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Effect of Dosing Vitamin E and Selenium Nanoparticles in Milk Yield for Holstein Cows

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Abstract

The experiment was carried out at the cows Al-Khalis station in Habhab district in Diyala Governorate, during the period from 1-10/2022 to 1- 5 / 2023 using 16 Holstein multiparous cows from milk-producing cows raised at the station. The animals were divided into four treatments randomly in the last two months of pregnancy and were as follows: T1: four cows without dosing (control treatment). T2: four cows were vaccinated 3000 IU vitamin E/ cow per day. T3: three cows were harvested Nano selenium element in an amount of 5 mg / cow per day. T4: five cows were sprayed with a combination of vitamin E 3000 IU and Nano-selenium in an amount of 5 mg/ cow per day. Vitamin E is a Alpha-tocopherol acetate powder packed in capsules and dosed directly into the animal's mouth in an amount of IU / cow / day, as well as selenium nanowires weighing each mg of it and packed in a capsule and dosed to cows once a day in the morning (5 mg/cow/Day). Treatment T2 vitamin E dosage in the sixth month showed its moral superiority in milk production and recorded 442.50 kg/ cow compared to the control treatment T1, which recorded the lowest milk production per month and total amounted to 202.50 kg/ cow, while the rest of the months there were no significant differences between the treatment, and it is noted in the quality of the amount of fat in the milk a cow, compared to the T3 treatment with a Nano selenium dose, which recorded the lowest amount of fat in milk at 3.01 and 6.50 kg/ cow, respectively, and there were no significant differences between the coefficients in the rest of the qualities Based on the 4% fat-modified milk and the amount of protein in the milk, we conclude from the current study that the addition of vitamin E in the amount of 3000 IU per cow per day had a positive role in improving milk production for cows .

Keywords: Holstein cows, vitamin E, selenium nanoparticles.

Introduction

Dairy cattle important for humans because they transform all feedstuffs that are not useful to humans into substances that have a high important nutritional value, namely milk (al-Qudsi and Elijah, 2010). The global dairy industry is one of the most important industries in the agri-food sector, with the EU, the USA, New Zealand and Australia dominating dairy exports, while Mexico, Japan, Russia and a number of other countries are major importers of dairy products (Meilke et al., 2001). Milk and dairy products provide high concentrations of essential amino acids and other nutrients necessary for humans, however, the amount of milk produced from dairy cows globally is insufficient to meet future needs (Britt et al., 2021).

Vitamin E is a fat-soluble vitamin and a powerful antioxidant agent that protects the cell membrane from lipid oxidation and reactive oxygen species attacks (Benhenia et al., 2016), is the most widely known antioxidant and provides protective effects by reducing or preventing oxidation damage (El-Sawy et al., 2018), is an important nutrient for cows and that vitamin E levels in the blood gradually decrease during the prenatal period to reach their lowest levels after birth (Haga et al., 2018). As vitamin E is widely consumed due to its antioxidant capacity and multiple health benefits, it can be found in two forms: natural or synthetic (Idamokoro et al., 2020).

Selenium (Se) is also a mineral element that acts as a cofactor for antioxidant enzymes (such as glutathione peroxidases) and affects the antioxidant activities and immune functions of animals (Zhang et al., 2018). It has antioxidant effects and thus increases cellular defense against oxidative stress (Gandin et al., 2018; Lubinsky et al., 2018). In animals there are two important sources of selenium the first are selenoamino acids selenoamino acids naturally derived from plants, such as selenomethionine (selenomethionine) and selenocysteine selenocysteine), and the second is inorganic silicate selenite (selenite), dietary selenium (Se) can be added from organic or inorganic sources, and this may affect selenium metabolism and functional results such as antioxidant status and immune functions in dairy cows (Kryukov et al., 2003). Even if the animal's physiological requirements of Se are low, the antioxidant system weakens if it is not met by this element, which leads to negative effects on the animal's health (Spears, 2000). Therefore, the aimed of current study to demonstrate the effect of dosing vitamin E and selenium nanoparticles for milk cows after being placed in capsules in the last two months of pregnancy and two months after delivery on a daily basis to show the extent of their role in improving some of the production qualities of cows.

Materials and Methods

The experiment was carried out at the cows Al-Khalis station in Habhab district-AL-Khalis district in Diyala Governorate, which is 5 km away from the city, during the period from 1-10/2022 to 1- 5 / 2023 using 16 Holstein cows from the milk-producing cows raised at the station and their ages were between 3-8 years. The cows were placed in semi-polygonal sheds 75 m long and 25 m wide containing feeders for the cow to eat from, which have an iron clamp designed so that the cow's head enters the feed to eat the feed, and the barn is equipped with self-filling non-rusting water basins dictated by water (liquefaction water) and is equipped for the cows to drink from whenever they want the barn floor is a concrete casting.

