ration (Table 1) two meals (2M) daily (8 AM and 4 PM) and received Nano selenium (Na-S) (2 and 4 mg daily), respectively. While the 3rd and 4th groups were fed the basal ration of three meals (3M) daily (8 AM, 2 PM, and 8 PM) and received Na-S (2 and 4 mg daily) orally, respectively. The ewes were given 1500 g of pelleted concentrate, and the study lasted 84 days.

Table (1): components and chemical makeup analysis of the feed. of the meal used in the study.

Ration materials	%	Nutrient Name	Analysis by dry matter	Unit
Yellow Corn	20	Dry Matter	90.340	%
Sunflower meal	5	Crude Fat	1.920	%
Wheat bran	10	Crude Protein	17.850	%
Wheat flour	6.50	Crude Fiber	6.820	%
Black barley	23	Crude Ash	5.150	%
Crushed chickpea	7	Nitrogen Free Extract	58.590	%
Soybean meal	17	Metabolic Energy	2799.550	Kca/Kg
Soya bean hulls	4			
Molasses	4			
Appetite	0.025			
limestone	1			
Premix	1			
NaCl	1			
Sodium bicarbonate	0.5			
Total	100			

Chemical analysis of ration was done according to AOAC (2016) in Erbil Feed Company Laboratory.

The animals were kept in semi-open enclosures (24 m² for each group), were inspected by a veterinarian, and were found to be healthy, disease-free, and under the care of veterinarians during the study period. They also had all the necessary vaccinations.

Milk samples

Daily milk production was measured every 14 days after birth using hand milking. The newborns were isolated from their mothers in the evening at 8 PM and then measured the next morning after 12 hours of isolation at 8 AM using a sensitive balance. The resulting quantity was multiplied by 2 to obtain the daily milk yield (ICAR., 2018). The milk samples were filtered from impurities using a piece of clean gauze and filled into 20 ml plastic containers. Milk samples were analyzed using the Eko-milk analyzer (China). The analysis included the percentages of fat, protein, lactose and non-fat solids%.

Veterinary care

Before the trial began, the animals were inspected and their safety was guaranteed. Throughout the research time, they were under veterinary monitoring and in good health. ewes received injection of a 5 ml dosage from Saudi Pharmaceutical Industries to combat internal parasites. Five milliliters of Ivermectin were subcutaneously administered into the ewes before lambing. Administering vaccine to animals to prevent enterotoxaemia at a dose of 5 milliliters subcutaneously using a vaccine made by Saudi Pharmaceutical Industries.

Blood samples collection

The ewes utilized in the study had their jugular veins sampled every month. The blood samples were taken in the morning and before to feeding, and they were put in ordinary plastic tubes devoid of an anticoagulant. After the blood serum was separated using a centrifuge set to 3500 rpm for 10 minutes, it was put in sealed plastic tubes with a capacity of 2 ml and kept in a freezer at -20 Co. Commercial kits from Bio Lab, France access were used to estimate the levels of cholesterol (CHO), triglycerides (TRI), glucose (GLU), albumin (ALB), globulin (GLU), and total proteins (TP). The analysis was then conducted in accordance with standard protocols. (Kridli *et al.,* 2006).

Statistical analysis

A completely randomized design (CRD) and a two-factor factorial experiment were used for statistical analysis of the study data using the following mathematical model:

$$Yijk = \mu + Fi + Sj + FSij + Eijk$$

To determine whether there were statistically significant variations in the means based on the significant F value, the data was analyzed using SAS (2003) and the Duncan's multiple range test (Torrie, Steele, 1984).

RESULTS AND DISCUSSION

Table 2 points out the impact of feeding frequency (2M or 3M daily) and Nano-selenium (2 or 4mg/daily) on milk yield of Awassi ewes, and indicate milk yield increased significantly ($P \leq 0.05$) in 3M ewes at 2nd week of study. Ewes reared 2M had higher milk yield at 4th, 6th, 8th 10th and 12th weeks of study. Milk yield increased significantly in ewes drenched Na-S 4mg/daily in all weeks of study as compared with Na-S 2mg/daily groups. The results of interaction between feeding frequency and Na-S showed higher milk yield in T2 (2M and Na-S 4mg/daily) at all weeks of study and recorded 932.50, 953.75, 1117.75, 10.83.75, 1197.00 and 667.50 gm/daily respectively.

