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EFFECT OF FORCE MOLTING BY ZINC OXIDE AND THE ROLE OF VITAMIN C ON BODY WEIGHT AND REENTRY TO PRODUCTION OF BROILER BREEDER

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ABSTRACT

A total of 296 Arbor Acres broiler breeder 375 days old were randomly divided into eight treatment. Hens in each treatment were subdivided into five replicates and reared on the floor throughout the experimental period. Two treatments free of Zinc included control with or without vitamin C; six treatments included three levels of Zn as ZnO (15000, 20000 and 25000ppm) with or without vitamin C. All treatments extirpated significant differences in percentage body weight loss during molting program. The most significant loss occurred in the T8 and T7 hens. The most reduction of feed intake (%) occurred in T8, T7 and T6 respectively. Furthermore, molting periods significantly affect body weight loss and feed intake (%). The most significant loss of body weight and reduction of feed intake (%) were occurred at day 9 of molting period. Moreover, T4 hens significantly take up more days to 1st day out of production, less days to out of production and to return to egg production compared with other molting treatments.

INRODUCTION

The first objective of a forced molt program is to cause hens to cease egg production long enough and enter a non reproductive state that cause body weight loss (Gordon et al., 2009; Khan et al., 2011).The body weight loss has also been identified as a major factor contributing to the forced molting because body weight loss has influence on the successful results of a forced molting procedure (Idowu et al., 2011). Although, a body weight loss of (0.3-0.4 kg) was reported to be necessary for broiler breeders (Baker et al., 1983), El-Deek and Al-Harthi (2004) cited it is not clear what the optimum BW loss of hens should be during a forced molt for broiler breeder.

An incomplete molt means a period of unprofitability due to a reduction of egg production and the end of the useful life of a flock (Berry, 2003). Buhr and Cunningham (1994) suggested that the longer the cessation period, the better the post molt production.Maximal improvements appears to have been reached with rests periods of 14-21 day (Hurwitz et al., 1995), to cause hens to totally cease egg production and enter a non reproductive state (Webster, 2003). Hassanabadi and Kermanshahi (2007) stated that the possible reason for the improvement in shell weight is the length of the egg production cessation period.

Vermaut et al. (1998) referred to that the only alternatives to the techniques based on feed withdrawal are the feeding of a high-Zn diet or a low-Zn and Ca-deficient diet (Breeding et al., 1992). These diets owe their efficacy to the pronounced anorexia, and also to a direct effect on steroidogenesis, that is, an inhibitory action on ovarian granulosa cell function (Johnson and Breke, 1992).

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Heavy breeders seem less responsive to feed changes than do commercial layers, and so it may be necessary to combine programs such as high mineral eg. Zn together with feed restriction (Leeson and Summer, 2009). Zn supplemented diets have been examined as a possible alternative for induction of molt to avoid the problems associated with feed withdrawal forced molt (Moore et al., 2004).

Although ample literature is available on production parameters in broiler breeder hens by dietary Zn forced molting (El-Deek and Al-Harthi, 2004; Reddy et al., 2008; Mohammed (2010), a better understanding of the effects of vitamin C to reduced stress due to forced molting, particularly by ZnO addition (15000, 20000 and 25000ppm Zn), is necessary if commercial practices involving forced molting are to be optimized in hens.

Therefore, the present study aimed to investigate the effect of different levels of Zn with or without vitamin C addition of molt diet in commercial broiler breeder (Arbor Acres) and their effects on:-

1. Feed intake, body weight, body weight loss of hens during molting period.
2. The appropriate level of Zn with or without vitamin C addition that could cease the producing of eggs during the fore molting period and return to produce egg without being subjected the hens to great stress.

MATERIALS AND METHODS

The present study was conduct using 296 hens of Arbor Acres broiler breeder at 375 days old. The experiment was carried out at the Poultry Research Farm belonging to Faculty of Agriculture Science, Sulaimani University in Bakrajo. Each hen received 155g/day,the laying hen diet formulated to meet or exceed recommendations from the Arbor Acres commercial management guide(Arbor Acres Plus, 2007).

