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Effect of Nano or Metallic Zinc Oxide Dosing on Local Awassi Ewes on Some Reproductive Traits and Milk Components

Moataz Hassoun Karkouch[1] *; Ahmed Ali Adhab[2]
1Wasit Agriculture Directorate
2Animal Production Department College of Agriculture-University of Diyala *e-mail: moatazkrkush@gmail.com

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Abstract:
This experiment was conducted in a field of a breeder (private sector) in Wasit Governorate / Kut district for the period from 1/7/2021 to 1/4/2022. 50 pregnant local Awassi sheep, aged 3-4 years, with average 62.00±0.5kg Body weight were used in this experiment to study the effect of dosing on Nano zinc oxide. Or mineral for local Awassi ewes in some productive traits. The ewes were divided into 5 groups, a control group and four treatments, each group comprising 10 ewes. The first group represented the control group without addition, the first treatment was 40 mg/animal/day Zno, the second treatment was 20 mg/animal/day nZno, and the third treatment was 60 mg/animal/day Zno and the fourth treatment 30 mg/animal/day nZno. Ewes were dosed with zinc capsules at the beginning of the fourth month of pregnancy on 1/10/2021 and until30/11/2021. The results of this study showed that, the second and fourth treatments were significantly (P≤0.05) superior to the control group and the third treatment in milk production at the second month, the second and fourth treatments were significantly (P≤0.05) superior at the third month in milk production. The second treatment was highly significant (P≤0.01) than the control group and the other treatments in the percentage of protein, which amounted to 4.60%, and it was significantly (P≤0.05) superior to the third treatment in the percentage of lactose, which amounted to 5.43% first month, the third treatment was highly significant (P≤0.01) over the control group and the first, second and fourth treatments in the percentage of fat, which amounted to 5.07%, and significantly (P≤0.05) was superior to the fourth treatment in the percentage of non-fat solids, which amounted to 9.73%, and there were no significant differences. Between the third, first and second treatment and the control group, the third treatment outperformed the highly significant (P≤0.01) on the control group and remaining treatments in the percentage of protein and lactose, which amounted to 5.68, 4.64 % at second month, No significant differences between the treatments and the control group in all milk components at the third month of lactation. There were no significant differences between the treatments and the control group in the fertility rate, significant superiority (P≤0.05) in the percentage of fertilization between the treatments, and the third and fourth treatments recorded the highest percentage of (100,100) % for each of them, and the lowest percentage was for first treatment, which amounted to (80) %.

Keywords: local Awassi sheep, Nano, zinc oxide, milk production, fertility *
The research is a part of master's thesis for the first researcher.

INTRODUCTION

The trace elements are necessary to feed animals, and are required in quantities smaller or equal to 100 mg / kg in the dry food, and these elements include (iron, zinc, copper, manganese, selenium), and in the event of a deficiency of one or all of them in the components of natural feed will require the use of supplements To make the diet nutritionally complete (Miller et al, 1991), and micro minerals have a great importance and impact on animal physiology and reproduction, and most of the rough and commercial feeds have a deficiency in trace mineral elements, and the imbalance of these elements leads to many problems, including a decrease in The reproductive efficiency of the animal, which is therefore an economic loss (Kumar et al, 2011). One of the most important of these trace elements is zinc, which has a vital role in the animal and is an essential component in more than 200 mineral enzymes, and participates in protein synthesis, carbohydrate metabolism, and many reactions Other biochemical (Salim et al, 2008), and zinc is necessary and important for ruminants, where preliminary studies indicated that zinc helps in the digestion process and in the case of its deficiency causes problems in the digestive system. For animal growth and reproduction (Suttle, 2000). And zinc is fed in the form of inorganic salts, for example, zinc oxide (ZnO) and zinc sulfate (Znso4). However, enhancing the availability of zinc biologically can help improve livestock performance (Abedini et al., 2018). Nanoparticles of metallic elements have higher bioavailability, due to their novel properties such as larger surface area, higher surface activity, high catalytic efficiency, and stronger adsorption capacity (Manuja et al., 2012), Nanotechnology is one of the modern technologies that have proven its positive effects in many fields, including agriculture, medicine, engineering, and the field of energy, as they deal with materials and structures of dimensions ranging from 1-100 nanometers(Aljuheishu,2020) , The metal is excreted and polluted the environment (Raje et al, 2018), Studies have shown that the relationship between milk production and the amount of energy consumed by milking ewes is a direct relationship, and the level of production of milk, its components The sugar lactose is the main osmotic component in milk, and it ranges in a concentration of 4.8-5.0% in sheep milk and in the form of fat / lactose and protein / lactose and metabolic aspects is the basic and first step in developing nutrition that aims to meet the nutritional requirements of animals (Pulina et al., 2004). Fertility in a herd of sheep as the number of ewes born from ewes exposed to rams during the breeding season It is considered one of the important economic characteristics, as the higher the fertility of the herd, the greater the number of births, and consequently the increase in profit. Therefore, the efficiency of production in sheep is conditional on fertility, that is, the number of lambs born is better than the increase in weight (Petrovic et al., 2012), Deficiency of one or more of the trace elements such as copper, cobalt, manganese, selenium, iodine, iron and zinc causes a failure in reproductive performance in ruminants. The manifestations of zinc deficiency are low in fertilization females and failure to reproduce (Vazquez et al, 2011).

