EFFECT OF FORCE MOLTING USING HIGH LEVELS OF DIETARY NANO ZINC OXIDE ON PRODUCTIVE PERFORMANCE OF LAYING HENS

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ABSTRACT

The experiment was conducted during 1/4/2020-7/31/2020 to study the effect of adding high levels of nano-zinc oxide with the diet to induce force molting in laying hens by measuring some productivite traits. Eighty laying hens, 69 weeks old were used, randomly divided into four treatments, five replicates for each treatment using CRD. Experimental treatments were: first treatment (T1), second treatment (T2), third treatment (T3) and fourth treatment (T4), which means control treatment without molting, adding 10, 15, and 20 gm of nano-zinc oxide / kg feed respectively. Results showed significant decreases (P<0.01) in egg production and almost ceased in the 2nd and 3rd week after start molting. Egg production increased significantly in T2, T3, and T4 when compared to T1 since 2nd week of starting egg production until the end of the period. The mean of egg production was 54.8, 75.19, 74.9 and 78.0 in T1, T2, T3 and T4 respectively . There was a significant decreases in body weight during the molting and most of the loss was in liver, pancreas, ovary and oviduct. It can be concluded that 10, 15 and 20 gm of nano-zinc oxide/kg feed showed high efficiency in inducing molting and producing eggs, and the level of 20 gm was the best.

Key words: body loss, nanotechnology, egg production, layer chicken, liver

مجلة العلوم الزراعية العراقية -2022 :53 (1):230-236 **الموسوي والحسني**

تاثير نزع الريش الاجباري باستعمال مستويات مرتفعه من نانو اوكسيد الزنك في العلف في الاداء الانتاجي لدجاج البيض

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المستخلص

اجريت التجربة للفترة 2020/4/1 لغاية 2020/7/31 لدراسة تأثير اضافة مستويات عالية من نانو اوكسيد الزنك في أحداث نزع الريش في دجاج البيض بقياس بعض الصفات الانتاجية. استعمل 80 دجاجة بياضة بعمر 69 اسبوع، قسمت عشوائياً الى اربعة معاملات، لكل منها خمسة مكررات.شملت معاملات التجربه: الاولى (T1)، الثانية (T2)، الثالثة (T3) والرابعة (T4) و تعني معاملة سيطرة دون اجراء نزع ريش، أضافة 10، 15، و 20 غم نانو اوكسيد الزنك / كغم علف بالتتابع. حصل أنخفاض معنوي (P<0.01) في أنتاج البيض وتوقف الانتاج في الاسبوعين 2 و3 من بدأ نزع الريش. أرتفع أنتاج البيض معنويا في معاملات نزع الريش مقارنة بمعاملة السيطره منذ الاسبوع 2 من بدأ الانتاج ولغاية نهاية الفتره أذ بلغ المعدل 54.8، 75.19، 74.9و 78.0 في T1 ، T2 T3 و T4 بالتتابع. انخفض معنويا وزن الجسم خلال عملية نزع الريش وكان معظم الفقد في اوزان الكبد، االبنكرياس، المبيض و قناة البيض. يستنتج ان 10، 15 و 20 غم نانو اوكسيد الزنك/ كغم علف أظهر كفاءه عاليه في نزع الريش وانتاج البيض وكان 20 غم أفضلها.

كلمات مفتاحيه: فقدان الوزن، تقنيه نانويه، أنتاج البيض، دجاج البيض

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INTRODUCTION

Modern commercial hybrid strain of laying hens have a great genetic potential for egg production that can last for more than one laying cycle using the force molting process. The process of force molting stops egg production by resting the reproductive system for some time in order to restore its activity and production capacity and extend the period of egg production to a cycle extending to 25-30 weeks, and to improve the quality of eggs and shell (8, 13). More than five decades ago, the use of force molting were used in laying hen projects for the purpose of prolonging the period of egg production (4). Most of the methods depended mainly on food removal or deprivation (fasting), not providing water and reducing the lighting duration and intensity (7 , 11). After humane societies objected to the use of animal starvation, which caused them severe suffering and acut stress, researches have turned to experimenting with other more merciful and friendly methods with birds, so they have gone towards using many organic compounds, minerals and hormones in inducing molting (18). Among these methods zinc oxide has shown high efficiency (14). Despite the outstanding successes and achievements of nanotechnology and its practical applications in all sciences, we have not found studies that have applied this technique in the molting process (21,22). Based on the above, high levels of nano zinc oxide have been experimented with the feed of old layer chickens to determine their efficiency in inducing molting .