Birds were randomly divided into eight treatments of 37 hens each. Each treatment contains five replicates (R) with seven hens except R1 and R2 were have eight hens, The eight treatment groups were as fallow: T1: Control group fed on commercial Arbor Acres diet. T2: Control group fed on commercial Arbor Acres diet with (1g/kg) vitamin C for 9 days. T3: Force molting by (15000ppm Zn as ZnO) for 9 days. T4: Force molting by (15000ppm Zn as ZnO) with (1g/kg) vitamin C for 9 days. T5: Force molting by (20000ppm Zn as ZnO) for 9 days. T6: Force molting by (20000ppm Zn as ZnO) with (1g/kg) vitamin C for 9 days. T7: Force molting by (25000ppm Zn as ZnO) for 9 days. T8: Force molting by (25000ppm Zn as ZnO) with (1g/kg) vitamin C for 9 days.On the first day of the treatment, the light program was changed to 8Light:16Dark and water was provided *ad libitum*. (Table 1). At day10 post molt, hens from all molting treatment were returned to a regular broilerbreeder diet and 16 h/d of photoperiod. Performance data were obtained at day 7 and 9 during the molting period.The basal diet was formulated using a linear program, to contain 2858 Kcal ME/Kg diet and 16% CP to meet, at least the nutrient requirements according to Arbor Acres broiler breeder nutrition manual (Table 2).

Individual live weights of birds were measured at just before molting, day 7 and day 9 to determine average of body weight loss. Body weight changes were calculated as the difference between the initial and final body weight of the period.

Feed intake was measured during molting periods daily by a weighting the residual feed.

Table (1): Experimental design of periods and treatments schedule for Zinc induced molting.

Stage of Molt	Periods	Date	Age days	Feed g/ hen/day	Light hour	Water
Molting period	9 days	1-9/4/2010	375-383	155 + T**	8	*Ad-lib*
Rest Periods	7 days	10-16*/4/2010	384-390	155	16	

* Resuming of egg production (17/4/2010) ** Treatments

Table (2): Composition calculated and analytical content of diets.

Ingredient	%
Yalow Corn	54.8
Wheat	14.2
Soybean meal(44% CP)	21.5
Breedmix-2.5 W*	2.5
Dicalcium Phosphate	0.3
limestone	6.5
salt	0.2
Total	100
Calculated	
ME, kcal/kg	2858
CP (%)	16
Calcium (%)	3.2
Methionine + cyst. (%)	0.69
Lysine (%)	0.85
Fiber (%)	3.1

* added Vitamin and Minerals per kg:
Vitamin. A 700.000 IU; Vitamin. D_3 140.000IU; Vitamin. E 960 mg; Vitamin. K 80 mg; Vitamin. B1 10 mg; Vitamin. B2 200 mg; Pantothenic acid 320 mg; Vitamin. B6 80 mg; Vitamin. B12 800 mg; Nicotinic acid 800 mg; Folic acid 20 mg; Biotin 3.680 mcg; Choline Chloride 12.000mg; Antioxidant 1.800 mg; Iron 2.000 mg; Copper 400 mg; Manganese 3.200 mg; Zinc 2.400 mg; Iodine 40 mg; Selenium 8 mg; Calcium 23.00%; Phosphorus (available) 8.60%; Methionine 5.40%; Methionine + Cystine 5.40%; Sodium 5.30%; Lysine 2.50%.

Statistical analysis was accomplished using SPSS-17 Package Program for Windows. Least Significant Difference tests (L.S.D) was used to determine the significant of difference among treatments means (Steel and Torrie, 1960). Level of significant used in all results was ($P<0.05$).

RESULTSAND DISSECTION

The highest reduction of feed intake was resulted in molting treatments T8 followed by T7, T6, T5, T4 and T3 respectively (Table 3). Moreover, the differences between unmolting treatments T1 and T2 was not significant. The differences in feed intake between unmolting with molting treatments attributed to molting procedure, subsequently resulted in a significant loss of body weight, feed intake, such results in agreement with (Abo Elouun, 2009).In addition there were significant ($P<0.05$) reduction of feed intake in T4, T6 and T8 compared with corresponded treatments T3, T5 and T7, these differences may be attribute to addition of vitamin C (Al-Kirkuki, 2012). High Zn and vitamin C resulted in significant decreased of feed intake. This result may be attributing to in addition to unpalatability of diet contained high Zn, or to presence of vitamin C interfere with Zn although vitamin C has little effect on Zn (Al-Kirkuki, 2012). Solomons (1982) reported that in the diet and at the tissue level, vitamin C can interact with mineral nutrients. In the intestine, vitamin C enhances the absorption of dietaryiron and selenium; reduces the absorption of copper, nickel, and manganese; but apparently has little effect on zinc or cobalt. Or in contras high levels of Zn interfere with Vitamin C. Maurice et al. (2002) reported that the inconsistent beneficial responses to dietary vitamin C might be due to dietary factors that alter biosynthesis or tissue turnover of vitamin C. Subsequently presences of both resulted in high reduction in feed intake compared with corresponded treatments.

