GROWTH PERFORMANCE AND CARCASS TRAITS OF JAPANESE QUAIL AS AFFECTED BY DIETARY HIGH DIETARY VITAMIN A AND D3 SUPPLEMENTATION DOSES.

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SUMMARY

A total number of one hundred eighty unsexed seven-days-old quails were used in present study in a 2 × 3 factorial arrangement (2 levels of vitamin A, 0 and 40,000 IU/kg feed) and three levels of vitamin D3 (0, 1500 and 3000 ICU/kg feed). Chicks were randomly divided into six equal treatments of three replicates of ten quails each. Results showed that vitamin A affects significantly (P<0.05) on body weight (BW) at 28 and 35days of age. The highest level of vitamin A (40,000 IU) achieved an increase in BW. Also, vitamin D affects significantly (P<0.05) BW at 42 days of age. The highest levels of both vitamin A and D3(40,000 IU vitamin A and 3000 ICU vitamin D3) in treatment 6 achieved the heights BW compared to control treatment. Vitamin A affects significantly (P<0.05) body weight gain (BWG) during the period from 7-28 and 7-42days of age. The highest level of vitamin A (40,000 IU) achieved an increase in BWG. However, vitamin D affects significantly (P<0.05) on BWG during the period from 7-42 days of age. Vitamin A affects significantly (P<0.05) on feed consumption during (14-21), (21-28), (28-35), and (35-42) days of age. Vitamin A affect significantly (P<0.05) on feed conversion ratio (FCR) during the period from 7-35 and 7-42 days of age. Vitamin D3 affects significant (P>0.05) on FCR during the period from 7-14, 7-21 ,7-28 ,7-35, and 7-42 days of age. The highest levels of both vitamin A and D3(40,000 IU vitamin A and 3000 ICU of vitamin D3/kg**)** achieved the best values of both BW and BWG compared to control group. Vitamin A didn't affect significantly on carcass characteristics, but vitamin D3 affects significantly on gizzard weight and the highest levels of vitamin D3 (1500 and 3000 ICU /kg feed) achieved a decrease in gizzard weight. Also, the level of 3000 ICU achieved increase in carcass constituents.It can be concluded that the level of 40000 IU vitamin A/kg achieved the highest values of both body weight and body weight gain. The addition of 3000 ICU of vitamin D3/kg feed improved FCR. Therefore, the results of this study show the improvement of growth performance and carcass traits in Japanese quail, especially at the level of 40000 IU vitamin A/kg or 3000 IU/kg of vitamin D3/kg.

***Keywords**: Quail, vitamin A, vitamin D3, performance, carcass.*

INTRODUCTION

Generally, quail occupy a small but special segment of the Egyptian poultry industry. These birds are raised as source of specialty egg and meat. Japanese quail have the advantage of rapid growth rate, small size, good reproductive potential, short life cycle, low feed requirements, good meat taste, better laying ability and shorter time of hatching as compared with the different species of poultry (Roshdy *et al.*, 2010 and Siyadati *et al*., 2011). The optimum performance of livestock depends largely on the quality and quantity of their dietary nutrients. Compared to other game birds, requirements of Japanese quail are more documented (NRC, 1994), but are to fare to be compared with other domestic fowl and they are missing last 20 years. The increase in quail production has been highlighted over the last years. Its evolution has been constant and increasing numbers of poultry companies have expressed an interest in improving their product quality at a low cost and in meeting the needs of the consumer (Bertechini, 2009). The market is expanding and, as a result, companies related to quail production need scientific information and data pertaining to nutrition, genetics, management, and ambience of meat-type quail to enhance their production. An accurate determination of nutritional requirements is of great importance to all bird species, as diet is perhaps the main environmental factor that determines bird growth and allows them to reach their maximum genetic potential (Albino and Barreto, 2003). Calcium deposition in the skeleton is greater during the grower phase. Thus, calcium content in the body of chicks increases quickly in the starter stage, so that at the end of the first month of age the chicks have 80% of the total calcium of an adult bird (Edwards, 2000).

Japanese quail (Coturnix coturnix japonica) has gained attention in poultry industry. It is becoming more popular as a source of meat and eggs in various countries including Egypt due to rapid growth enabling quail to be marketed for human consumption at 5-6 week of age, early sexual maturity, high egg production rate and much lower feed and space requirement than domestic fowls (Manville, 2004 and Huss, *et al*., 2008). Uni *et al*. (2000) reported that the absence of vitamin A interferes with the normal growth rate in chickens because it influences the functionality of the small intestine by altering proliferation and maturation of cells in the small intestinal mucosa. Aburto, and Britton (1998a,b) found that feeding vitamin A at 80,000 IU/kg of diet caused a small reduction in BW. Moreover, reported that body weight was reduced when vitamin A was fed at 40,000 IU/kg of diet. Friedman and Sklan (1989a,b) reported that the BW between two groups of chickens receiving either normal (1mg retinol equivalent/kg feed) or vitamin A depleted diets (no added vitamin A) were not significantly different which may be due to the short period of experiment (40 days). Mori *et al.* (2003) noticed an increase in the feed consumption (FC) while hens were supplied with vitamin A at the level 30,000 UI/kg of feed.

Kheiri and Landy (2019) reported that final body weight (BW) of broiler chickens supplemented with 1-α(OH)D_3 and 1500 IU of cholecalciferol/kg of diet and 1-α(OH)D_3 and 3000 IU of cholecalciferol/ kg of diet was greater than those fed basal diet, basal diet supplemented with 1-α(OH)D_3 alone and basal diet supplemented with 1-α(OH)D_3 and 5000 IU of cholecalciferol/kg of diet. Bhuiyan *et al*. (2004) showed that overall body weight gain (BWG) and feed efficiency were significantly better in the vitamin A group receiving 1500 IU/kg feed.