The quality of the feed and its quantity varied according to the season and depending on the availability of feed materials, as the green feed represented by Jet and alfalfa is provided in bales on two meals in the amount of approximately 20-25 kg per cow and the dry coarse feed represented by hay material is served on two meals as well morning and evening after the concentrated feed and in the amount of 4-5 kg per cow in the herd, while the concentrated feed is purchased from the best fed feed lab-Erbil-Makhmour road- The weight of each bag is 50 kg, the type of ingredients is known (Alfalfa, wheat flour, bran, soybeans, oil, calcium carbonate, table salt, animal mix, molasses, sodium carbonate, Dicalcium Phosphate and antitoxin), but the proportions are unknown due to the specificity of the company's work, and the chemical analysis of the proportions of the ingredients for this feed was carried out in the Nutrition Laboratory of Graduate Studies at the Faculty of Agricultural Engineering Sciences / University of Baghdad.

The source of vitamin E that was used in this experiment is alfa- fatocopherol acetate powder, it is packed in capsules after weighing a certain amount and dosed directly into the mouth of the animal in an amount of 3000 IU /cow/Day and was imported through a pure platform electronic shopping program of American origin, while the source of selenium that was used in the experiment is from the company 99%, which is of American origin, contains all the information, weighing each 5 mg of it, packed in a capsule and dosed for cows once a day in the morning.

The study was conducted on 16 Holstein cows, the animals were divided into four treatments randomly in the last two months of pregnancy and were as follows:

T1: four cows without dosing (control treatment).

T2: four cows were dosing 3000 IU vitamin E/ cow per day.

T3: three cows were dosing nanoselenium element in an amount of 5 mg / cow per day.
T4: five cows were dosing with a combination of vitamin E 3000 IU and nano selenium in an amount of 5 mg/ cow per day.

Studied Qualities

- Milk production

The milk production of the cows included in the study was calculated based on the daily milk production, as the cows are milked twice a day in the morning at 6 and evening at 4, using automatic milking machines and after the completion of milking the cow, the daily amount of milk produced is recorded in an electronic balance and the monthly and total milk is calculated on its basis.

Fat Corrected Milk (FCM) 4 %

The amount of fat-adjusted milk based on 4% fat was calculated according to the formula of fat-adjusted Milk 4% (Fat Corrected Milk or FCM)

FCM 4% = (0.4 × amount of milk) + (15 × amount of fat)

Al-Qudsi and Elijah (2010)

- The amount of fat in milk

The amount of fat was calculated by the following equation and according to al-Qudsi and Elijah (2010).

Amount of fat in milk= amount of milk ×percentage of fat in milk

- The amount of protein in milk

The amount of protein was calculated by the following equation and according to Al-Qudsi and Elijah (2010).

Amount of protein in milk= amount of milk × percentage of protein in milk

Using the design of complete random sectors (RCBD) Random Complete Block Design as a sector to remove its influence from the experiment in analyzing the results according to the SPSS program, the significance of differences between the averages of transactions was tested according to the Duncan multi-range test at a significance level of 0.05, regardless of the significance of the F test in the table of analysis of:

$y_{ij} = \mu + p_j + t_i + e_{ij}$

Yij: the viewing effect j is the return of treatment I.

µ: the general average of the adjective.

: pj sector Impact (season)

ti: treatment effect (vitamin E and selenium)

eij: the random error that is distributed σ naturally.

Results and discussion

- Monthly and total milk production

Table 1 shows. The effect of dosing vitamin E and nanoselenium two months before and after birth on monthly and total milk production, and it was found that there were significant differences in the sixth month, in which the T2 treatment exceeded the vitamin E dose, which recorded 442.50 kg / cow, compared to the T1 control treatment without dosing and recorded 202.50 kg/ cow, as for the T3 and T4 they reached 270.00 and 360.00 kg/ cow respectively. This shows the superiority of all dosing treatments over the control treatment in the same month, but in the rest of the months there are no significant differences between the transactions, but an arithmetic increase is observed in the first month in all dosing transactions T2 and T4, reaching 578.75 and 566.20 kg/ cow respectively, while T3 recorded 361.66 kg/ cow, which did not differ mathematically from transaction T1, which amounted to 360.00 kg / cow. As for the second month, there was an increase in the calculation of treatment T2, which recorded 593.25 kg/ cow, compared to treatment T1, which amounted to 434.00 kg/ cow, while treatment T3 and T4 recorded only 394.33 and 320.00 kg/ cow/ respectively. In the third month, we also note an arithmetic increase for treatment T2, which recorded 658.75 kg/ cow, compared to the dosing treatment T3 and T4, which recorded 485.66 and 421.60 kg/ cow, respectively, as all dosing treatments increased mathematically compared to the control treatment, which decreased arithmetically, which amounted to 410.75 kg/ cow. In the fourth month, we note a computational increase in the T2 and T4 treatments, which amounted to 495.00 and 468.00 kg/ cow, respectively, compared to the T3 treatment, which amounted to 290.00 kg/ as well as the control, which amounted to 345.00 kg/ cow. As for the fifth month, my account also increased for treatment T2, reaching 550.25 kg/ cow, compared to the two dosage treatment T3 and T4, which reached 341.00 and 378.20 kg/ cow, and treatment T1, which recorded a decrease of 356.50 kg/ cow, As for the total milk production, there were no significant differences between the treatments, but there was an arithmetic increase for treatment T2, which was 3318.50 kg/ cow compared to the rest of treatments T1, T3 and T4, reaching 2108.75, 21.42.66 and 2514.00 kg/ cow respectively.