Nayel *et al,* studied the effect of feeding frequency on milk yield in Barki ewes and recorded that feeding more frequently increased milk yield. Bunting *et al,* (1987) suggested that increasing feed frequency may result in the escape of degradable fibers from the rumen, dietary supplementation with selenium nanoparticles, particularly for ruminant animals is a necessary element with a variety of biological functions. It is particularly crucial for a number of physiological functions, including the immunological and reproductive systems, thyroid hormone metabolism, and antioxidant protection. Additionally, because of its high bioavailability and low toxicity, selenium nanoparticles in the diet contribute to a high level of selenium in milk and meat (Badgar, and Prokisch 2020). The significant increase in milk yield, fat% in this study agreed with the results of Gaafar *et al.,* (2022, whom recorded a significant increase in milk yield and fat%, in their study on dairy Zaraibi goats.

Regarding the increase in the percentage of fat in the milk of ewes fed twice, it may be due to what French and Kennely, (1990) indicated, that the increase in the percentage of milk fat by the feed frequency, leads to a decrease in the percentage of propionic acid, and this is reflected in an increase in the percentage of acetic acid, which is the main source of milk fat (Das *et al.,* 2023).

Table (2): The impact of feeding frequency and Nano-selenium on milk yield (gm) of Awassi ewes.

Treatments	Weeks					
	2	4	6	8	10	12
Effect of feed frequency						
2 M	711.25 [b] ± 83.73	786.30 [a] ± 63.30	1031.38[a] ± 33.20	951.88 [a] ± 51.18	1049.75[a] ± 56.27	737.50 [a] ± 37.69
3 M	775.25 [a] ± 17.45	793.12 [a] ± 7.48	850.88 [b] ± 28.21	851.50 [b] ± 9.23	545.63 [b] ± 31.71	665.13 [b] ± 41.90
Effect of Nano-Selenium						
Na-S 2mg/ daily	612.63 [b] ± 47.29	697.62 [b] ± 29.90	932.13 [a] ± 8.40	846.13 [b] ± 11.65	764.38 [b] ± 53.00	681.63 [b] ± 47.97
Na-S 4 mg/ daily	873.88 [a] ± 22.14	881.87 [a] ± 27.45	950.13 [a] ± 64.28	957.13 [a] ± 64.28	831.00 [a] ± 38.56	721.00 [a] ± 22.02
Effect of interaction between feed frequency and Nano-Selenium						
1	490.00 [d] ± 7.90	619.00 [d] ± 3.18	954.00 [b] ± 10.80	820.00 [c] ± 9.57	902.50 [b] ± 10.92	807.50 [a] ± 6.61
2	932.50 [a] ± 7.77	953.75 [a] ± 4.26	1117.75 [a] ± 7.42	1083.75 [a] ± 23.21	1197.00 [a] ± 14.34	667.50 [b] ± 16.39
3	735.25 [c] ± 18.73	776.25 [c] ± 60.57	919.25 [b] ± 10.11	872.25 [b] ± 9.36	626.25 [c] ± 16.51	555.75 [c] ± 11.53
4	815 [b] ± 2.05	810.00 [b] ± 7.35	782.50 [c] ± 22.29	830.75 [bc] ± 4.85	830.75 [b] ± 9.35	774.50 [a] ± 9.32

Significant variations at the probability level P≤0.05 are indicated by different letters arranged vertically.
NS: Nano selenium, 2 M, 3M: two meals and three meals, 1: 2M and 2mg NS, 2: 2M and 4mg Na-S, 3: 3M and 2mg Na-S, 4: 3M and 4mg Na-S.

Table 3 displays of the effect of feeding frequency and supplementation of Na-S on fat% in ewe’s milk, ewes reared 3 M had higher fat at 6th week of study, while ewes reared 2 M had high fat significantly at 8th and 12th weeks of study. Fat% increased

Table 4 explains the effects of feeing frequency and Na-S on protein% in Awassi milk at weeks of study, a significant increase showed in 3 M groups at 2nd and 10th weeks. No effects recorded for Na-se on protein%, T3 had high protein% at 2nd week of study, no effects recorded in the interaction treatments between feeding frequency and Na-S supplementation at other weeks of study.