Perine *et al.* (2016) found that in meat-type quail (Coturnix coturnixsp) between 15- and 35-days old body weight increased linearly with the four levels of vitamin D :1000; 2,000; 3,000; and 4,000 IU. Han *et al.* (2015) reported that supplementation of 5 µg/kg 1a-OH-D_3 in diets containing 0.30% of NPP could improve growth performance of broiler chickens. Landy and Toghyani (2014) evaluated the efficacy of feeding 5 µg of 1-α(OH)D_3/ kg of diet as a replacement for cholecalciferol in compare with dietary containing 5000 IU cholecalciferol/kg of diet, the result indicated that 1-α(OH)D_3 as a replacement for cholecalciferol could improve growth performance of broiler chickens whereas the results were not statistically significant. Cho *et al*. (2019) reported that at 14 day of age, the effect of dietary Vitamin D_3 levels on body weight gain was mathematically significant between the groups that received VD_3 200 IU/kg of feed and 3,125 IU/kg of feed, and the highest weight gain was observed in birds fed with VD_3 at 3,125 IU/kg of feed. Han et *al*. (2012) indicted that the addition of 1α-OH D_3 increased BWG in Ca- and P-deficient diets of 21- to 42-d-old broilers. Atencio et *al*. (2005) reported that increasing the level of25-OH-D3 in the chick's diet significantly improved body weight gain.

Fatahi *et al*. (2019) found that feed conversion ratio were influenced by levels of vitamin D_3 ($p < 0.05$), The feed conversion ratio in 4000 IU/kg of vitamin D_3 (3. 68) was significantly lower than the control (4. 22)($p < 0.05$). Kheiri *et al.* (2019) illustrated that Ca-P-deficient diets supplemented with phytase and 1α-OH-D_3 improved FCR in quails. Kheiri and Landy (2019) reported that feed conversion ratio of broiler chickens fed basal diet supplemented with 1-α(OH)D_3 and 1500 or 3000 IU of cholecalciferol/kg of diet were significantly better than those fed basal diet, basal diet supplemented with 1-α(OH)D_3 alone or basal diet supplemented with 1-α(OH)D_3 and 5000 IU of cholecalciferol/ kg of diet. Perine *et al. (*2016) found that feed conversion showed some linear improvement due to increased levels of Ca and vitamin D. Landy *et al.* (2015) reported that the supplementation of 5000 IU cholecalciferol/kg of diet contained 5 µg of 1-α(OH)D_3/kg of diet significantly decreased feed efficiency of broiler chickens during starter period.

Okafor and Kalio (2017) reported that there was a significant difference in the weight of the gizzards at the 80% and 100% inclusion levels. Birds fed 100% inclusion levels of vitamin D_3 in their diet had the highest carcass weight. Perine *et al*. (2016) observed that calcium and vitamin D levels did not have significant effects (P>0.05) on carcass and cut yields. However, the same pattern was observed with WG and BW such that calcium and vitamin D levels led to a linear increase (P<0.05) in carcass weight, breast weight, and leg weight. Calcium and vitamin D requirements in meat-type quail between 15 and 35 days of age is greater or equal to 0.90% Ca and greater or equal to 4,000 IU of vitamin D, probably because the experiment was conducted during the pre-laying phase. The femoral seedor index increased linearly (P<0.05) due to calcium levels, while a quadratic effect (P<0.05) was Observed as a result of vitamin D levels, with an estimated Level of 2,756 IU of vitamin D. Dietary 25OHD$_3$ supplementation has also been reported to improve breast meat yield as a result of increased muscle protein synthesis (Hutton *et al*., 2014; Vignale *et al*., 2015). Khan *et al.* (2010) showed that the dressing percentage and breast meat yield were better in birds fed diets containing 2500 or 3500 IU/Kg vitamin D$_3$. Paul *et al*., (2010) reported that increased vitamin supplementation in broiler diets significantly improved carcass composition of broilers The tibia Seedor index and femoral bone resistance increased linearly (P<0.05). 25-Hydroxycholecalciferol is formed in the liver from vitamin D$_3$ by the 25-hydroxylase (Bar *et al*., 2003). Deficiencies and excesses of vitamins, minerals and minor nutrients may affect leg Health (Waldenstedt, 2006). Aburto and Britton (1998a,b) had shown an effect of vitamin A in the range 0.45 to 4.5 mg/kg on vitamin D3 status and requirement, but the present findings suggest that within a narrower range encompassing the dietary range most often encountered in commercial practice, vitamin A is not a factor influencing vitamin D3 requirement and the high dietary concentrations of vitamin A have been found to depress the vitamin D3, status of chicks, as assessed by growth, bone ash content and incidence of rickets. This positive response to dietary vitamin D3 was produced only when vitamin A was added at 1,500 IU/kg of diet, because vitamin A (45,000 IU/kg) interfered with dietary vitamin D3 (500 IU/kg) in birds exposed to UV light. Veltmann and Jensen (1985) reported that high dietary concentrations of vitamin A have been found to depress the vitamin D3 status of chicks, as assessed by growth, bone ash content and incidence of rickets. High dietary concentrations of vitamin A have been found to alleviate the toxicity of vitamin D3.

Therefore, the present study was conducted to investigate the growth performance and carcass traits of Japanese quail as affected by dietary vitamin A and D3 supplementation.

MATERIALS AND METHODS

The study was conducted at the Poultry Research Farm, Dep. of Poultry Production, Faculty of Agriculture, New Valley University, during the period from March to April 2019.