The reason for this may be attributed to the importance of vitamin E supplements for cows, as it significantly improves the performance of cattle and their products, and its effectiveness in reducing fat oxidation (Gallardo et al., 2015) in milk (Santos et al., 2016), thus protecting the mammary glands and also reducing the number of somatic cells in cow's milk and thus a lower percentage of clinical mastitis, and this leads to increased production (Netto et al., 2022). It also plays an important role by acting as an antagonist of free radicals in muscle cells, membranes and udder tissues while strengthening the immune system (Azzi and zinggl, 2005). This is consistent with the findings of Chandra et al. (2013) when adding vitamin E in an amount of 1000 IU / Day / cow to Sahiwal Sahiwal dairy cows at the age of two months before birth to three months after birth, as well as agreed with Singh et al. (2020) when adding vitamin E in the Formula Alpha-tocopherol in an amount of 1 g/ cow/ day during a period of 30 days before birth and 30 days after birth to Jersey cows. While it did not agree with the findings of O'donnell-Megaro et al. (2012) when vitamin E was added to the feed in the form of all-rac-α-tocopheryl acetate in an amount of 10,000 IU / cow/ day, the feed was provided daily for two weeks during a 28-day study period in Holstein cows.

Table 1. Effect of dosing vitamin E and selenium nanoparticles two months before and after birth on the monthly and total milk production (kg / cow) of Holstein cows (Mean ±Standard error).

Treatments / Duration	First month	second month	Third Month	fourth month	fifth month	sixth month	total
T1: control without dosing	**360.00 ± 178.74**	**434.00 ± 189.83**	**410.75 ± 147.25**	**345.00 ± 168.15**	**356.50 ± 177.85**	**202.50 b ± 94.37**	**2108.75 ± 946.10**
T2: vitamin E dosage 3000 IU / cow	**578.75 ± 114.85**	**593.25 ± 67.79**	**658.75 ± 38.75**	**495.00 ± 58.09**	**550.25 ± 62.48**	**442.50 a ± 49.56**	**3318.50 ± 271.20**
T3: Nano Selenium dosing 5mg / cow	**361.66 ± 54.67**	**394.33 ± 134.54**	**485.66 ± 186.28**	**290.00 ± 101.48**	**341.00 ± 142.05**	**270.00 ab ± 105.35**	**2142.66 ± 640.06**
T4: dosing of vitamin E and Selenium nanoparticles in the amount of 3000 IU / cow	**566.20 ± 87.10**	**320.00 ± 32.47**	**421.60 ± 112.02**	**468.00 ± 104.18**	**378.20 ± 74.91**	**360.00 ab ±**	**2514.00 ± 437.53**

and 5 mg / cow, respectively						**57.70**	
significant level	**0.519**	**0.387**	**0.141**	**0.219**	**0.197**	**0.025**	**0.222**

* Averages with different letters within the same column differ from each other significantly at a probability level of 0.05 according to the Duncan multi-range test.

- Fat Corrected Milk (FCM) 4%

Table 2. The table shows that the effect of dosing vitamin E and nanoselenium in FCM 4% shows that there were no significant differences at dosing and for all treatments within 10 days of birth, a month after birth and two months after birth, but an arithmetic increase was observed in the treatment T2 dose of vitamin E, reaching 241.92 kg/cow, treatment T3 dose of nanoselenium reached 91.86 kg/cow, while treatment T1 control without addition amounted to 115.08 kg/cow, treatment T4 dose vitamin E and selenium nanoparticles reached 142.91% ten days after birth.

As for a month after birth, there is an increase, but the calculation for the T2 treatment, the dose of vitamin E reached 593.56 kg/cow compared to the T3 and T4 treatment, which reached 255.33 and 272.00 kg/cow, respectively, while the T1 control treatment without addition amounted to 402.26 kg/cow, while two months after birth, there is also an arithmetic increase for the T2 treatment, the dose of vitamin E reached 633.13 kg/cow compared to the T1 controlled without addition, which amounted to 293.97%. T3 and T4 reached 394.41 and 488.98 kg/cow, respectively.