Table (3): The impact of feeding frequency and Nano-selenium on fat% in Awassi ewes milk.

Treatments	Weeks					
	2	4	6	8	10	12
Effect of feed frequency						
2 M	3.81 [a] ± 0.27	3.92 [a] ± 0.28	3.70 [a] ± 0.12	3.00 [b] ± 0.19	3.86 [a] ± 0.15	4.22 [b] ± 0.13
3 M	3.53 [a] ± 0.16	3.69 [a] ± 0.15	3.13 [b] ± 0.14	3.75 [a] ± 0.20	3.96 [a] ± 0.21	4.86 [a] ± 0.25
Effect of Nano-Selenium						
Na-S 2mg/ daily	3.98 [b] ± 0.15	3.47 [b] ± 0.16	3.35 [a] ± 0.21	3.55 [a] ± 0.28	3.93 [a] ± 0.16	4.32 + ± 0.10
Na-S 4 mg/ daily	3.36 [a] ± 0.15	4.14 [a] ± 0.22	3.48 [a] ± 0.11	3.20 [a] ± 0.17	3.88 [a] ± 0.20	4.76 [a] ± 0.29
Effect of interaction between feed frequency and Nano-Selenium						
1	3.12 [b] ± 0.09	3.20 [b] ± 0.10	3.82 [a] ± 0.13	3.17 [ab] ± 0.37	4.05 [a] ± 0.18	4.40 [b] ± 0.21
2	4.50 [a] ± 0.14	4.65 [a] ± 0.12	3.57 [a] ± 0.20	2.82 [b] ± 0.11	3.67 [a] ± 0.22	4.05 [b] ± 0.14
3	3.60 [b] ± 0.25	3.75 [b] ± 0.26	2.87 [b] ± 0.19	3.92 [a] ± 0.37	3.82 [a] ± 0.29	4.25 [b] ± 0.06
4	3.47 [b] ± 0.23	3.20 [b] ± 0.20	3.40 [a] ± 0.12	3.57 [ab] ± 0.18	4.10 [a] ± 0.13	5.47 [a] ± 0.20

Significant variations at the probability level P≤0.05 are indicated by different letters arranged vertically.
NS: Nano selenium, 2 M, 3M: two meals and three meals, 1: 2M and 2mg NS, 2: 2M and 4mg Na-S, 3: 3M and 2mg Na-S, 4: 3M and 4mg Na-S.

Table (4): The impact of feeding frequency and Nano-selenium on protein% in Awassi ewes milk.

Treatments	Weeks					
	2	4	6	8	10	12
Effect of feed frequency						
2 M	4.11 b ± 0.07	4.20 [a] ± 0.05	4.32 [a] ± 0.05	4.10 [a] ± 0.28	4.45 [b] ± 0.05	4.46 [a] ± 0.07
3 M	4.36 [a] ± 0.07	4.32 [a] ± 0.06	4.35 [a] ± 0.04	4.53 [a] ± 0.06	4.61 [a] ± 0.04	5.10 [a] ± 0.30
Effect of Nano-Selenium						
NS 2mg/ daily	4.31 [a] ± 0.08	4.28 [a] ± 0.07	4.33 [a] ± 0.06	4.48 [a] ± 0.11	4.51 [a] ± 0.06	4.61 [a] ± 0.09
NS 4 mg/ daily	4.16 [a] ± 0.08	4.23 [a] ± 0.05	4.33 [a] ± 0.04	4.15 [a] ± 0.28	4.51 [a] ± 0.05	4.94 [a] ± 0.33
Effect of interaction between feed frequency and Nano-Selenium						
1	4.17 [ab] ± 0.06	4.20 [a] ±	4.30 [a] ± 0.10	4.32 [a] ± 0.18	4.45 [a] ± 0.10	4.45 [a] ± 0.15
2	4.20 [b] ± 0.08	4.25 [a] ± 0.06	4.35 [a] ± 0.06	3.87 [a] ± 0.56	4.45 [a] ± 0.06	4.47 [a] ± 0.06
3	4.45 [a] 0.11	4.37 [a] ± 0.11	4.37 [a] ± 0.07	465 [a] ± 0.10	4.58 [a] ± 0.06	4.78 [a] ± 0.05
4	4.27 [ab] ± 0.08	4.27 [a] ± 0.06	4.32 [a] ± 0.06	4.42 [a] ± 0.04	4.65 [a] ± 0.06	5.41 [a] ± 0.60

