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THE USE OF CRUDE PALM OIL AND ITS PIGMENT ADSORBENT AS CAROTENE SOURCES IN THE DIET OF LAYING HENS

Jublin F. Bale-Therik[1]

Abstract

The objective of this experiment was to study the effect of carotene sources, levels of β-carotene and vitamin A in the diet with their interactions on reproduction potency of laying hens which were fertility and hatchability. The experiment was arranged in completely randomised design in a 2x3x2 factorial lay out with three replications. The first factor was carotene sources with two levels i.e.: crude palm oil and pigment adsorbent of crude palm oil. The second factor was β-carotene in the diet with three levels i.e. 0 IU/kg, 6000 IU/kg and 12000 IU/kg equivalent vitamin A. The third factor was vitamin A in the diet with two levels i.e.: 4000 IU/kg and 10000 IU/kg. The 12 dietary treatments were fed to three replicates of four birds each. Data collected were analysed using Multivariate Analysis of Variance (MANOVA) and continued with Contras Orthogonal Test. The result showed that level of β-carotene had significant effect on reproduction potency, whereas the other factors and their interactions had no effect on reproduction potency of the hens. It was also indicated that β-carotene as well as its interaction with vitamin A, had a significant linear effect on reproduction potency of the hens.

Key Words: Palm oil, β-carotene, Vitamin A, Reproduction, Layers.

Introduction

Crude palm oil (CPO) has a dark-orange colour due to presence of some 500 mg/kg or more of carotenoid pigments (Cornelius, 1983). In practice, bleaching earth, bentonite is commonly used in the bleaching process of CPO as pigment adsorbent (PACPO). It is guessed that in that colour there is also carotenoids compound in the bleaching earth. In fact, the PACPO is usually unused and thrown away as wasted material of oil industry. According to Maclellan (1983), β-carotene is the biggest component in the carotenoids with the portion of around 62 percent.

Carotene can be converted in the animals body into pure vitamin A (Chew, et al., 1991). It has been reported that vitamin A is necessary for fertility and hatchability of laying hens (Wahyu, 1985). In another experiment it is found that a minimum of

[1] Nusa Cendana University, Kupang 85361

approximately 400μg of carotene per 100 g feed was required for good egg production and hatchability (Perez, 2000).

As waste material, there is a chance to use PACPO as feedstuff, but to what extent the possibility of using it in the diet and its impact toward reproduction potency of laying hens has not been reported.

Materials and Methods

Experimental design and birds

One hundred and forty four Hy-line brown pullets of 23 wk of age were used in this experiment. Birds were obtained from a commercial source and reared to 52 wk of age at Poultry Houses of Faculty of Animal Husbandry, Bogor Agriculture University. Fifteen broiler breeder males of around 1 year old were also used in this experiment fo the purpose of providing semen for artificial insemination (AI).

This experiment was arranged in completely randomised design in a 2x3x2 factorial lay out with three replications. The first factor was carotene sources with two levels i.e. crude palm oil (CPO) and pigment adsorbent of crude palm oil (PACPO). The second factor was β-carotene in the diet with three levels i.e. 0 IU/kg, 6000 IU/kg and 12000 IU/kg equivalent vitamin A. The third factor was vitamin A in the diet with two levels i.e. 4000 IU/kg and 10000 IU/kg. Birds were divided into twelve treatments groups with three replicates of four birds each.

Diet composition and preparation

Birds were fed diet 1 to 12 (Table 1), formulated according to nutrient requirements of poultry provided by the National Research Council (NRC, 1988). Before using as ingredients, carotene content of CPO and PACPO were analysed at the laboratory of Balai Penelitian Ternak Ciawi, using Wina procedures, 1981. The result of laboratory analysis showed that total carotene of CPO and PACPO were 837 mg/kg and 513 mg/kg respectively. Diets and water were provided *ad libitum*.

Processing of PACPO

CPO and bentonite were used in this process. CPO was taken from PT Bimoli, Jakarta and bentonite was taken from PT Bentonit Alam Citeureup, Indonesia. CPO and bentonite were mixed at the ratio of 5:1. The mixing was done two times of 20 minutes each with 2000-rpm speed. Oil was then separated to get adsorbent as the material of PACPO. PACPO was supplied every time to fulfil the need of the treatments diet.

Insemination and reproduction potency evaluation

In the last 5 wk of experiment, semen was pooled weekly to inseminate the birds. Each semen sample was then diluted 10-fold with 0.85% NaCl. Every bird was inseminated two times a week. On wk 29, over 6-d period, eggs were collected and selected daily. Eggs were incubated and candled on Day 10 of incubation for determination of fertile eggs. Fertility was calculated as a percentage of total eggs incubation, while hatchability was expressed as a percentage of total fertile eggs set.