MATERIALS AND METHODS

This experiment was conducted at the Al-Amer Poultry Company (private sector) farms, Babil Governorate for the period from 1/4/2020 to 31/7/2020. In the experiment, 80 Lohman red laying hens of 69 weeks old were used, divided randomly into four treatments, each treatment had five replicates, each replicate contained 4 hens. Chickens were reared inside cages placed in a control closed room. The chickens were allocated into 20 cages, 4 hens in each cage. The dimensions of one cage were 40 x 45 x 35 cm. All treatments were raised in the same conditions. The experimental treatments included the following: The first treatment (T1): a control treatment without force molting process, the second treatment (T2): adding 10 gm of nano-zinc oxide / kg of feed, the third treatment (T3): adding 15 gm of nano-zinc oxide / kg of feed, the fourth treatment (T4): Add 20 gm of zinc oxide/ kg of feed. A layer ration was used as feed (Table 1). The nano zinc oxide compound was purchased from the local market, which is produced by U.S. Research nanomaterials, Inc. USA. At the end of the experiment, one chicken was randomly selected from each replicate, weighed and then slaughtered. The ovaries, oviducts, heart, pancreas and liver were extracted for the purpose of weighing and calculating the absolute and relative weight. Statistical analysis of the traits data was carried out using the ready-made statistical program (12) and the effect of treatments was determined using the Complete Randomized Designe (CRD). To test the significance of differences between the means, Duncan's multilevel test (7) was used in the < 0.01- < 0.05 probability levels.

RESULTS AND DISCUSSION

Table -2 indicats to the effect of adding high levels (10, 15 and 20 g nano zinc oxide /1 kg feed) to trigger the process of force molting and to know the mean of weekly egg production for three weeks and the total eggs produced during the period of forced molting. Egg production in T2, T3 and T4 treatments were significantly decreased compared to the control treatment (T1) in the first week of the force molting process and then ceased permanently in the 2^{nd} week and the 2^{nd} and 3^{rd} weeks in T2 and T4, T3 treatments respectively. Compared to the control treatment (T1), the mean of egg production increased significantly in the three experimental treatments (T2, T3, and T4) since the 2^{nd} week after completing the force molting process until week 13, and the mean of weekly egg production for all the productive period after the molting process showed the same trend (Table 3 and Figure 1) .Table 4 indicats that there was a decreases in the chicken's body weight about 25% of its body weight before the force molting initiation. The decrease was significant in the treatments T4 and T3 compared to the treatment T2. Table 5 showed a significant decreases in the absolute and relative weight

of the liver, pancreas, ovary and oviduct , while there were no significant differences in the heart between all treatments of nano zinc oxide addition and the control treatment. It appears that the action of the zinc oxide compound in its chemical formula or in the form of nano-zinc oxide in the force molting process is mainly to inhibite the satiety center in the brain, which leads to loss of appetite and a significant decrease in the amounts of food intake that leads to a decrease in live body weight ranging between 25 -30% (3, 5). The greatest part of weight loss occured in the female reproductive organs (ovaries and oviducts) (2,12,19) and less liver, as this causes atrophy of both ovaries and oviducts, thus inhibiting the secretion of the gonad hormones such as; progesterone, estrogen, luetinizing hormone (LH) and follicle stimulating hormone (FSH), eventually egg production stops (1, 12). The cause of liver weight loss is primarily due to the consumption of fat stored in it (15, 16). The results show the effectiveness of nano zinc oxide added to the diet of old laying hens in inducing molting and the cessation of egg production and the return of high egg production in the period following the molting. According to its economic importance, it is recommended to use it in chicken herds.

Table 1. Formulation and chemical composition of experimental diet

Item	(%)
Ingredients	
Soybean meal (46% C.P)	**25**
Premix for layer	**2.5**
Yellow corn	**42**
Wheat	**21**
Limstone	**7.5**
Sunflower oil	**1.8**
Salt (NaCl)	**0.2**
Cemical composition	**(%)**
Crude protein	**18.3**
Metabolizable energy	**2857 Kcal/ kg diet**
Lysine	**0.92**
Methionin	**0.45**
Methionin+ cystein	**0.86**
Thrionin	**0.69**
Tryptophan	**0.21**
Arginin	**0.94**
Isoluecin	**0.72**
Valien	**0.81**
Calcuim	**0.29**

Reference (feedstuffs Reference Issue and data 2018-2019).