Significant variations at the probability level P≤0.05 are indicated by different letters arranged vertically.
NS: Nano selenium, 2 M, 3M: two meals and three meals, 1: 2M and 2mg NS, 2: 2M and 4mg Na-S, 3: 3M and 2mg Na-S, 4: 3M and 4mg Na-S.

Lactose% increased significantly (P≤0.05) (Table 5) in milk of ewes reared 3 M at 2nd, 10th and 12th weeks and no effects recorded to Na-S on lactose%. T3 treatment showed a significant increase at 2nd week, while the treatments 2, 3 and 4 had significant increase in lactose% at 6th weeks. The results also showed a significant increase in T3 and T4 at 12th weeks of study. The significant increase in lactose and solids non-fat in this study agreed with the results of Gaafar *et al.,* (2021), whom recorded a significant increase in lactose and solids not fat% in their study on dairy Zaraibi goats.

Table 6 points out a significant (P≤0.05) increase in solid non-fat% in milk of ewes reared 3M/ daily at 2nd, 10th and 12th weeks of study, while no significant differences will be recorded for the effect of Na-S on solid non-fat% at all weeks of study. T3 recorded a significant increase at 2nd week (12.30%) and at 12th week (15.56%). The statically analysis of data presented in Table 8, revealed that TP, ALB, GLO, GLO/ALB, GLU and CHO increased significantly (P≤0.05) in blood serum of ewes reared 2M at the end of 1st month of study. There were no significant effects of Na-S on the biochemical blood characteristics of the treated ewes.

Because it offers useful information on the amounts of various lipid types in the bloodstream, the lipid profile is a crucial indicator of an animal's health. The levels of CHO, TG, and GLU in ewes given selenium nanoparticle treatment were the main focus of this investigation.

Table (5): The impact of feeding frequency and Nano-selenium on lactose% in Awassi ewes milk.

Treatments	Weeks					
	2	4	6	8	10	12
Effect of feed frequency						
2 M	6.18 b ± 0.10	6.19 a ± 0.15	6.43 a ± 0.07	6.18 a ± 0.42	6.70 b ± 0.08	6.72 b ± 0.11
3 M	6.58 a ± 0.11	6.55 a ± 0.08	6.60 a ± 0.a06	6.81 a ± 0.09	7.00 a ± 0.06	7.28 a ± 0.03
Effect of Nano-Selenium						
NS 2mg/ daily	6.48 a ± 0.12	6.40 a ± 0.10	6.45 a ± 0.08	6.73 a ± 0.16	6.86 a ± 0.10	6.95 a ± 0.14
NS 4 mg/ daily	6.28 a ± 0.12	6.34 a ± 0.16	6.58 a ± 0.05	6.26 a ± 0.41	6.83 a ± 0.08	6.99 a ± 0.12
Effect of interaction between feed frequency and Nano-Selenium						
1	6.27 ab ± 0.06	6.18 a ± 0.06	6.30 b ± 0.07	6.50 a ± 0.27	6.70 a ± 0.16	6.72 b ± 0.22
2	6.10 b ± 0.19	6.20 a ± 0.32	6.57 a ± 0.08	5.87 a ± 0.83	6.70 a ± 0.07	6.74 b ± 0.08
3	6.70 a ± 0.18	6.61 a ± 0.12	6.60 a ± 0.11	6.97 a ± 0.14	7.03 a ± 0.08	7.26 a ± 0.02
4	6.47 ab ± 0.12	6.48 a ± 0.11	6.60 a ± 0.07	6.65 a ± 0.06	6.97 a ± 0.11	7.30 a ± 0.08

Significant variations at the probability level P≤0.05 are indicated by different letters arranged vertically.
NS: Nano selenium, 2 M, 3M: two meals and three meals, 1: 2M and 2mg NS, 2: 2M and 4mg Na-S, 3: 3M and 2mg Na-S, 4: 3M and 4mg Na-S.

