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EFFECT OF FEEDING A MIXTURE OF COW, POULTRY, AND RABBIT MANURES ON LAYING HEN PERFORMANCE AND EGG QUALITY

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ABSTRACT

The composition and feeding value of dried cow manure (CM), poultry manure (PM) and rabbit manure (RM) were indirectly determined for laying hens using yellow corn as a basal. Results of chemical composition of CM, PM, and RM showed acceptable percentage of nutrients. Also there were suitable values of nutrient digestibility and feeding value of such materials. The ME values were 1833, 2226 and 1969 Kcal/Kg of CM, PM and RM, respectively.

In feeding trial, 189 Mamoura chickens of 24 weeks old were divided into 7 triplicate groups (9 birds x 3 replicates x 7 treatments). Each replicate contains one cock and eight hens. Seven experimental diets were formulated in which the 1st was the control (T_1) and based mainly on yellow corn and soybean meal. A mixture of CM, PM and RM, in a ratio of 1:1:1, was used to replace part of T_1 at levels of 10, 15 or 20 % without or with addition of 0.05 % Kemzyme (a commercial mixture of some enzymes, KZ) for T_2, T_3, T_4, T_5, T_6 and T_7, respectively. Laying hen performance, egg quality and economic efficiency were measured along 3 months experimental period. The results of hen performance showed significant superiority of the substitution level 15% with or without KZ supplementation (T_5 & T_4) followed by those of T_3, T_2, T_7, T_1 and T_6, respectively. Also there were significant differences in some measurements of egg quality. From the economic point of view, T_5 recorded the best value followed by those of T_4, T_3, T_7, T_6, T_2 and T_1 respectively.

In conclusion, when the performance of laying hens are taken in consideration in addition to the economic efficiency, it appeared that using a mixture of CM, PM and RM to replace 15% of the laying diets is practically effective and more cheaper final product could be achieved.

Keywords: Laying hens, manure, feeding, egg quality

INTRODUCTION

It is well known that the most important factor (s) affecting the improvement in livestock production is the availability of cheep and good quality feedstuffs. In Egypt, there is a serious problem of feed shortage for livestock especially in poultry field. However, one of today's real challenges for poultry feed formulation is to produce efficient feedstuffs that will meat the absolute nutrient requirement of the bird. This goal is even more important today in the time of high feed ingredient prices and low profits of production.

Some investigators directed their researches to study the possibility of using farm by-products such as cow manure (CM), poultry manure (PM) and rabbit manure (RM) as ingredients, in poultry rations in order to lowering feeding cost.

Soliman (1992) studied the chemical composition and feeding value of dried CM for laying hens and its effect on egg production and quality. He found that dried CM contained 18.52% CP and 1878 Kcal ME / Kg on dry

matter basis (DM). The results of feeding trial showed that the level of 15% CM in the diet resulted in the best laying hen performance. Several studies decided that CM could be used in poultry diets up to 15 or 20 % without any adverse effect on their performance (Lipstein and Bortein, 1971 and 1973; Abou-Sido, 1978; Oluyemi *et al.*, 1979; Ahmed, 1981; Dessouky, 1990 and Soliman, 1992).

Dessouky (1990) found that dried PM contained 23.87 % CP and 1211 Kcal ME/Kg DM. He also reported that using dried PM in laying hen diets up to 15 % resulted in the better performance. Once again several studies decided that PM could be used in poultry rations up to 15% without any adverse effect on their performance (Flegal and Zindal, 1971 & 1972; Trakulchange and Balloun 1975; Galal *et al.,* 1977; El- Deek *et al.,* 1984; Hassan, 1984; Abdel-Moty *et al.*, 1986; Abdel-Hakim *et al.,* 1991 and El-Hussieny *et al.,* 1994).

Dessouky (1990) found that dried RM contained 13.2 % CP and 2097 Kcal ME/Kg DM. He reported that using 15% RM in layer diets resulted in better performance of laying hens than the other levels. However, several studies showed that RM could be used in poultry diets without any adverse effect on their performance. (Chawan *et al.,* 1979; Elemele, 1980; Mendoca *et al.*, 1980; Malavazzi *et al.,* 1985; Abdel-Hakim *et al.*, 1991).

