Effect of Different Levels of Mineral and Vitamin Premix on Laying Hens Performance during the First Laying Phase

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ABSTRACT

An experiment was conducted to evaluate the effects of different levels of mineral and vitamin premix on performance and egg traits of laying hens from 37 to 49 weeks of age. Two hundred and forty laying hens (Hy-Line W-36 strain) were randomly assigned to 5 dietary treatments of four replicates each with 12 hens per replicate. The levels of mineral and vitamin premixes in the experiment were 0, 0.15, 0.25 (as recommended by manufacturer), 0.35 and 0.45% of diets and fed to laying hens for 12 weeks. The results showed that the supplementation of different concentration of mineral and vitamin premix improved (P>0.05) the performance of laying hens. The highest percentage of egg production (83.48), the highest amount of egg mass (47.89 g), the best feed conversion (ratio 2.09 g:g) and the lowest price for production per kilogram of (6760 Rials) were observed in group fed: 0.45% of mineral and vitamin premix. Different levels of dietary mineral and vitamin premix did not affect the eggs weight, the amount of daily feed intake and egg traits of laying hens. The overall results of the present study indicate that during the first phase of egg production in laying hens, increasing the levels of dietary mineral and vitamin premix up to 0.45% can improve the performance and reduce the feed cost of egg production.

KEY WORDS egg quality, laying hen, mineral and vitamin premix, performance.

INTRODUCTION

Vitamins and microminerals are defined as groups of complex organic compounds present in small amounts in natural foodstuff that are essential for normal metabolism, and their deficiencies in the diet cause certain diseases (Scott et al. 1982). In the recent years, considerable research has carried out to determine the appropriate levels of these nutrients in poultry diets (Inal et al. 2001; Nobakht and Taghizadeh, 2008; Nobakht, 2013). Most of these studies are about the reduction or elimination of these compounds from poultry diets (Jafari et al. 2005; Afshar et al. 2006; Nobakht et al. 2008). Removing dietary minerals and vitamins supplements from broiler diets in growing period is possible (Nobakht et al. 2008). Also, it was shown that in late laying period noninclusion of dietary minerals and vitamins premixes did not affect the productive parameters and egg traits (Nobakht and Taghizadeh, 2008).

In the first phase of egg production, the nutrients requirements are higher. Therefore, providing sufficient amounts of essential nutrients such as microminerals and vitamins are necessary for health and production of layers (Inal et al. 2001). In the first phase of egg production, using two- fold of NRC recommended vitamin levels significantly improved the performance and reduced the cost of production (Afshar et al. 2006). Similarly, Nobakht (2013) reported that in the first phase of egg production, using 0.55% of dietary minerals and vitamin premixes improved the performance and egg quality traits of laying hens. Lack of vitamin A in the breeder diets had negative effects on
eggs established by the NRC (1994) for laying hens (Table 1). Removal of vitamin A from layer diets after 12 weeks, reduced egg production (Sato et al. 1994). Laying hens were found to tolerate short term deficiency of riboflavin, but in the long term the production declined (Scott et al. 1982). Exclusion of some vitamins and micro minerals from laying hens diets in peak production period (30 weeks) reduced the amount of feed intake and egg production (Inal et al. 2001). However, dietary supplements of vitamins C and E above NRC levels could not improve the performance of laying hens (Zagari and Mohiti Asli, 2011). Very less information is available about the precise levels of minerals and vitamin premixes in laying hens diets (especially in the first phase of egg production). Therefore, the present experiment was carried out to see the supplemental effects of increasing levels of these premixes on production performance and egg quality traits of laying hens.

MATERIALS AND METHODS

Two hundred and forty laying hens (Hy-Line W36 strain) were randomly assigned to 5 dietary treatments with four replicates of 12 hens each level of mineral and vitamin premixes in the experiment were 0, 0.15, 0.25 (factory recommended level), 0.35 and 0.45% of diets and fed to laying hens for 12 weeks.

The diets were formulated to meet the requirements of birds established by the NRC (1994) for laying hens (Table 1) and 16L: 8D lighting programme was provided. Environmental temperature and humidity were maintained respectively at 18°C and 70%. Weekly feed intake, feed conversion ratio, egg production percentage, mass and weight were determined.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>The composition of basic diet</th>
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<tbody>
<tr>
<td>Ingredients</td>
<td>(%)</td>
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<tr>
<td>Corn</td>
<td>50</td>
</tr>
<tr>
<td>Wheat</td>
<td>23.64</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>16.37</td>
</tr>
<tr>
<td>Oyster shell</td>
<td>7.14</td>
</tr>
<tr>
<td>Bone meal</td>
<td>1.67</td>
</tr>
<tr>
<td>Salt</td>
<td>0.28</td>
</tr>
<tr>
<td>Inert (sand)</td>
<td>0.40</td>
</tr>
<tr>
<td>Vitamin premix1</td>
<td>0.25</td>
</tr>
<tr>
<td>Mineral premix2</td>
<td>0.25</td>
</tr>
</tbody>
</table>

1 Vitamin premix per kg of diet: vitamin A (retinol): 8500000 IU; vitamin D3 (cholecalciferol): 2500000 IU; vitamin E (tocopherol acetate): 11000 IU; vitamin k3: 2200 mg; Thiamine: 1477 mg; Riboflavin: 4000 mg; Pantothenic acid: 7840 mg; Pyridoxine: 7840 mg; Cyanocobalamin: 10 mg; Folic acid: 110 mg and Choline chloride: 400000 mg.