Experimental birds, measurements and design:

A total number of 180 (one hundred eighty) unsexed seven-days-old quails were used in present study in a 2 × 3 factorial arrangement (2 levels of vitamin A, 0 and 40,000 IU/kg feed) and three levels of vitamin D3 (0, 1500 and 3000 ICU/kg feed). Chicks were randomly divided into six equal treatments of three replicates each of ten quails each. Experimental diets were corn –soybean based and contain 24% (standard protein requirement according to NRC (1994, recommendation). The ingredient composition and chemical analysis of the experimental diets are presented in Table 1. Samples of the experimental diets were taken for analysis according to AOAC (1990). One alpha-hydroxycholecalciferol (VIT-D3) based on the conversion of 0.025 µg to 1 ICU (Leeson and Summers, 2001).The experimental design as follows: Treatment 1: chicks were fed basel diet (control); Treatment 2: chicks were fed basel diet with 1500 ICU of Vit. D3; Treatment 3: chicks were fed basel diet with 3000 ICU of Vit. D3; Treatment 4: chicks were fed basel diet with 40,000 IU of Vit. A.;Treatment 5:chicks were fed basel diet with 40,000 IU of vitamin A + 1500 ICU of Vit.D3.;Treatment 6:chicks were fed basel diet with 40,000 IU of vitamin A + 3000 ICU of Vit.D3.

The experimental chicks were housed in galvanized batteries composed of three tiers, equipped with cages, having the dimensions of (75 cm length, 50 cm width and 45 cm height) and placed in a semi closed house. They were raised under adequate and similar managerial, nutritional and hygienic conditions. Chicks were exposed during the first three days of age to a lighting period of 23 hr/day, which was gradually decreased by 1hr/day to reach 12L:12D hours/day during the rest of the growing period. Body weight and feed consumed were recorded starting from seven days of age and each week per each replicate till the last of the experiment at 42 days of age. Body weight gain and feed conversion ratio were calculated during the period from 0-7, 0-14, 0-21, 0-28, 0-35, 0-42 and 0-49 days of age according to McDonald *et al.* (1987).

Mortality was recorded daily. In the last of the experiment, three chicks from each replicate (total 45 chicks) were taken to slaughter to measure carcass parts and dressing percentage. Complete bleeding, scalding and plucking, the edible organs (heart, liver, empty gizzard), and estimated as percentage of the live body weight. The dressing percentage was estimated by dividing the weight of the carcass giblets on the pre-slaughter body weight of birds.

Statistical analysis:

The Data were statistically analyzed by using ANOVA and General linear Model (GLM) procedure of SAS software (2009). Duncan's multiple range tests (1955), was used to determine the difference among means, when the treatment effects were significant. Significant difference were considered to exist when ($p<0.05$). The mathematical model used was:

$$Yijk=\mu+Ai+Dj+(AD)ij+ eijk$$

Where: Y_{iK} is any observation by vit A and D3;μ=the population mean.; A_i= Vitamin A effect (i=1,2); D_j=Vitamin D3 effect (j=1,2,3); (AD)ij = Interaction effects; e_{ik}=Experimental error.

RESULTS AND DISCUSSION

Body weight:

The results of body weight (BW) of Japanese Quails as affected by dietary vitamin A and vitamin D_3 supplementation are shown in Table (2). Vitamin A at level of 40,000 IU/Kg of diet improved BW of quail at 28 and 35 days of age as compared to control group. On the other hand, there were no significant differences in the remainder ages of the experiment. This result may be in agreement with Aburto and Britton, (1998a,b) who found that feeding VIT. A at 80,000 IU/kg of diet caused a small reduction in BW. Moreover, reported that body weight was reduced when VIT A was fed at 40,000 IU/kg of diet. Also, Friedman and Sklan (1989a,b) reported that the BW between two groups of chickens receiving either normal (1mg retinol equivalent/kg feed) or VIT A depleted diets (no added VIT A) were not significantly different which may be due to the short period of experiment (40 days).

Furthermore, Quail chicks fed basal diet with 1500 and 3000 IU of vitamin D3 had significantly greater ($P\leq0.01$) BW compared to the control group at 42d of age. The obtained results are in agreement with. Stevens *et al.* (1984) who observed an increase in BW in poults hatched from turkey breeders fed 300, 900, and 2,700 IU/kg of VIT. D3, Bajwa *et al.* (2020) explained that supplementation of vitamin D sources improved the growth performance ($P<0.05$). On the other side, Alves *et al.* (2018) found that the performance variables BW at ages from 7 to 42 days were significantly poor ($P<0.05$) when the metabolite 1, 25(OH) 2D3-glycoside was used as the single source of vitamin D. Edwards *et al*. (1994) reported that birds fed no VITD3 were exposed to ultraviolet light from battery fluorescence tubes required 800 to 1,600 IU/kg of dietary VITD3 to provide maximum response for 16-d body weight,. Also, Han *et al.* (2009) reported that supplementation of 5 μg 1 -α(OH)D3/kg to broiler chicken diet containing 5 μg cholecalciferol/kg had negative effects on BW of broiler chickens, which indicated that 1 -α(OH)D3, could not enhance growth performance indices of broiler chickens when basal diet contained adequate content of cholecalciferol

The effect of the interaction between vitamin A and D3 in the two treatments, T4, T5 and T6 were higher than other treatments and control at ages 28, 35 and 42 days, while there were no significant differences between treatments at 7,14 and 21 days of age.