At the end of 1st month of study (Table 8) the significant increase in most biochemical traits of treated ewes blood serum, matched with the results of Abozed *et al,* (2021), whom noticed that total protein, globulin and urea levels tended to slightly increase by feeding twice daily. The findings demonstrated that the lipid profile of local Awassi ewes considerably impacted by the introduction of selenium nanoparticles. Ewes treated with selenium nanoparticles showed a considerable decrease in CHO and TG levels. These finding is consistent with the results of Hamzah and Dawood, (2024), in their study on Awassi lambs by Oral administrated with selenium nanoparticles (0.1 mg/kg body weight). Additionally, Guo *et al,* (2020) and Zhao *et al,* (2021) documented the impact of selenium supplementation reducing cholesterol in various animal species. Either increased cholesterol excretion or suppression of cholesterol production could be the mechanism behind this effect. To determine the precise mechanism of action, more research is required.

Table (6): The impact of feeding frequency and Nano-selenium on solid non-fat% in Awassi ewes milk.

Treatments	Weeks					
	2	4	6	8	10	12
Effect of feed frequency						
2 M	11.31 b ± 0.18	11.63 a ± 0.14	11.90 a ± 0.16	12.05 a ± 0.25	12.27 b ± 0.16	12.27 b ± 0.20
3 M	12.05 a ± 0.18	12.00 a ± 0.13	12.10 a ± 0.11	12.43 a ± 0.17	12.80 a ± 0.11	14.43 a ± 0.80
Effect of Nano-Selenium						
NS 2mg/ daily	11.88 a ± 0.20	11.84 a ± 0.17	11.96 a ± 0.18	12.30 a ± 0.30	12.54 a ± 0.19	12.77 a ± 0.27
NS 4 mg/ daily	11.47 a ± 0.22	11.79 a ± 0.13	12.03 a ± 0.08	12.18 a ± 0.10	12.53 a ± 0.14	13.93 a ± 0.91
Effect of interaction between feed frequency and Nano-Selenium						
1	11.47 ab ± 0.13	11.60 a ± 0.21	11.82 a ± 0.31	11.87 a ± 0.48	12.25 a ± 0.31	12.25 b ± 0.41
2	11.15 b ± 0.35	11.67 a ± 0.21	11.97 a ± 0.13	12.22 a ± 0.20	12.30 a ± 0.16	12.30 b ± 0.14
3	12.30 a ± 0.26	12.08 a ± 0.24	12.10 a ± 0.23	12.72 a ± 0.28	12.83 a ± 0.15	13.30 ab ± 0.04
4	11.80 ab ± 0.22	11.91 a ± 0.15	12.11 a ± 0.10	12.15 a ± 0.09	12.77 a ± 0.18	15.56 a ± 1.43

Significant variations at the probability level P≤0.05 are indicated by different letters arranged vertically.
NS: Nano selenium, 2 M, 3M: two meals and three meals, 1: 2M and 2mg NS, 2: 2M and 4mg Na-S, 3: 3M and 2mg Na-S, 4: 3M and 4mg Na-S.

Table (7): The impact of feeding frequency and Nano-selenium on biochemical traits of Awassi ewes blood at 1st month of study.

Traits / Treatments	TP gm/dL	ALB gm/dL	GLO gm/dL	GLO/ALB	GLU mg//dL	CHO mg/dL	TG mg/dL
Effect of feed frequency							
2 M	8.00 ^{a} ± 0.26	3.80 ^{a} ± 0.29	4.19 ^{a} ± 0.16	1.15 ^{a} ± 0.11	49.63 ^{a} ± 1.78	86.03 ^{a} ± 3.63	17.97 ^{a} ± 0.69
3 M	5.46 ^{b} ± 0.20	2.56 ^{b} ± 0.10	2.89 ^{b} ± 0.18	1.14 ^{a} ± 0.09	36.15 ^{b} ± 2.05	59.56 ^{b} ± 4.79	19.78 ^{a} ± 1.43