Table 2. Effect of dosing vitamin E and selenium nanoparticles two months before and after birth in FCM 4% of Holstein cows (mean ± standard error).

Duration / Treatments	**10 days from birth**	**A month of 10 days**	**Two months of 10 days**
T1: control without dosing	**115.08±50.50**	**402.26±165. 58**	**293.97±95.17**
T2: vitamin E dosage 3000 IU / cow	**241.92±63.69**	**593.56±91.88**	**633.13±146.22**
T3: 5mg / cow Nano Selenium dosing	**91.86±20.90**	**255.33±73.77**	**394.41±196.23**
T4: dosing of vitamin E and Selenium nanoparticles in the amount of 3000 IU / cow and 5 mg / cow, respectively	**142.91±22.10**	**272.00±59.82**	**488.98±178.51**
significant level	**0.053**	**0.156**	**0.180**

- The amount of fat in milk

And through Table 3. Effect of dosing vitamin E and selenium nanoparticles can be seen in the amount of fat in the milk of Holstein cows and there are significant differences between the transactions, where the T2 treatment was superior and recorded a value of 10.99 kg/cow compared to the T3 dosing treatment, which amounted to 3.01 kg/cow, while in the T4 treatment there was a clear decrease of 4.88 kg/cow, which did not differ significantly from the T1 treatment, recorded 4.47 kg/cow 10 days after birth, either in the first month after birth, the superiority of the T2 treatment is noted, as a value of 23.75 kg/cow was recorded compared to the T3 dosing treatment, which amounted to 6.50 kg/cow, while the T4 treatment decreased significantly, reaching 9.60 kg/cow, which did not differ Significantly, the T1 treatment was recorded at 15.24 kg / cow.

While it is observed in the period of two months after birth, there are no significant differences between the treatments, but there appears to be an increase, but the calculation of the T2 treatment recorded a value of 24.64 kg/cow compared to a treatment without the addition of T1, which amounted to 8.66 kg/cow, while the T3 and T4 dosage treatments amounted to 13.34 and 21.35 kg/cow, the reason may be due to the role of vitamin E as an antioxidant its quantity is in milk (pchova et al., 2008). This result does not agree with what Rahmani et al. (2014) found when adding vitamin E in an amount of 4400 IU/ cow to the Holstein cows ' meal during four weeks before calving and five weeks after calving, and it agrees with what Santoshi et al. (2018) found when adding a mixture of sodium citrate in a ratio of 25 g/ kg feed and vitamin E in an amount of 1000 IU/ Animal/ Day to thirty Sahiwal Sahiwal cows births.

Table 3. Effect of dosing vitamin E and selenium nanoparticles two months before and after calving on the amount of milk fat of Holstein cows kg / cow (mean ±standard error).

Duration / Treatments	10 days from birth	A month of 10 days	Two months of 10 days
T1: control without dosing	4.47±1.79 ab	15.24±6.08 ab	8.66±2.46
T2: vitamin E dosage 3000 IU / cow	10.99±3.37 a	23.75±5.35 a	24.64±9.77
T3: 5mg / cow Nano Selenium dosing	3.01±0.92 b	6.50±1.33 b	13.34±7.10
T4: dosing of vitamin E and Selenium nanoparticles in the amount of 3000 IU / cow and 5 mg / cow, respectively	4.88±0.97 ab	9.60±3.39 ab	21.35±8.99
significant level	0.061	0.134	0.285

* Averages with different letters within the same column differ from each other significantly at a probability level of 0.05 according to the Duncan multi-range test.

- The amount of protein in milk

And through Table 4. The effect of vitamin E and selenium nanoparticle dosing is shown in the amount of protein in the milk of Holstein cows, it is noted that there are no significant differences between the treatments for all durations, but an arithmetic increase was observed a month after birth, as the T2 dosing treatment recorded an arithmetic increase of 20.00 kg/cow, while it is observed during two months after birth, in which the T2 dosing treatment also recorded an arithmetic increase of 20.16 kg/cow.

Table 4. The effect of dosing vitamin E and selenium nanoparticles two months before and after birth on the amount of protein in milk for Holstein cow's (kg / cow) (mean ±standard error).

Duration / Transactions	10 days from birth	A month of 10 days	Two months of 10 days
T1: control without dosing	8.89±4.49	14.66±6.24	13.17±4.48
T2: vitamin E dosage 3000 IU / cow	6.78±1.18	20.00±2.36	20.16±1.17
T3: 5mg / cow Nano Selenium dosing	4.33±0.84	12.40±4.09	14.66±5.71
T4: dosing of vitamin E and Selenium nanoparticles in the amount of 3000 IU / cow and 5 mg / cow, respectively	5.95±1.03	9.88±1.23	12.80±3.52
significant level	0.221	0.295	0.186

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