Body weight gain:

The results of body weight gain of Japanese Quails as affected by vitamin A and vitamin D supplementation are shown in Table (3). Vitamin A at 40,000 IU/Kg of diet addition improved BWG of quail during periods 7-28 and 7-35 d of age compared with control group. The results obtained were consistent with Bhuiyan *et al*. (2004) showed that Overall BWG and feed efficiency were significantly better in the Vit A group receiving 1500 IU/kg feed. Also, Uni *et al*. (2000) reported that the absence of VIT A interferes with the normal growth rate in chickens because it influences the functionality of the small intestine by altering proliferation and maturation of cells in the small intestinal mucosa. On the other hand, there were no significant differences in the remainder of the experiment periods compared to the control. Matching to Shellenberger and Lee (1965) reported that Japanese quail did not show growth responses to VIT A supplementation in the low or high energy diets at levels of 550 to 4400 units/kg. Furthermore, Quail chicks fed basal diet with 1500 and 3000 IU of vitamin D had significantly greater ($P \leq 0.01$) BWG compared to the control group during 7-42d of age. The obtained results are in agreement with (Khan *et al*., 2010; Gómez-Verduzco *et al*., 2013) who reported that VIT-D3 added In diets of broiler chickens at 10 times (2000 IU/kg of feed) the recommendations of NRC (1994), or those levels commonly included in commercial feed formulations improved the body weight gain (BWG).Also, Positive results have been obtained for other VIT. D3 derivatives, i.e., 1α-hydroxycholecalciferol (1α-OH-D3), whereby addition to a low Ca and P diet increased BWG (Ebrahimi *et al.*, 2016). Bajwa *et al.* (2020) showed that supplementation of vitamin D sources improved the growth performance ($P<0.05$).

The effect of the interaction between vitamin D and A led to an increase in body weight in treatments T4, T5 and T6 compared to treatment T3 and T1 (control) in the period from (7-28), while there were no significant differences due to the interaction effects in the other periods. It was cleared that the high dose of vitamin A (40000 IU/kg feed) achieved the highest body weight gain compared to control chicks. Also, the high dose of both vitamin A (40000 IU/kg) plus 1500 or 3000 ICU vitamin D3/kg achieved also the highest BWG compared to the other levels during the periods of 7-28, 7-35 and 7-42 days of age. The obtained results are in agreement with Veltmann et *al.* (1986), who found that a significant vitamin A x vitamin D interaction was observed in weight gain response. A much wider range of vitamin A and vitamin D levels may explain the difference in response. it was apparent that increasing vitamin D level in the diet of starting chicks to at least 1,500 ICU/kg with appropriate levels of other fat soluble vitamins improved weight gain and feed efficiency. On the other hand, Lofton and Soares (1986) did not show the same response to increasing D levels in broilers. The negative effect of simultaneous presence of excessive levels of vitamin A and vitamin D on weight gain does not agree with the observation reported by Payne and Manston (1967) in cattle, where the two vitamins at high levels seemed to depress toxic effects of each other. Veltmann and Jensen (1985) reported that high dietary concentrations of vitamin A have been found to depress the vitamin D3 status of chicks, as assessed by growth, bone ash content and incidence of rickets. High dietary concentrations of vitamin A have been found to alleviate the toxicity of vitamin D3.

Feed consumption (FC):

The results of feed consumption of Japanese Quails as affected by dietary vitamin A and vitamin D supplementation are shown in Table (4). It was found that there was an increase in feed consumption when vitamin A was added at the level of 40,000 IU compared to control during the all-experiment periods, except for the first period from 7-14 days. The obtained results agreed with Mori *et al.* (2003) who noticed an increase on FC while hens were supplied with VIT A at the level 30,000 UI/kg of feed. However, our findings were in contrast to Mendonça Júnior *et al*. (2002), who did not verify any differences on FC of hens supplied with VIT. A supplementation. Vitamin A supplementation did not result in statistical difference for daily feed intake of quails during the experimental period. Similar results with vitamin A supplementation were described by Lin *et al*. (2002). However, Mori *et al.* (2003) noticed an increase on feed intake while hens were supplied with vitamin A at the level 30,000 UI/kg of feed.

The results of vitamin D3 supplementation indicated that, there were no significant differences in feed consumption when adding vitamin D3 with all levels during the experiment periods. The obtained results agreed with Bonagurio *et al.* (2020) who reported that supplementation of (25-OH-D3 did not influence FC. Also, Adhikari et *al*. (2020) showed that there was no difference in FC between hens fed diets supplemented with different levels of vitamin D3 and 25-OHD.

In addition to, Kheiri and Landy (2019) stated that in starter period, there were no significant differences between vitamin D3 dietary treatments for FC. Alves *et al.* (2018) found that the performance variables FC during the 7 - 42 days period were significantly poor ($P<0.05$) when the metabolite 1, 25(OH)2D3- glycoside was used as the single source of vitamin D. Lin *et al.* (2002) and MendonçaJúnior *et al.* (2002), did not verify any differences on FC of hens supplied with VIT A supplementation. On the contrary, Frost and Roland (1990) determined a significant 3 g/h/d improvement of FC when hens were fed a diet supplemented with 1,500 IU/kg of D3 and 1 μg/kg of 1,25-(OH)2-D3 with0.55% P and 3.75% Ca. Also, Musapuor et *al.* (2005)

noted a significant ($P \leq 0.05$) increase in FC when hens (42 weeks of age) were fed a supplemental diet of 400 IU/kg of D3 with 2.27 or 3.25% Ca. Mori *et al.* (2003) noticed an increase on FC while hens were supplied with VIT, A at the level 30,000 UI/kg of feed. Also, Atencio *et al*. (2005) reported that increasing the level of 25-OH-D3 in the chicks' diet did not affect the FC and they also reported that FC increased as the VIT.D3 level in the maternal diet of broiler breeder hens. In cases of prolonged toxicity, VIT. D can cause a decrease in FC (Zanuzzi *et al.,* 2012). Also, Chou *et al.,* (2009) found that the supplementation of broiler diets with 25(OH) D3 has been reported to decrease feed consumption and to subsequently improve feed efficiency by 5% during the grower phase.