Traits / Treatments	TP gm/dL	ALB gm/dL	GLO gm/dL	GLO/ALB	GLU mg//dL	CHO mg/dL	TG mg/dL
Effect of Nano-Selenium							
Na-S 2mg/ daily	6.79 [a] ± 0.68	3.30 [a] ± 0.34	3.48 [a] ± 0.37	1.06 [a] ± 0.07	40.91 [a] ± 3.00	74.4 [a] ± 3.12	17.68 [b] ± 0.06
Na-S 4 mg/ daily	6.67 [a] ± 0.32	3.06 [a] ± 0.28	3.60 [a] ± 0.20	1.23 [a] ± 0.11	44.88 [a] ± 3.20	71.19 [a] ± 8.70	20.07 [a] ± 1.41
Effect of interaction between feed frequency and Nano-Selenium							
1	8.53 [a] ± 0.31	4.10 [a] ± 0.34	4.42 [a] ± 0.12	1.10 [a] ± 0.10	48.37 [a] ± 1.85	78.39 [b] ± 2.55	18.95 [b] ± 0.71
2	7.48 [b] ± 0.20	3.50 [ab] ± 0.46	3.97 [a] ± 0.27	1.21 [a] ± 0.20	50.90 [a] ± 3.22	93.67 [a] ± 4.00	16.99 [b] ± 1.05
3	5.06 [d] ± 0.28	2.51 [b] ± 0.16	2.55 [c] ± 0.22	1.03 [a] ± 0.10	33.45 [b] ± 1.22	70.42 [b] ± 5.32	16.41 [b] ± 0.37
4	5.86 [c] ± 0.08	2.62 [b] ± 0.15	3.23 [b] ± 0.16	1.25 [a] ± 0.13	38.86 [b] ± 3.63	48.70 [c] ± 0.70	23.16 [a] ± 1.37

Significant variations at the probability level P≤0.05 are indicated by different letters arranged vertically. NS: Nano selenium, 2 M, 3M: two meals and three meals, 1: 2M and 2mg NS, 2: 2M and 4mg Na-S, 3: 3M and 2mg Na-S, 4: 3M and 4mg Na-S.

Table (8): The impact of feeding frequency and Nano-selenium on biochemical traits of Awassi ewes blood at the end of study.

Traits / Treatments	TP gm/dL	ALB gm/dL	GLO gm/dL	GLO/ALB	GLU mg//dL	CHO mg/dL	TG mg/dL
Effect of feed frequency							
2 M	6.59 [a] ± 0.16	2.92 [a] ± 0.15	3.67 [a] ± 0.08	1.28 [a] ± 0.07	37.90 [a] ± 1.32	99.79 [a] ± 6.60	19.25 [b] ± 0.05
3 M	6.82 [a] ± 0.11	3.00 [a] ± 0.10	3.81 [a] ± 0.09	1.28 [a] ± 0.06	35.30 [b] ± 0.90	89.85 [b] ± 4.50	21.22 [a] ± 1.42
Effect of Nano-Selenium							
Na-S 2mg/ daily	6.77 [a] ± 0.19	3.01 [a] ± 0.15	3.75 [a] ± 0.07	1.26 [a] ± 0.07	37.08 [a] ± 1.51	98.06 [a] ± 7.26	18.93 [b] ± 0.61
Na-S 4 mg/ daily	6.64 [a] ± 0.09	2.91 [a] ± 0.09	3.73 [a] ± 0.07	1.29 [a] ± 0.06	36.12 [a] ± 0.82	91.58 [b] ± 3.91	21.54 [a] ± 1.32
Effect of interaction between feed frequency and Nano-Selenium							
1	6.60 [a] ± 0.33	3.08 [a] ± 0.25	3.51 [c] ± 0.12	1.16 [a] ± 0.09	40.75 [a] ± 1.15	116.91 [a] ± 1.70	20.39 [b] ± 0.42
2	6.58 [a] ± 0.13	2.76 [a] ± 0.15	3.82 [ab] ± 0.06	1.40 [a] ± 0.09	35.06 [bc] ± 1.20	82.66 [c] ± 2.32	18.12 [c] ± 0.63
3	6.94 [a] ± 0.19	2.95 [a] ± 0.20	3.99 [a] ± 0.03	1.37 [a] ± 0.10	33.42 [c] ± 0.64	79.20 [c] ± 2.48	17.48 [c] ± 0.39
4	6.70 [a] ± 0.13	3.06 [a] ± 0.07	3.63 [bc] ± 0.13	1.19 a ± 0.05	37.18 [b] ± 1.01	100.49 [b] ± 3.60	24.97 [a] ± 0.15