The differences between T1 with molting treatments T3, T5 and T7 may be due to addition of high Zn levels which resulted in decreased feed intake, ZnO addition to layer feed reduced feed intake significantly (El-Deek and Al-Harthi, 2004). Due to unpalatability of diet, such Zn effects on feed intake is in agreement with that reported by Khan et al. (2011) and El-Gendi et al. (2009).

Table 3: Effect of treatments on body weight, feed intake and body weight loss values of hens during 1st molting periods.

T*	Feed Intake (%)	Body Weight (kg)	Body Weight Loss (kg)	Body Weight Loss (%)
T1	$100.00^{a}\pm0.00$	$3.783^{a}\pm0.03$	$0.035^{f}\pm0.01$	$0.908^{f}\pm0.30$
T2	$100.00^{a}\pm0.00$	$3.714^{a}\pm0.05$	$0.072^{f}\pm0.04$	$1.892^{f}\pm2.00$
T3	$55.566^{b}\pm1.04$	$3.458^{b}\pm0.05$	$0.344^{e}\pm0.03$	$9.315^{e}\pm0.73$
T4	$52.420^{c}\pm1.16$	$3.428^{b}\pm0.06$	$0.436^{d}\pm0.05$	$11.650^{d}\pm1.19$
T5	$50.162^{d}\pm1.18$	$3.380^{bc}\pm0.08$	$0.500^{cd}\pm0.04$	$13.378^{cd}\pm0.90$
T6	$47.937^{e}\pm1.20$	$3.318^{cd}\pm0.08$	$0.556^{bc}\pm0.05$	$15.068^{bc}\pm1.29$
T7	$45.606^{f}\pm1.23$	$3.276^{d}\pm0.09$	$0.612^{ab}\pm0.06$	$16.596^{ab}\pm1.64$
T8	$43.095^{g}\pm1.25$	$3.253^{d}\pm0.09$	$0.657^{a}\pm0.05$	$17.813^{a}\pm1.37$

a-g Means ± SEM within columns without common superscripts differsignificantly (*P* < 0.05).*Treatment

There were observation in presence study that with increasing Zn level in diet the birds consumed lower feed, birds stopping feed intake in last few days of molting periods earlier than birds fed diet contained lower Zn levels. Khan et al. (2011) reported that hens given (20000ppm) ZnO in otherwise typical layer ration virtually begin fasting. Daniel and Balnave (1980) reported that feed intake was related to dietary Zn levels: high dietary Zn addition suppressed appetite and reduced daily feed intake to extremely low levels. The reduction in feed intake might be attributed to some factors, including appetite suppression with fed minerals addition, decreased feeding stimulation with reduced daylight hours (Abo Elouun, 2009). Hassan (1996) concluded that using dietary ZnO, for hens, affected the feed center in hypothalamus leading to decrease in feed intake and anaroxy syndrome. While the differences between T2 with molting treatments T4, T6 and T8 may be in addition to molting procedure by high levels of Zn, due to presence of vitamin C and their interaction (Solomon, 1982; Maurice et al., 2002).

The effect of treatments on body weight was significant (Table 3). There were significant differences between unmolting treatments T1 and T2 with all molting treatments. Among molting treatments T8 followed by T7 had significantly lowest body weight, while T3 followed by T4 had significant higher body weight. The absence of significant differences between T3 and T4, T5 and T6, T7 and T8 may be due to vitamin C did not affect significantly on body weight. Because of little effect of vitamin C on Zn absorption, or in contras effect of high levels of Zn on beneficial responses to dietary vitamin C. Solomons (1982) reported that in the diet and at the tissue level, vitamin C can interact with mineral nutrients. In the intestine, vitamin C enhances the absorption of dietary iron and selenium; reduces the absorption of copper, nickel, and manganese; but apparently has little effect on zinc or cobalt. Maurice et al. (2002) reported that the inconsistent beneficial responses to dietary vitamin C might be due to dietary factors that alter biosynthesis or tissue turnover of vitamin C.