In the interactions during the period of 7-14 days of the experiment, the results showed that there were no significant differences between all treatments. However, there were significant ($p<0.05$) interaction effects between the previous two vitamins during the other periods (7-21, 7-28, 7-35 and 7-42 days of age). It was cleared that the high dose of vitamin A (40000 IU/kg feed) achieved the highest FC compared to control chicks. Also, the high dose of both vitamin A (40000 IU/kg) plus 1500 or 3000 ICU vitamin D3/kg achieved also the highest FC compared to the other levels. Metz *et al*. (1985) reported that when fed a diet containing the required level of vitamin A (4,000 IU/kg, NRC estimated requirement) and a high level of vitamin D (900,000 ICU/kg), poults developed hypervitaminosis D as evidenced by mild growth depression and renal tubular mineralization. When poults were fed a diet containing high levels of both vitamins A and D growth rate and bone mineral content were like control poults fed a diet containing the required levels of vitamins A and D. In addition, lameness and renal tubular mineralization were not apparent in the poults fed a diet containing high levels of both vitamins A and D. It was concluded that there is an antagonistic interaction between vitamins A and D.

Feed conversion ratio (FCR):

The results of feed conversion ratio on Japanese Quails as affected by dietary vitamin A and vitamin D supplementation are shown in Table (5). Concerning with the main effect of vitamin A, the results showed that vitamin A at 40,000 IU/Kg of diet addition affect significantly ($P<0.05$) on feed conversion ratio of quail during periods 7-35 and 7-42 days of age. However, the highest level of vitamin A (40000 IU/kg feed) achieved lower FCR than control group. No significant ($P>0.05$) effects due to vitamin A on FCR on the periods of 7-14, 7-21 and 7-28 days of age. Vitamin A supplementation did not result in statistical difference for FCR of quails during the experimental period (Marques *et al.,* 2011). Similar results with vitamin A supplementation were described by Lin *et al.* (2002) and Mendonça Júnior *et al*. (2002), who also did not verify any differences on FCR of hens supplied with vitamin A supplementation. However, concerning with the main effect of vitamin D3 effects, no significant difference due to vitamin D3 on FCR during the whole experiment. These results are consistent with **Bonagurio *et al.* (2020)** who reported that supplementation of (25-OH-D3 did not influence FCR. **Fatahi *et al.* (2019)** reported that the feed conversion ratio in 4000 IU/kg of vitamin D3 (3. 68) was significantly lower than the control (4. 22) ($p<0. 05$). The group (T3) in which chicks were fed the highest level of vitamin D3 (3000 ICU of vitamin D3/kg feed) achieved the best FCR compared to the other treatment on the period of 7-35 and 7-42 days of age.

Carcass characteristics:

The results of carcass constituents Japanese Quails affected by dietary vitamin A and vitamin D are shown in **Table (6).** The addition of different levels of vitamin A (0, 40000IU) did not lead to any significant effect on the studied carcass characteristics. **Davis and Sell (1983)** reported reduced impaired growth of the Bursa of Fabricius and thymus in chicks fed a low VIT A diet and VIT A free diet when compared to birds raised on a supplemented VIT A diet.

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أداء النمو وخصائص الذبيحة للسمان الياباني متأثرا بإضافة جرعات عالية من فيتامين أ و د 3

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تم استخدام عدد مائة وثمانين طائر سمان غير مجنس عمر سبعة أيام في الدراسة الحالية بترتيب عاملي 2 × 3 (مستويان من فيتامين أ (0 و 40000 وحدة دولية / كجم علف) وثلاثة مستويات من فيتامين د 3 (0 ، 1500 و 3000 وحدة دولية / كجم علف).

قسمت الكتاكيت عشوائياً إلى ستة معاملات متساوية من ثلاثة مكررات كل منها مكونة من عشرة طيور سمان. أظهرت النتائج أن فيتامين (أ) يؤثر معنوياً (P <0.05) على وزن الجسم عند عمر 28 و 35 يوماً. حقق أعلى مستوى من فيتامين أ (40000 وحدة دولية) زيادة في وزن الجسم. ومع ذلك ، فانه لم يؤثر على وزن الجسم عند 42 يومًا من العمر. كما حقق أعلى مستوى من فيتامين د (1500.3000 وحدة دولية) زيادة في وزن الجسم وأعلى مستويات كل من فيتامين أ ود 3 (40000 وحدة دولية فيتامين أ و 3000 وحدة دولية فيتامين د 3) في المعاملة 6 حقق زيادة في وزن الجسم مقارنة بمعاملة الكنترول.

اثر فيتامين (أ) بشكل ملحوظ في زيادة وزن الجسم (P <0.05) عند عمر 7-28 يوم و7-42 يوم. بينما حقق أعلى مستوى من فيتامين أ (40000 وحدة دولية) زيادة في وزن الجسم. ومع ذلك ، فقد اثر فيتامين (د) بشكل ملحوظ في وزن الجسم (P <0.05)عند 7-42. يؤثر فيتامين أ معنوياً (P <0.05) على استهلاك العلف عند (14-21) ، (21-28) ، (28-35) ، (35-42) يوماً من العمر ومع ذلك ، حقق أعلى مستوى من فيتامين أ (40000 وحدة دولية) زيادة في استهلاك العلف. كما حققت أعلى مستويات فيتامين أ ود 3 (40000 وحدة دولية و فيتامين أ 3000 وحدة دولية فيتامين د 3) في معاملة 6 زيادة في وزن الجسم مقارنة بمعاملة الكنترول.