MATERIALS AND METHODS

Experimental site

The experiment was conducted in Wasit Governorate / Kut district in a field belonging to a sheep breeder (private sector) west of Kut city for the period from 1/7/2021 for 1/4/2022. To know the effect of Nano or metallic zinc on some productive traits and growth characteristics of local Awassi ewes and their lambs.

Experimental Animals

The experimental animals were monitored from the beginning of the fertilization until the weaning of the newborns (3 months). The mothers and their newborns were weighed at birth and then monthly until weaning. The ewes were spoiled, as the ewes were placed with the rams for the duration of the mating period from the beginning of the fertilization1/7/2021. Where a specific number was placed on the back of the ewe, indicating the date of insemination with spry dye, and the date of insemination of each ewe was recorded. The ewes were grazing in the morning from six in the morning until eleven in the morning and from three to seven in the evening in summer, while in winter they were grazing from seven in the morning to four in the afternoon with giving agricultural crop residues such as wheat straw, barley straw after cutting it and yellow corn and barley groats Barley groats with different types of grains with crushed hay and served to the animals in the evening after returning from the pasture, at the rate of 500 g per head in a feeder be displayed 50cm width 60 cm high and 10 m long. It provides clean drinking water for animals. In the barn there is an iron basin with an area of (2 m * 0.75) cm, in which drinking water is placed for the animals.

Experimental Design

The experimental animals consisted of 50 Awassi sheep, divided into 5 groups, 10 ewes per group. Each group was numbered sequentially from 1-10. Each group was given a color with spry dye. Its initial weight was recorded after mating on1/7/2021. The capsules were filled with zinc oxide. Nano or metallic ones and weighed with a sensitive scale in the laboratory of the Department of Animal Production / College of Agriculture Wasit University for each treatment as follows: (40 mg/animal/day Zno, 20 mg/animal/day nZno, 60 mg/animal/day Zno, 30 mg/ animal/day nZno).

Studied traits

1. Milk production: By hands milking method was used to collect milk samples once a week after Isolation the lambs for 12 hours from the mothers and milking the next morning and multiplying the result by 2 according to the ICAR method (1992).
2. The proportions of milk components were measured using the German-origin Milk Analyzer In the laboratory of the Department of Animal Production / College of Agriculture / Wasit University, samples are taken immediately after milking by 50 ml milk sample for each ewe in the second week of birth for the parent ewes to conduct the analysis as the sample is placed in the device and the result appears after a minute and a half on the device screen as percentages For each component of the milk, which includes fat, non-fat solids, density, protein and lactose sugar, these components were measured in milk every month during the experiment period from the beginning to the end of the experiment.
3. Fertility: The fertility rate was calculated according to the following law

Fertility percentage = number of ewes born x 100
Number of ewes exposed to Rams 4.