Table 3 referred that body weight loss of unmolting hens significantly differed with molting hens, while the differences between T1 and T2 did not significant this may be due to that these two treatments did not exposed to molt treated except reduction in photoperiod during trial period. However, body weight loss (kg and %) significantly differed among molting hens. The highest reduction was resulted in T8 followed by T7 and T6 respectively, the lowest was resulted in T3 followed byT4 and T5 respectively. Furthermore, there were no significant differences between T5 and T7 with corresponded T6 and T8, while T3 had significantly least body weight loss compared with T4. Moreover, T4 did not significantly differenced with T5, which did not significantly differenced with T6, which also did not significantly differenced with T7. Such results may be due to that the interfere between vitamin C and different levels of Zn resulted in lower levels of Zn acts as the higher levels of Zn to forced molting, because vitamin C interact with mineral nutrients and influence the metabolism and absorption of calcium (Sifri*et al.*, 1977; Solomons, 1982). In addition, excessive zinc intake will eventually affect the balance and proper ratios to numerous other important nutrients that may include iron, calcium, selenium, nickel, phosphorus, copper, as well as vitamin A, B1, C, and others (Hill, 2008). Moreover, zinc inhibits vitamin C absorption, but this mechanism is not well understood (Kutlu, 2001).

Significant differences were observed in body weight, feed intake and body weight loss (kg and %) between molting periods (Table 4). At P3 hens had significantly lower body weight and feed intake, and higher body weight loss (kg and %) compared with same birds at P2 of molting period. These results may be attributed to prolongation of molting period, moreover reduction of feed intake increased, subsequently body weight loss increased, may be due to increase reduction of reproductive organs weight. Maulood (1996) reported the birds reproductive organs weight lower significantly at day 6 compared with corresponding traits at day 4.

Table 4: Effect of the molting periods on body weight, feed intake and body weight loss values of hens.

Molting Periods	Body Weight (kg)	Feed Intake (%)	Body Weight Loss (kg)	Body Weight Loss (%)
P1(just before molting)	3.719^{a}±0.02			
P2 (at day 7)	3.398^{b}±0.04	64.227^{a}±3.36	0.321^{b}±0.03	8.640^{b}±0.78
P3 (at day 9)	3.237^{c}±0.05	59.469^{b}±3.80	0.482^{a}±0.05	13.015^{a}±1.25

a-c Means ± SEM within columns without common superscripts differsignificantly ($P < 0.05$).

The significant effects of treatments on parameters of egg production during molting periods and date of reentry to first and (50-60%) production may be attribute to high levels of Zn diet to forced molt.All forced-molting treatment completely ceased egg production, whereas un-molted hens continued laying throughout the 9 days of study. There are significant differences between treatments on egg production parameters (Table 5). The differences were significant between hens subjected to T3 and T4 in 1st day out of production from start of treatment (egg cessation). Hens in T3 ceased egg production by 6.8 days of the experiment, while T4 hens ceased egg production on day 9.0.

Table 5: Effect of treatments on egg production parameters during and after 1^{st}molting periods.

T*	1st day out of production from start of treatment	Days out of production	Days to first egg Post molt	Days to return to (50-60%) egg production
T3	6.800^{b}±0.49	13.600^{a}±0.75	21.400±0.40	26.800^{bc}±0.49
T4	9.000^{a}±0.55	10.800^{b}±0.49	20.800±0.74	25.400^{c}±0.25
T5	$5.400b^{c}$±0.68	14.200^{a}±1.50	20.600±0.93	26.600^{bc}±1.03
T6	4.800^{c}±0.20	15.200^{a}±0.37	21.000±0.55	29.800^{a}±0.20
T7	5.000^{c}±0.71	15.000^{a}±0.84	21.000±0.55	28.200^{ab}±0.80
T8	4.800^{c}±0.58	14.600^{a}±5.75	20.400±0.87	29.200^{a}±0.80

a-g Means ± SEM within columns without common superscripts differsignificantly ($P < 0.05$).
*Treatments

Such differences in results between T3 and T4 may be due to interact of Zn with vitamin C in T4 diet, whereas the absorption of metal ions may be altered by vitamin C (EGVM, 2003). Solomons (1982) reported that in the diet and at the tissue level, vitamin C can interact with mineral nutrients. which may be resulted in decrease the effect of Zn cation (Zn^{2+}) on atresia of follicular which it the reason for halt egg laying although, consumption of feed intake in T4 lower than T3 (Table 6). Johnson and Brake (1992) reported that Zn cation (Zn^{2+}) have an ability to force follicular atresia and halt egg laying and subsequently reduced feed intake, also, they demonstrated that the effectiveness of Zn to force the cessation of lay is due, at least in part, to a direct inhibitory action on ovarian granulosa cell function both in differentiating and in preovulatory follicles. Or the reasons may be attributed to effect of Zn on inhibit vitamin C absorption, but this mechanism is not well understood (Kutlu, 2001).