Significant variations at the probability level P≤0.05 are indicated by different letters arranged vertically. Na-S: Nano selenium, 2 M, 3M: two meals and three meals, 1: 2M and 2mg NS, 2: 2M and 4mg Na-S, 3: 3M and 2mg Na-S, 4: 3M and 4mg Na-S.

CONCLUSIONS

The results of the study demonstrated that ewes reared twice daily and drenched with 4 mg Nano-selenium had more milk yield as compared with three meals and 2 mg Nano-selenium. Fat and lactose % increased significantly in the milk of the 3M and 4 mg Na-S ewe groups in the last weeks of the study. Most of the biochemical traits increased significantly in the ewe's blood reared twice daily.

ACKNOWLEDGMENT

The University of Mosul, the College of Agriculture and Forestry and Animal Production Department, are to be thanked by the authors, for their gracious cooperation in carrying out this research.

CONFLICT OF INTERESET

The work's authors declare that there are no conflicts of interest associated with its publication.

أثر تكرار التغذية وتجريع السيلينيوم النانوي على إنتاج الحليب وصفات الدم للنعاج العواسية

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الخلاصة

تم إجراء دراسة لتحديد تأثير تكرار التغذية وتجريع السيلينيوم النانوي على إنتاج الحليب ومكوناته والصفات الكيموحيوية لدم النعاج العواسية. تم تقسيم ستة عشر نعجة (52.28 ± 1.37 كغم وزن جسم) تتراوح أعمارها بين 3–4 سنوات مع مواليدها المفردة بشكل عشوائي إلى أربعة مجاميع (4/مجموعة). تم تغذية النعاج في المجموعتين الأولى والثانية على العليقة القياسية وبوجبتين يوميا مع تجريعها بالسيلينيوم النانوي (2 و 4 ملغم / يوميا) على التوالي. بينما تم تغذية المجموعتين الثالثة والرابعة على العليقة القياسية وثلاثة وجبات يوميًا مع تجريعها بالسيلينيوم النانوي (2 و4 ملغم / يوميا) عن طريق الفم. تبين من النتائج أن إنتاج الحليب ونسبتي الدهن والبروتين قد زادت معنويا ($P \leq 0.05$) في مجموعتي النعاج التي غذيت مرتان يوميا في معظم أسابيع الدراسة، وتوافقت مع الزيادة المعنوية في إنتاج الحليب للنعاج التي جرعت 4 ملغم نانو سيلينيوم. وسجلت نتائج التداخل بين تكرار التغذية وتجريع السيلينيوم النانوي، معاملة التغذية لمرتين وتجريع السيلينيوم بالجرعة 4 ملغم/يوميا زيادة معنوية في إنتاج الحليب في معظم أسابيع الدراسة. وتبين من النتائج ان النعاج التي غذيت مرتان يوميًا حققت زيادة معنوية في مستويات البروتين الكلي والالبومين والكلوبيولين والكلوكوز والكوليستيرول في مصل دم النعاج، ولم تظهر أي تأثيرات للسيلينيوم النانوي في مصل الدم في الشهر الأول من الدراسة. وفي نهاية الدراسة، ارتفع مستوى الكوليستيرول معنويا ($P \leq 0.05$) في مصل دم نعاج مجموعتي التغذية مرتين وتجريع النانو سيلينيوم 2 ملغم/ يوميا، بينما انخفض مستوى الكليسيريدات الثلاثية معنويا في مصل الدم لنفس المجموعتين. بشكل عام، حقق نظام التغذية مرتان يوميا وتجريع النانو سيلينيوم 4 ملغم/يوميا زيادة معنوية في إنتاج الحليب ونسبة دهن الحليب في النعاج العواسية.

الكلمات المفتاحية: أنظمة التغذية، الحليب، السيلينيوم النانوي، الاغنام.

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