فيتامين (أ) له تأثير معنوي (P <0.05) على معامل تحويل الغذاء عند الفترة 7-35 و 7-42 يوم من العمر. ومع ذلك ، حقق أعلى مستوى من فيتامين أ (40000 وحدة دولية) زيادة في معامل تحويل الغذاء .

لا يؤثر فيتامين D3 معنوياً (P> 0.05) على معامل تحويل الغذاء عند 7-14 و7-21 و7-28 و7-35 و7-42 يومًا من العمر وحققت أعلى مستويات من كل من فيتامين أ ود 3 (40000 وحدة دولية من فيتامين أ و 3000 وحدة دولية من فيتامين د 3) في المعاملة 6 ازدياد في معامل التحويل الغذائي مقارنة بمعاملة الكنترول. لم يؤثر فيتامين أ معنويا (P> 0.05) على خصائص الذبيحة المدروسة. واثر فيتامين د معنويا (P <0.05) على وزن القانصة. ومع ذلك ، فإن أعلى مستوى من فيتامين د (1500.3000 وحدة دولية) حقق انخفاضًا في القانصة.كما حقق مستوى 3000 وحدة دولية من فيتامين د زيادة معنوية في مكونات الذبيحة.

يمكن الاستنتاج أن مستوى 40000 وحدة دولية من فيتامين أ / كجم حقق أعلى قيم لكل من وزن الجسم والزيادة في وزن الجسم. بينما إضافة 3000 وحدة دولية من فيتامين د 3 / كجم علف أدى إلى تحسين معامل التحويل الغذائي. لذلك أظهرت نتائج هذه الدراسة تحسن في أداء النمو وصفات الذبيحة في السمان الياباني وخاصة عند مستوى 40000 وحدة دولية من فيتامين أ / كجم أو 3000 وحدة دولية / كجم من فيتامين د 3 / كجم.

Table (1): The chemical composition of the experimental diets.

Ingredients	%
Corn, Grains	53.00
Soybean Meal (44%)	36.20
Vegetable oil	1.00
Corn gluten Meal (60%)	6.40
Di calcium phosphate	2.05
Vit . Min. Premix*	0.30
Limestone	0.45
NaCl	0.30
DL-Methionine	0.15
L-Lysine HCl	0.15
TOTAL	100
Determined1 and calculated2 composition (% as fed basis)	
Nutrient Determined	
Dry matter	85.82
Crude protein[1]	23.92
Ether extract[1]	3.51
Crude fiber[1]	4.02
Nutrient Calculated	0.172
Dry matter[2]	86.6
ME (kcal/kg)[2]	2920
Crude protein[2]	24.79
Ether extract[2]	3.46
Crude fiber[2]	3.86
Calcium[2]	0.76
Available phosphorus[2]	0.53
Lysine[2]	1.29
Methionine[2]	0.59
Total phosphorus[2]	0.8

** Vitamins and minerals mixture provide per kilogram of diet: Vitamin A (as all-trans-retinyl acetate); 12000 IU; Vitamin E (all rac-□-tocopheryl acetate); 10 IU; k3 3mg; Vit.D3, 2200 ICU; riboflavin, 10 mg; Ca pantothenate,10 mg; niacin, 20 mg; Choline chloride, 500 mg; Vitamin B12, 10□g; Vitamin B6, 1.5 mg; Thiamine (as thiamine mononitrate); 2.2 mg; Folic acid, 1 mg; D-biotin, 50□g. Trace mineral (milligrams per kilogram of diet) Mn, 55; Zn, 50; Fe, 30;Cu, 10; Se, 0.1 and Ethoxyquin 3mg.*

Table (2): Body weight (g) of Japanese quail as affect by dietary vitamin A and vitamin D3.

Treatments	Body eight during the trial period					
	7d	14d	21d	28d	35d	42d
Vitamin A levels (IU)						
0	15.92±0.20	48.86±1.18	86.38±2.46	123.78^{b}±3.20	178.02^{b}±2.89	203.94±3.57
40000	15.94±0.22	49.53±1.52	92.13±2.06	143.72^{a}±1.50	189.02^{a}±1.85	207.95±2.61
Vitamin D levels (ICU)						
0	15.89±0.26	49.34±0.93	89.99±1.95	131.14±5.82	178.65±4.88	197.98^{b}±3.57
1500	15.85±0.23	49.02±1.89	88.93±3.54	136.71±4.23	186.23±2.48	209.63^{a}±2.75
3000	16.05±0.30	49.23±2.12	88.85±3.64	133.40±5.88	185.68±3.05	210.22^{a}±3.15
Interactions						
T1	15.49±0.14	48.55±1.45	86.50±1.76	118.69^{b}±1.65	169.22^{b}±1.77	193.02^{b}±2.83
T2	16.21±0.31	49.19±3.17	86.96±6.71	130.22^{ab}±6.63	183.48^{a}±4.78	210.03^{a}±5.30
T3	16.07±0.46	48.85±2.12	85.69±4.93	122.44^{b}±6.44	181.36^{a}±3.87	208.78^{a}±5.19
T4	16.30±0.40	50.13±1.26	93.49±1.94	143.59^{a}±3.40	188.07^{a}±5.19	202.95^{ab}±5.56
T5	15.49±0.21	48.85±2.77	90.91±3.69	143.21^{b}±1.89	188.97^{a}±0.56	209.23^{a}±3.11
T6	16.03±0.48	49.62±4.23	92.00±5.64	144.36^{a}±3.40	190.00^{a}±3.57	211.67^{a}±4.55

[a,b]Means in the same columns with different superscript are significant different (P≤0.05). T1: chicks were fed basel diet (control); T2: chicks were fed basel diet with 1500 ICU of Vit. D3; T3: chicks were fed basel diet with 3000 ICU of Vit. D3; T4: chicks were fed basel diet with 40,000 IU of Vit. A.;T5:chicks were fed basel diet with 40,000 IU of vitamin A + 1500 ICU of Vit.D3.;T6:chicks were fed basel diet with 40,000 IU of vitamin A + 3000 ICU of Vit.D3.