Fertilization: It was calculated according to the following law:

Fertilization rate = number of ewes born + aborted x 100
Number of ewes exposed to Rams

Statistical analysis

The data of the experiment were analyzed using the Complete Randomized Design (CRD) to determine the effect of the treatments on the studied traits and the significant differences between the means were compared with (Duncan, 1955) polynomial test, and the ready-made statistical program (SAS) (2012) was used in the statistical analysis

According to the following mathematical model:

Yij=the observed value j of the transaction i. μ= the overall mean Ti= effect of treatment. Eij=the Experimental error.

Chi-square test was used to compare the significant differences between percentages.

RESULTS & DISCUSSIONS Milk Production

Table (1) shows the monthly milk production for the treatments (1,2,3,4) and the control group during the lactation months, and it is noted that there are no significant differences between the treatments (1,2,3,4) and the control group at the first month of milk production, As there were arithmetic differences, but did not reach the level of significance, while treatment (2,4) was significantly (P≤0.05) superior to treatment (3) and the control group in the second month of lactation in milk production, and there were no significant differences between the treatments (2,4), and treatment (1), and at the third month of lactation, treatments (2,4) were significantly superior to treatment (3) and the control group (P≤0.05), and there were no significant differences between treatments (2,4) and treatment (1),This result agreed with (Mohamed et al ,2017) when using Nano-zinc oxide and zinc oxide in the control group and the superiority of the Nano-zinc treatment as it reached the peak of milk production in the fifth week of the second month compared to the zinc oxide treatment and the control group, this result also agreed. With what was indicated by (Abo-El-haded et al,2021) in pregnant ewes, the treatment of Nano-zinc was superior to that of zinc sulfate and the control group, and in the sixth week at the second month of lactation, and this result agreed with what (Mohamed et al ,2017) mentioned The superiority of Nano- zinc treatment significantly, where the highest value of milk production was recorded in the tenth week, the third month of the lactation period, in comparison with the other groups. And the control group, and there were no significant differences between the zinc nanoparticle treatment and the zinc methionine treatment, where the highest value of milk production was recorded in the third month at the end of the lactation period. The reason for this may be due to the disease of a number of ewes in the treatments that produce less milk with inflammation in the udder, full or half of the udder cirrhosis, as for the better-productive treatments, the reason may be due to the improvement of the digestive treatments of the food in order to improve the digestive enzymes, and the secretion of the hormone prolactin, which works on Initiation and continuation of milk, as nano zinc has an important role in the synthesis of enzymes and hormones, As mentioned by (Zalewski et al,2005).

Table 1. Effect of Nano or metallic zinc oxide dosing on milk production for Awassi ewes (Mean ± standard error)

Treatment / Periods	Control	T1 40mg Zno	T2 20mg nZno	T3 60mg Zno	T4 30mg nZno	Sig Test
First Month	9.01a 1.04±	9.28a 0.81 ±	10.34a 0.48 ±	9.14a 0.67 ±	10.26a 0.48 ±	N.S
Second Month	7.25b 0.68 ±	8.03ab 0.74 ±	9.01a 0.45 ±	7.02b 0.52 ±	8.98a 0.38 ±	*
Third Month	6.26b 0.62 ±	7.60ab 0.59 ±	8.08a 0.33 ±	6.22b 0.73 ±	8.01a 0.29 ±	*

Means with different letters within the same row mean that there are significant differences at the level of probability (P≤0.05)
*significant, ** (P≤0.01) highly significant
N.S not significant.