Table 2. Effect of different levels of Nano Zinc oxide supplemented with diet on egg production (H.D%) during force molting period

Treatment	Weeks			Mean of egg production	Total egg produced
	1	2	3		
T1	**75.71±4.14 a**	**74.28±5.92a**	**78.57± 6.14 a**	**76.19± 4.83 a**	**269**
T2	**30.28± 3.5 b**	**0.00**	**2.86 ± 0.98 b**	**11.04± 2.27 b**	**50**
T3	**28.57 ± 3.01 b**	**0.00**	**0.00**	**9.52± 1.66 b**	**40**
T4	**31.57 ± 4.22 b**	**0.00**	**0.00**	**10.52± 2.87 b**	**43**
P value	**	**	**	**	

T1,T2,T3 and T4 mean control treatment without force molting, adding 10, 15, and 20 gm of nanozinc oxide / kg feed respectively

Table 3. Effect of different levels of Nano Zinc oxide supplemented with diet on egg production (H.D%) during post force molting laying period

Treatment	Weeks													Mean of egg production	Total egg produced
	1	2	3	4	5	6	7	8	9	10	11	12	13		
T1	60.07 ± 4.51 a	54.3 ± 4.18 b	55.7 ± 5.2 b	52.15± 3.3 b	42.15 ± 0.6 b	40.0± 3.6 b	45.0 ± 5.11 b	45.7 ± 3.08 b	44.3 ± 4.2 b	45.79.14 ± 3.52 b	50.7 ± 3.09 b	49.3 ± 3.1 b	47.15± 4.16 b	54.8 ± 5.2 c	872
T2	27.85 ± 3.29 c	70.7 ± 7.61 a	82.15± 7.4 a	80.0 a±4.15	79.25± 2.3 a	80.7± 18.19 a	86.3 ± 7.5 a	81.3 ± 6.2 a	80.0 ± 6.9 a	78.55 ± 8.41 a	75.7 ± 7.3 a	75.5 ± 7.14 a	73.55 ± 9.31 a	75.19 ± 3.2 b	1220
T3	37.1 ± 4.42 b	79.3 ± 9.34 a	82.1± 6.1 a	79.3± 4.4 a	76.3 ± 3.2 a	80.0 ± 9.01 a	82.15 ± 6.8 a	82.3 ± 6.4 a	78.55 ± 7.99 a	75.0 ± 8.66 a	73.55± 8.05 a	74.25 ± 9.01 a	74.3± 9.26 a	74.9 ± 3.1 b	1364
T4	35.7 ± 2.76 b	78.55 ± 6.82 a	82.7 ± 5.8 a	79.3 ± 5.1 a	83.0± 3.4 a	84.3 ± 9.7 a	82.85 ± 6.6 a	78.55 ± 5.11 a	77.15 ± 6.27 a	81.3 ± 9.8 a	80.85 ± 9.12 a	70.7 ± 9.18 a	76.3 ± 7.58 a	78.0 ± 7.99 a	1316
P value	**	**	**	**	**	**	**	**	**	**	*	**	**	**	

T1,T2,T3 and T4 mean control treatment without force molting, adding 10, 15, and 20 gm of nanozinc oxide / kg feed respectively