Table (3): Body weight gain (g) of Japanese quail as affected by dietary vitamin A and vitamin D3 supplementation.

Treatments	Body weight gain				
	7-14d	7-21d	7-28d	7-35d	7-42d
Vitamin A levels (IU)					
0	32.94±1.20	70.46±2.47	107.86^{b}±3.16	162.57^{b}±2.89	188.49±3.57
40000	33.59±1.60	76.19±2.13	127.78^{a}±1.57	173.57^{a}±1.84	192.50±2.61
Vitamin D levels (ICU)					
0	33.44±0.94	74.09±1.79	115.24±5.65	163.19±4.88	182.53^{b}±3.57
1500	33.17±1.80	73.08±3.50	120.86±4.27	170.78±2.47	194.18^{a}±2.75
3000	33.18±2.35	72.80±3.86	117.35±6.00	170.23±3.05	194.77^{a}±3.15
Interactions					
T1	33.05±1.35	71.01±1.70	103.19^{b}±1.65	153.77^{b}±1.77	177.57^{b}±2.83
T2	32.98±3.02	70.75±6.50	114.01^{ab}±6.35	168.03^{a}±4.78	194.58^{a}±5.30
T3	32.78±2.53	69.62±5.29	106.37^{b}±6.76	165.91^{a}±3.88	193.33^{a}±5.19
T4	33.83±1.57	77.19±1.90	127.29^{a}±3.42	172.63^{a}±5.19	187.50^{ab}±5.56
T5	33.36±2.66	75.42±3.66	127.72^{a}±1.99	173.52^{a}±0.55	193.78^{a}±3.11
T6	33.58±4.61	75.96±6.04	128.33^{a}±3.72	174.55^{a}±3.57	196.22^{a}±4.55

[a,b]Means in the same columns with different superscript are significant different (P≤0.05). T1: chicks were fed basel diet (control); T2: chicks were fed basel diet with 1500 ICU of Vit. D3; T3: chicks were fed basel diet with 3000 ICU of Vit. D3; T4: chicks were fed basel diet with 40,000 IU of Vit. A.;T5:chicks were fed basel diet with 40,000 IU of vitamin A + 1500 ICU of Vit.D3.;T6:chicks were fed basel diet with 40,000 IU of vitamin A + 3000 ICU of Vit.D3.

Table (4): Feed consumption (g) of Japanese quail as affected by dietary vitamin A and vitamin D3 supplementation.

Treatments	Feed consumption during the trial period				
	7-14d	7-21d	7-28d	7-35d	7-42d
Vitamin A levels (IU)					
0	93.85±4.10	202.44^{b}±6.80	313.2^{b}±9.65	458.8^{b}±11.50	613.9^{b}±13.27
40000	100.38±6.23	242.95^{a}±7.89	389.6^{a}±9.77	558.8^{a}±9.76	723.5^{a}±10.62
Vitamin D levels (ICU)					
0	90.77±4.21	204.17±12.35	328.5±20.12	481.9±22.19	635.8±24.20
1500	100.26±6.78	228.27±12.07	355.6±19.97	521.0±25.50	682.2±27.88
3000	100.32±8.02	235.64±9.99	370.1±18.65	523.5±26.18	688.2±28.37
Interactions					
T1	89.48±8.96	180.26^{c}±2.60	289.5^{c}±15.54	437.2^{b}±18.41	585.5^{c}±18.89
T2	96.92±9.47	204.87^{bc}±7.87	316.9^{c}±16.63	468.2^{b}±20.26	625.6^{c}±22.88
T3	95.13±4.12	222.18^{ab}±6.45	333.2^{bc}±10.64	471.0^{b}±22.03	630.5^{c}±24.97
T4	92.05±2.59	228.08^{ab}±13.56	367.6^{ab}±16.08	526.7^{a}±11.04	686.0^{b}±6.80
T5	103.59±11.35	251.67^{a}±10.88	394.2^{a}±14.96	573.9^{a}±7.20	738.7^{ab}±12.90
T6	105.51±16.67	249.10^{a}±16.63	407.1^{a}±16.05	575.9^{a}±13.88	745.9^{a}±8.52

[a,b]Means in the same columns with different superscript are significant different (P≤0.05). T1: chicks were fed basel diet (control); T2: chicks were fed basel diet with 1500 ICU of Vit. D3; T3: chicks were fed basel diet with 3000 ICU of Vit. D3; T4: chicks were fed basel diet with 40,000 IU of Vit. A.;T5:chicks were fed basel diet with 40,000 IU of vitamin A + 1500 ICU of Vit.D3.;T6:chicks were fed basel diet with 40,000 IU of vitamin A + 3000 ICU of Vit.D3.

Table (5): Feed conversion ratio of Japanese Quail as affected by dietary vitamin A and vitamin D3 supplementation.