Statistical analysis

The data were subjected to multivariate analysis of variance (MANOVA) and contrast orthogonal test (Kramer, 1972).

Results and Discussion

The influence of various levels of carotene source, β-carotene and vitamin A on reproduction potency is presented in Table 2.

The result of statistical analysis (MANOVA) shows that β-carotene has significant effect on reproduction potency, whereas the carotene source, vitamin A and their interactions have no effect on reproduction potency of the hens.

Contras orthogonal test indicated that β-carotene as well as its interaction with vitamin A has a significant linear effect on reproduction potency of the hens.

Fertility

Response on fertility to low and high vitamin A levels with several levels of β-carotene on the diet is shown in Fig. 1. The increase of fertility caused by low vitamin A level (4000IU/kg) is greater than the diet with high vitamin A level (10000 IU/kg). The observation on fertility at the low vitamin A level is of considerable importance in the laying hens. In fact, the fertility of birds fed with vitamin A 4000 IU/kg added β-carotene 6000 IU/kg is about 20% higher than the diet without β-carotene (0 IU/kg).

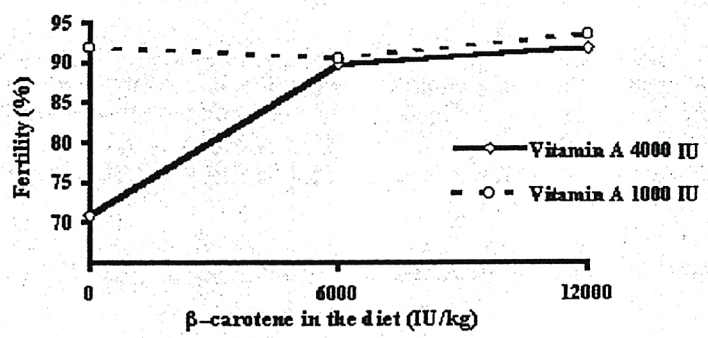

FIGURE 1. Effect of Vitamin A and β-Carotene on Fertility

There is no significant different on fertility for all levels of β-carotene in the diet with high vitamin A level, although the highest fertility percentage (93.33%) is caused by the diet with vitamin A 10000 IU/kg added β-carotene 12000 IU/ kg.

Hatchability

Response on hatchability to low and high vitamin A levels with several levels of β-carotene on the diet, is shown in Fig. 2. A hatchability response curves is similar to its counterpart fertility response curves. The increase of hatchability caused by low vitamin A level is greater than the diet with high vitamin A level. The hatchability of birds fed with vitamin A 4000 IU/kg added β-carotene 6000 IU/kg is about 25% higher than the diet without β-carotene. This study indicates that the highest hatchability percentage (94.30%) caused by the diet with 10000 IU/kg vitamin A added 6000 IU/kg β-carotene in the diet. The result of this study also indicates that β-carotene supplementation from CPO or PACPO may be beneficial in practical layer diets, particularly those marginal in the diet with low vitamin A level.

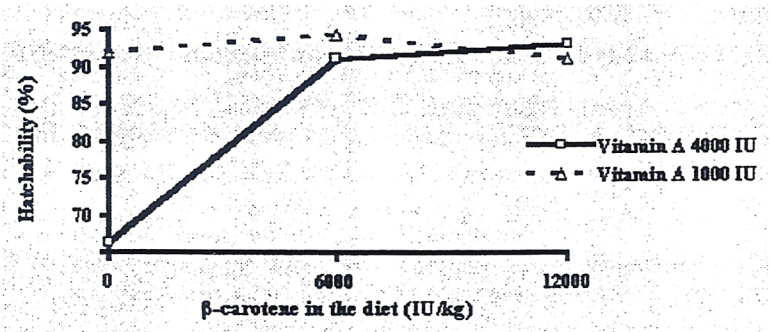

FIGURE 2. Effect of Vitamin A and β-Carotene on Hatchability

Conclusions

Level of β-carotene had significant effect on reproduction potency, whereas the other factors and their interactions had no effect on reproduction potency of the hens. β-carotene supplemental from CPO or PACPO has a beneficial practical layer diets, particularly those marginal in the diet with low vitamin A level. The 4000 IU/kg vitamin A with 6000 IU/kg β-carotene was equally effect in improving fertility and hatchability regardless of CPO or PACPO content in the diets. Further work is needed to determine maximum requirement of laying hens on PACPO to other parameters.

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