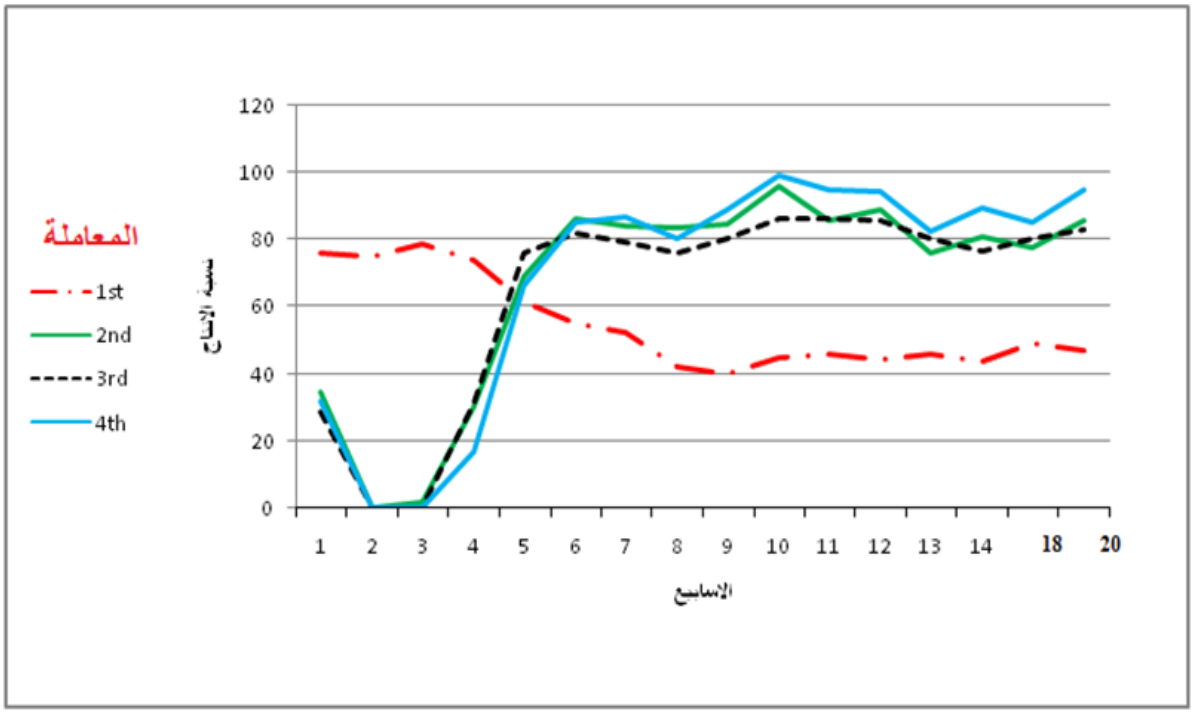

Figure 1. Effect of NanoZinc oxide on egg production post – force molting laying period

T1,T2,T3 and T4 mean control treatment without force molting, adding 10, 15, and 20 gm of nanozinc oxide / kg feed respectively

Table 4. Responses body weight loss of laying hens to different dietary high levels of nanozinc oxide at the end of molting

Treatment	Body weight pre – molting	Body weight post – molting	Weight lost	Weight lost percent (%)
T1	2061.25 ± 22.71	-------	-----	-----
T2	2047.40 ± 16.81	1535.67 ± 9.08	511.73 ± 3.21 b	24.99 ± 1.11
T3	2065 ± 20.06	1543.58 ± 4.55	521.42 ± 4.10 a	25.25 ± 1.09
T4	2063.0± 23.50	1540.41 ± 12.91	522.59 ± 3.97 a	25.33 ± 2.33
P Value	N.S	N.S	*	N.S

T1,T2,T3 and T4 mean control treatment without force molting, adding 10, 15, and 20 gm of nanozinc oxide / kg feed respectively

Table 5. Effect of different levels of Nano Zinc Oxide supplemented with diet on absolute and relative organs weight (g) at the end of force molting period

Treatment	Liver		Pancreas		Heart		Ovary		Oviduct	
	absolute	Relative	absolute	Relative	absolute	Relative	absolute	Relative	absolute	Relative
T1	44.0 ± 2.74 a	0.022 ± 0.008 a	7.8 ± 1.06 a	0.0038 ± 0.003 a	12.6 ± 1.19	0.0062 ± 0.0005	37.6 ± 3.19 a	0.019 ± 0.0005 a	65.6 ± 4.21 a	0.033 ± 0.002 a
T2	30.6 ± 1.91 b	0.015 ± 0.0004 b	4.8 ± 0.99 b	0.0023 ± 0.002 b	13.0 ± 1.38	0.0063 ± 0.0003	11.6 ± 0.88 b	0.007 ± 0.0003 b	30.6 ± 2.29 b	0.015 ± 0.001 b
T3	30.8 ± 2.05 b	0.015 ± 0.0007 b	4.8 ± 0.70 b	0.0023 ± 0.001 b	13.0 ± 107	0.0063 ± 0.0006	12.8 ± 1.95 b	0.0006 ± 0.0005 b	34.0 ± 2.81 b	0.016 ± 0.0008 b
T4	32.2 ± 2.00 b	0.016 ± 0.0009 b	4.6 ± 0.61 b	0.0022 ± 0.001 b	13.2 ± 1.62	0.0064 ± 0.0004	12.0 ± 1.06 b	0.0006 ± 0.0004	29.8 ± 2.07 b	0.014 ± 0.0009 b
P value	*	*	*	*	N.S	N.S	*	*	*	**

T1,T2,T3 and T4 mean control treatment without force molting, adding 10, 15, and 20 gm of nanozinc oxide / kg feed respectively.

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