Treatments	Feed conversion ratio				
	7-14d	7-21d	7-28d	7-35d	7-42d
Vitamin A levels (IU)					
0	2.90±0.22	2.90±0.14	2.92±0.11	2.82^{b}±0.06	3.26^{b}±0.07
40000	3.13±0.39	3.23±0.20	3.05±0.095	3.22^{a}±0.06	3.76^{a}±0.05
Vitamin D levels (ICU)					
0	2.73±0.18	2.75±0.13	2.85±0.11	2.95±0.08	3.48±0.11
1500	3.12±0.39	3.15±0.20	2.94±0.13	3.05±0.13	3.52±0.17
3000	3.19±0.52	3.29±0.26	3.17±0.12	3.07±0.12	3.53±0.13
Interactions					
T1	2.74±0.38	2.54±0.09	2.81±0.20	2.84^{b}±0.11	3.30^{bc}±0.12
T2	2.73±0.14	2.96±0.17	2.89±0.13	3.05^{ab}±0.07	3.66^{ab}±0.08
T3	3.04±0.58	2.93±0.23	2.79±0.19	2.79^{b}±0.13	3.22^{c}±0.19
T4	3.21±0.64	3.37±0.32	3.09±0.16	3.31^{a}±0.05	3.82^{a}±0.12
T5	2.93±0.24	3.22±0.23	3.15±0.14	2.84^{b}±0.09	3.26^{c}±0.09
T6	3.45±1.12	3.36±0.52	3.18±0.22	3.30^{a}±0.12	3.81^{a}±0.09

[a,b]Means in the same columns with different superscript are significant different (P≤0.05). T1: chicks were fed basel diet (control); T2: chicks were fed basel diet with 1500 ICU of Vit. D3; T3: chicks were fed basel diet with 3000 ICU of Vit. D3; T4: chicks were fed basel diet with 40,000 IU of Vit. A.;T5:chicks were fed basel diet with 40,000 IU of vitamin A + 1500 ICU of Vit.D3.;T6:chicks were fed basel diet with 40,000 IU of vitamin A + 3000 ICU of Vit.D3.

Table (6): Carcass constituents (g) of Japanese Quail as affected by dietary vitamin A and vitamin D3 supplementation.

Treat.	Live BW	Carcass constituents										
		Carcas W	Liver W	Gizard W	Spleen W	Stoma.W	Carcass Net Weight	Dresing %	Liver %	Gizard, %	Splen %	Stomac, %
VitaminA levels (IU)												
0	216.50±3.8	152.98±2.6	5.26±0.3	4.02±0.10	0.14±0.01	0.82±0.0	162.40±2.8	75.12±0.7	2.40±0.13	1.86±0	0.06±0.	0.38±0.
4000	211.61±4.5	152.99±2.9	4.63±0.2	3.84±0.12	0.14±0.01	0.86±0.0	161.61±3.1	76.59±0.8	2.16±0.08	1.81±0	0.06±0	0.40±0
Vitamin D levels (ICU)												
0	210.30±4.7	152.41±3.5	4.87±0.4	4.09±0.12	0.13±0.01	0.82±0.0	161.50±3.8	76.88±1.0	2.27±0.17	1.94^{a}±0	0.06±0	0.39±0
1500	221.64±4.4	157.06±2.7	5.30±0.3	3.93±0.10	0.13±0.01	0.89±0.0	166.42±2.8	75.28±1.0	2.38±0.11	1.78^{b}±0	0.06±0	0.40±0.
3000	210.22±5.9	149.49±3.7	4.69±0.3	3.77±0.16	0.17±0.02	0.80±0.0	158.12±4.1	75.39±0.8	2.20±0.10	1.79^{b}±0	0.08±0	0.38±0
Interactions												
T1	201.29^{b}±4	145.87^{ab}±3	4.54^{b}±0	4.03±0.1	0.11±0.0	0.76±0.0	154.57^{ab}±3.	76.83±1.	2.21^{ab}±0.	2.00^{a}±0	0.05^{ab}±0	0.38±0
T2	227.79^{a}±5	157.57^{ab}±4	6.13^{a}±0	4.14±0.1	0.15±0.0	0.89±0.0	168.00^{a}±4.	73.78±1.	2.69^{a}±0.1	1.82^{ab}±0	0.06^{ab}±0	0.39±0
T3	220.41^{ab}±7	155.47^{ab}±4	5.10^{ab}±0	3.88±0.2	0.16±0.0	0.79±0.0	164.63^{ab}±5.	74.73±0.	2.28^{ab}±0.	1.75^{b}±0	0.07^{ab}±0	0.36±0
T4	219.32^{ab}±7	158.93^{a}±5	5.18^{ab}±0	4.15±0.2	0.14±0.0	0.88±0.0	168.42^{a}±6.	76.92±1.	2.32^{ab}±0.	1.88^{ab}±0	0.06^{ab}±0	0.40±0
T5	215.48^{ab}±6	156.54^{ab}±3	4.45^{b}±0	3.71±0.1	0.11±0.0	0.87±0.0	164.82^{ab}±3.	76.79±1.	2.06^{b}±0.0	1.73^{b}±0	0.05^{b}±0	0.40±0
T6	200.02^{b}±8	143.50^{b}±5	4.27^{b}±0	3.65±0.2	0.17±0.0	0.80±0.0	151.60^{b}±5	76.04±1.	2.10^{b}±0.1	1.82^{ab}±0	0.08^{a}±0	0.39±0

[a,b]Means in the same columns with different superscript are significant different (P≤0.05). T1: chicks were fed basel diet (control); T2: chicks were fed basel diet with 1500 ICU of Vit. D3; T3: chicks were fed basel diet with 3000 ICU of Vit. D3; T4: chicks were fed basel diet with 40,000 IU of Vit. A.;T5:chicks were fed basel diet with 40,000 IU of vitamin A + 1500 ICU of Vit.D3.;T6:chicks were fed basel diet with 40,000 IU of vitamin A + 3000 ICU of Vit.D3.