Milk Component

From Table (2) that there are highly significant differences in the percentage of protein (P≤0.01), and the differences were significant (P≤0.05) in the percentage of lactose, while no significant differences in the percentage of fat, density and non-fat solids among the four treatments (4, 3,2,1) and the control group in the first month, as treatment (2) was superior to treatment (4,3,1) and the control group, and treatment (2) outperformed treatment (3), and there were no differences Significant between treatment (2) and treatments (4,1) and the control group in the percentage of lactose in the first month, In Table (3), there were highly significant differences in the percentage of fat, protein and lactose (P≤0.01), and the differences were significant (P≤0.05) in the percentage of non-fat solids, and there were no significant differences in density between the four treatments and the control group at the second month. , as treatment (3) was superior in the percentage of fat to treatments (4,2,1) and the control group, and treatment (3) was significantly superior to treatment (4), and there were no significant differences between treatments (2,1) and the control group and treatment (3).) in the percentage of non-fat solids at the second month, and treatment (3) was highly significant (P≤0.01) in protein percentage over treatments (4,2,1) and the control group, as well as treatment (3) was highly significant (P≤). 0.01) in the percentage of lactose on the control group and the treatments (4, 2, 1) at the second month, Table (4) the differences were not significant in all milk components between control group and four treatments at the third month, The protein content was in agreement with what was found by(Mohamed et al,2017) in pregnant ewes, and the zinc nanoparticle treatment was superior to the control group, and there were no differences between the nano zinc and zinc oxide treatment, and this result differed with what was found by (Abo El-haded et al,2021). In pregnant ewes, no significant differences between the treatments and the control group in the percentage of protein in first month. The reason for the high percentage of protein and lactose may be due to the high percentage of protein and glucose in the blood, This result differed with what was found by (Mohamed et al, 2017) in the percentage of fat, no significant differences between the treatments and the control group, and it also differed with what was mentioned by Abo El-haded et al, 2021) where there were no significant differences between the treatments and the control group in the percentage of fat. Fat at the second month, and this result differed with what was found by(Mohamed et al, 2017), as the treatment of nano-zinc and zinc oxide outperformed the control group in the percentage of non-fat solids, This result also differed with what (Abo El-haded et al, 2021) no significant differences between the treatments and the control group in the percentage of non-fat solids at second month, This result agreed with what was recorded by(Hassan et al,2011)which is the superiority of zinc sulfate treatment over zinc methionine treatment in lactose content, This result differed with what(Mohamed et al,2017) mentioned, which is that there were no significant differences between the treatments and the control group in the percentage of lactose, The reason for the high percentage of fat and lactose, as noted by (Sultan and Mohammad ,2019) may be due to the lack of mothers' milk in second month of suckling.

Table 2. Effect of nano or metallic zinc oxide dosing on milk components of Awassi ewes in first month of lactation % (mean ± standard error)

Treatment / Periods	Control	T1 40mg Zno	T2 20mg nZno	T3 60mg Zno	T4 30mg nZno	Sig Test
Fat	3.78a 0.33± 0	3.95a .62 ± 0.38 ±	4.82a 0.12 ± 0.36	3.70a ± Sold non	3.81a 8.49a 8.66a	N.S 9.06a 8.30a
7.75a N.S fat Protein	0.13 ± 0.78 3.12bc	± 0.75 ± 0.31 ± 0.22 ± 3.20bc 4.60a	2.86c 3	.72b ** 0.06 ±	0.28 ± 0.30 ±	
Density 1.02	0.11 ± 39a 1.0249a	0.32 ± 1.0271a 1.02	23a 1.0233a	N.S 0.00± 0.	00 ± 0.00 ±	0.00 ± 0.00 ±
Lactose	4.65ab 0.10±	4.85ab 0.43 ±	5.43a 0.37 ±	4.23b 0.14 ±	4.76ab 0.16 ±	*

Means with different letters within the same row mean that there are significant differences at the level of probability (P≤0.05)
*significant, ** (P≤0.01) highly significant
N.S not significant.

Table 3. Effect of nano or metallic zinc oxide dosing on milk components of Awassi ewes in second month of lactation %(mean ± standard error)

Treatment Periods	Control	T1 40mg Zno	T2 20mg nZno	T3 60mg Zno	T4 30mg nZno	Sig Test
Fat	2.98b 0.17±	3.69b 0.22 ±	0.27 ± 3.61b 0.41 ±	5.07a 0.54 ± Sold	3.80b non 8.69ab	** 8.51ab
8.63ab 9.73a Protein	7.81b 3.23b 0.08 ±	* fat 0.13± 3.16b 3.34b 0.35 ±	0.17 ± 4.64a	0.15 ± 0.65 ± 3.66b **	0.48 ± 0.05 ± 0.06 ±	0.09 ±
Density 1.0261a	1.0247a	1.0257a	1.0733a	1.0510a N.S	0.00± 0.00 ±	0.00 ± 0.04 ± 0.03 ±
Lactose	4.84b 0.07 ±	4.78b 0.09 ±	4.77b 0.11 ±	5.68a 0.29 ±	4.53b 0.23 ±	**

Means with different letters within the same row mean that there are significant differences at the level of probability (P≤0.05)

*significant, ** (P≤0.01) highly significant

N.S not significant.