2 Mineral premix per kg of diet: Fe (FeSO4.7H2O): 20.09% Fe: 75000 mg; Mn (MnSO4.H2O): 32.49% Mn: 74.4 mg; Zn (ZnSO4.5H2O): 30.35% Zn: 64.675 mg; Cu (CuSO4.5H2O): 600 mg; I (KI): 58% I: 867 mg; Se (Na2SeO3): 45.56% Se: 200 mg. The amounts of dietary minerals and vitamins premixes were 0, 0.15%, 0.25%, 0.35% and 0.45% in 1 to 5 experimental groups. The price of feed cost in 1 to 5 groups were 3160 Rails, 3190 Rails, 3250 Rails and 3280 Rails in 1 to 5 experimental groups.

The effects of different levels of mineral and vitamin premixes on the performance of laying hens are summarized in Table 2.

**RESULTS AND DISCUSSION**

Statistical analysis

The data were subjected to one-way analysis of variance procedures appropriate for a completely randomized design using the General Linear Model procedures of SAS Institute (2005). Means were compared using the Duncan multiple range test. Statements of statistical significance are based on P < 0.05.

The effects of different levels of dietary mineral and vitamin premix significantly improved (P<0.05) the production performance of laying hens. Adding 0.45% mineral and vitamin premix in the diets, improved (P<0.05) egg production, egg mass, and feed conversion ratio and decreased (P<0.05) the feed cost to each kilogram of egg production. However, different levels of the mineral and vitamin premixes did not affect the egg weight and feed intake in the present experiment. The effects of different levels of mineral and vitamin premix on the egg quality traits are presented in Table 3. Different levels of mineral and vitamin premix in layer diets did not (P>0.05) affect the egg quality traits among the various dietary groups of laying hens.

Production level has determining effects on nutrient demand. So, supplementing higher amounts of mineral and vitamin premix improves the bird’s health status and production parameters. No effect of dietary mineral and vitamin premix, supplementation on eggs weight might be due...
to the efficient supplementation of essential nutrients affecting the egg size. These findings are in contrast with other reports showing that use of higher levels of vitamin B₁₂ and vitamin E in laying hen diets can increase the egg size (Michael and Edwards, 1992; Saly et al., 1996). Supplementation of more than 0.45% of mineral and vitamin premix in wheat based diets significantly increased the egg weight of laying hen (Nobakht, 2013). However, in another experiment, the beneficial effects of high levels of vitamins E and C on egg size were not observed (Zagari et al., 2006). These findings are in contrast with reports by (Afshar et al., 2006) who realized no effect of two fold increase in vitamin supplementation over NRC recommended levels. The highest amount of egg mass was obtained in bird provided 0.45% vitamin and mineral premix which was in agreement with previous study (Afshar et al., 2006). Highest egg mass obtained in 0.45% vitamin and mineral premix supplemented group resulting in best feed conversion ratio was in agreement with previous report (Nobakht, 2013). The highest egg production percentage and the best feed conversion ratio achieved by birds receiving 0.45% vitamin and mineral premix in diet and the resultant lowest feed cost to each kilogram of egg production was resulted in this experimental group. This result was also in agreement with Afshar et al., 2006; Nobakht, 2013. Different levels of dietary minerals and vitamins premixes could not change the egg quality traits of laying hens.

In the present experiment, diets were iso-caloric, so the amount of feed intake has not changed by using different levels of dietary premix. Using higher levels of minerals and vitamin supplement could not significantly change the egg weight of laying hens (Afshar et al., 2006). In comparison with the egg weight and feed intake, inclusion of 0.45% mineral and vitamin premix in laying hens diet increased the egg production percentage. It may be related to the better supplementation of essential micro-minerals and vitamins.

Some reports showed that the absence of vitamins A and E reduced the amounts of egg production performance of laying hens will be reduced (Bartov et al. 1990; Sato et al. 1994). The beneficial effect of high levels of dietary micro-minerals and vitamins on egg production percentages of laying hens obtained in our study is in contrast to the findings of Afshar et al. (2006) who realized no effect of two fold increase in vitamin supplementation over NRC recommended levels. The highest amount of egg mass was obtained in bird provided 0.45% vitamin and mineral premix which was in agreement with previous study (Afshar et al., 2006). Highest egg mass obtained in 0.45% vitamin and mineral premix supplemented group resulting in best feed conversion ratio was in agreement with previous report (Nobakht, 2013). The highest egg production percentage and the best feed conversion ratio achieved by birds receiving 0.45% vitamin and mineral premix in diet and the resultant lowest feed cost to each kilogram of egg production was resulted in this experimental group. This result was also in agreement with Afshar et al., 2006; Nobakht, 2013. Different levels of dietary minerals and vitamins premixes could not change the egg quality traits of laying hens.

These findings are in agreement with reports by (Afshar et al., 2006; Nobakht and Taghizadeh, 2008; Nobakht et al., 2008). It has been reported that by supplementing 0.55% of dietary minerals and vitamins increased the percentage of egg albumin, while the percentage of egg yolk decreased (Nobakht, 2013). The difference in the results of various researchers may be attributed to different levels, composition and quality of commercial premix in diet ingredient and variation in experiment status.

### CONCLUSION

Supplementation of 0.45% mineral and vitamin premix during the first phase layer diets, could improve egg production, egg mass and reduce production cost without any adversely affecting egg quality traits.
ACKNOWLEDGEMENT

This study has been supported by islamic azad university of Maragheh branch. The author likes to appreciate Dr. ahadi for his supporting during experimental period in poultry farm.

REFERENCES