On the other hand, the differences between T5 and T6 or between T7 and T8 were not significant in spite of presence of vitamin C in T6 and T8 (Table 5), such non-significant effect might be attributed to the high levels of Zn in these treatments which inhibit the effectiveness of vitamin C to altered the absorption of metal ions. At the same time, the differences not significant between T5, T6, T7 and T8 due to that the level of Zn is high enough to halt egg production by depressing feed intake. Zhang (2004) reported that much evidence indicates that high levels of Zn (10000-20000ppm) caused the cessation of lay primarily by depressing feed intake. Alodan and Mashaly (1999) forced molting by (20000ppm Zn) as ZnO for 5 days; the last day of egg production was day 6. Also ZnO, when fed at (20000ppm) completely stops egg production within 5 days (Berry and Brake, 1985). While Hassanabadi and Kermanshahi (2007) reported that hens subjected to (20000ppm Zn) as ZnO for 10 days ceased egg production by day 8 of the experiment.

Days to first egg post molt production did not significantly differed between molting treatments following the return to full-feed layer ration and 16h photoperiod. While, days to return to (50-60%) egg production significantly differed between treatments. T6 and T8 took longer time to reach (50-60%) egg production, followed by T7 which was not significantly differed with T3 and T5. Hens in T4 took significantly shorter time to return to (50-60%) egg production. Such results could be attributed to the high reduction of body weight for hens in T6, T7 and T8 (Table 6), due to effects of high levels of Zn and presences of vitamin C as well as to their interactions on BW loss (kg and %). Furthermore, the body weight loss was related with reproductive organs weight loss, subsequently these treatments required more days to rejuvenate reproductive organs to the normal or larger weight and length in second cycle production. El-Deek and Al-Harthi (2004) reported that hens had body weight loss (18 and 21%) respectively, returned to 50% by 95 and 105 days when molted by (2 and 3% Zn) as ZnO respectively. While Goodman (1986) found no significant differences were observed among treatments for days to return to (50%) egg production when Leghorn hens, 15 months old fed diets to which ZnO was added at (10000, 5000, or 2500ppm) for 7, 14, or 21 days.

تأثير القلش الاجباري باستخدام اوكسيد الزنك وفيتامين C في وزن الجسم والعودة الى الانتاج لأمهات فروج اللحم

شهله محمد سعيد الكركوكي خسرو عبدالله علي
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الخلاصة

استخدمت في هذه التجربة 296 دجاجة (امهات فروج اللحم) من نوع Arbor Acres بعمر 375 يوما، وقسمت عشوائيا الى ثمانية معاملات وكل معاملة خمسة مكررات، ربيت في قاعة ذات تربية ارضية طوال فترة التجربة.لم يتم اضافة اوكسيد الزنك الى معاملتي السيطرة بدون او مع اضافة فيتامين C؛ اما معاملات القلش الاجباري فتم اضافة الزنك كاوكسيد الزنك اليها بمستويات (15000، 20000 و 25000ppm)بدون او مع اضافة فيتامين C (١غم\ كغم).دلت نتائج التجربة الى ان وجود انخفاض

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معنوي في وزن الجسم في كل المعاملات خلال فترة القلش الاجباري، معظم الفقد بالوزن معنويا حدث في المعاملة الثامنة والسابعة . وحققت المعاملة الثامنة تتبعها المعاملة السابعة والسادسة بشكل معنوياقل نسبة للعلف المتناول. بالاضافة الى ذلك كان لفترة القلش الاجباري تاثير معنوي في الفقد بالوزن والعلف المتناول . معظم الفقد بالوزن واقل نسبة للعلف المتناول معنويا في المعاملة الثامنة والسابع ة حدث في اليوم التاسع من فترة القلش. واخذت المعاملة الرابعة عدد ايام اكثر للتوقف عن انتاج البيض، وعدد ايام اقل منقطعا عن انتاج البيض والعودة لاستئناف انتاج البيض مقارنة مع بقية معاملات القلش الجباري.

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