Table 4. Effect of nano or metallic zinc oxide dosing on milk components of Awassi ewes in third month of lactation% (mean ± standard error)

Treatment Periods	Control	T1 40mg Zno	T2 20mg nZno	T3 60mg Zno	T4 30 nZno	Sig Test
Fat	4.67a 4.42a	4.35a 4.38a	4.19a N.S	0.22± 0.28 ±	0.11 ± 0.29 ±	0.16 ±
Sold non 0.15 ±	8.40a 0.13 ±	8.45a 0.12 ±	8.42a 8.38a	8.19a N.S fat	0.13± 0.11 ±	
Protein	3.15a 3.25a	3.31a 3.44a	3.24a N.S	0.06± 0.14 ±	0.08 ± 0.22 ±	0.12 ±
Density	1.0476a 1.0235a 0.00±	1.0512a	1.0252a 1.0234a	N.S 0.02±	0.00 ± 0.03	± 0.00 ±
Lactose	4.73a 0.08±	4.65a 0.08±	4.77a 0.11 ±	4.60a 0.06 ±	4.58a 0.08 ±	N.S

N.S not significant.

Fertility, fertilization

From Table (11) it shows that there are no significant differences between the control group and the four treatments in the fertility rate as it reached (90,80,90,80,80), and this result differed with what(Kundu et al,2014) mentioned in pregnant goats when using zinc oxide With two treatments and a control group, the treatment of zinc oxide with a concentration of 100 ppm was superior to that of zinc oxide at a concentration of 50 ppm and the control group in terms of fertility, which was 66.66, 83.3,100%, respectively, it differed with what (Awawdeh et al,2019) found in pregnant ewes, and there were significant differences when using zinc oxide and vitamin E with a treatment and a control group, as the zinc and vitamin E treatment outperformed the control group in the fertility rate, which amounted to 69.4,78.9%, respectively. It is clear that there are significant differences (P≤0.05) between treatments in the percentage of fertility, where third and fourth treatment recorded the highest percentage of (100,100) % for each of them, respectively, while the lowest percentage was with first treatment, which amounted to (80) %, This result differed with what was found by (Kundu et al,2014) which is that there were no significant differences between the treatments and control group in the fertilization rate, which was 1.66, 2.00, 2.40%, respectively, This result agreed with (Adhab et al,2015) when it was found that the breeder's flock recorded the highest fertilization rate of 80% in the local Awassi sheep, this result agreed with what (Shareef et al,2021) indicated in the local goats. Pregnant when using zinc and selenium with two treatments and a control group, the zinc and selenium treatments outperformed control group in fertilization rate, which was 60,100,100%, respectively, and reason for the high fertilization rate in third and fourth treatment may be due to the absence of barrier ewes in it and the occurrence of abortions and births.

Table 5. Comparison between the four treatments and the control group in the indicators of fertility and fertilization %

Treatment		T1	T2	T3	T4	Sig
Control 40mg 20mg 60mg 30mg Characteristic Zno nZno Zno nZno Test fertility 80.00 80.00 90.00 80.00 90.00 N.S fertilization 90.00 80.00 90.00 100.00 100.00 *						

*(P≤0.05) significant, N.S, not significant.

CONCLUSIONS

The second and fourth treatment were significantly (P≤0.05) superior to the control group and the third treatment in milk production, and there were no significant differences between the second and fourth treatment and the metallic zinc oxide treatment with a concentration of 40/mg at the second and third month. Highly significant (P≤0.01) for second treatment in the percentage of protein over other treatments, and significantly (P≤0.05) over the third treatment in the percentage of lactose in first month, Highly significant (P≤0.01) for zinc oxide treatment with a concentration of 60/mg over other treatments in the percentage of fat, protein and lactose, and significantly (P≤0.05) in the percentage of non-fat solids over fourth treatment at second month of lactation, There were no significant differences between treatments in all milk components in third month ,There are no significant differences between the control group and the four treatments in the fertility, The third and fourth treatments were significantly (P≤0.05) superior to control group, and first and second treatments were in fertilization rate.

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