The present work was carried out to study the composition, nutrient digestibility and feeding value of CM, PM and RM using indirect digestibility trials with poultry. In a feeding trial, the effect of using different levels of a mixture (1: 1: 1) of CM, PM and RM without or with Kemzyme supplementation in diets on laying hen performance was also studied.

MATERIALS AND METHODS

The experimental work of the present study was carried out at Mallawi Animal Production Station, Animal Production Research Institute, ARC, Egypt.

Firstly, digestibility trials with adult cocks were undertaken to determine the nutrient digestibility and feeding value of CM, PM and RM using the indirect method by using yellow corn as a basal diet_as described by Abbas (1986).

In the feeding trial, a total number of 189 Mamoura birds (168 hen and 21 cocks) 24 weeks old were randomly divided into 7 triplicate groups (9 birds x 3 replicates x 7 treatments). Each replicate contains one cock and eight hens. They were reared in conventional floor brooder houses and fed on the experimental diets for 3 months.

Seven experimental diets were formulated (Table 1) in which the first (T_1) was contained from yellow corn (YC) and soybean meal (SBM) as main sources of energy and protein, respectively and served as a control diet. Dried manure mixture (MM) contained cow manure (CM), poultry manure (PM) and rabbit manure (RM) in a ratio of 1:1:1, was used in the other diets at levels of 10,15 or 20 % without or with the addition of 0.05 % Kemzyme (a commercial mixture of some enzymes, KZ)* in the diets T_2, T_3, T_4, T_5, T_6 and

*** Each 1 Kg Kemzyme consists of 4.3 g Lipase, 4.2 g Cellulase, 77.0 g Bentonite and 897.4 g Lime stone.**

T_7, respectively. All diets were adjusted to be iso-caloric (about 2700 Kcal ME/Kg) and iso-nitrogenous (about 15 % CP). Feed and water were offered daily ad. libitum. under 16 hours lightening / daily. All birds were under similar management condition and veterinary control through the experiment.

Data of body weight (BW), weight gain (WG), egg production (EP), egg weight (EW), egg mass (EM), feed intake (FI), and feed conversion (FC), were recorded. At 32 weeks of age, a total number of 105 eggs (15 eggs from each treatment) were taken to determine some egg quality parameters {egg weight (EW), yolk index (YI), yolk color (YC), Haugh unit (HU) and shell thickness (ST)}. An economic study was carried out to deduce the economic use of the experimental diets for egg production using the in put and output analysis method. The chemical analysis of the tested materials, feed and excreta were carried out according to AOAC (1980) while the method of Jakobsen *et al.* (1960) was used for separating fecal protein in excreta

samples. Statistical analysis was carried out using the general linear model program of SAS (1990).

RESULTS AND DISCUSSION

Chemical composition and digestibility trials

The mean values of chemical composition (on DM basis) of the used manures are presented in table (2). The data obtained of CP, EE, CF, ash and NFE % for CM, PM and RM revealed reasonable values. Such values are generally within the published values for some investigators, (Ahmed, 1981; Dessouki, 1990 and Soliman, 1992) for CM, (Osman, 1980; Atta 1988; Abdel- Hakim *et al.*, 1991; Taie *et al.*, 1992; El- Husseiny *et al.*, 1994; El-Deek *et al.*, 1995; and Ehsan- El-Ansary *et al.*, 1996) for PM and (Chawan *et al.*, 1979; Mendonca, 1980; Dessouki, 1990; Fatma, 1992; Zaza, 1993 and Amany, 1997) for RM.

Comparing the chemical composition of the tested materials with each other, it is obvious that PM contained the highest level of CP (20.45 %) followed by CM (19.09 %) and RM (17.29 %). Also PM contained the highest value of NFE (52.18%) followed by RM (40.05 %) and CM (32.38 %), respectively. Once again PM recorded the lowest values of EE (1.90 %), CF (8.11 %) and ash (17.36 %) compared with CM and RM which recorded nearly similar values. The better figures of the PM composition than those of CM and RM might attributed to the concentrate rations that poultry fed on, while the rations of rabbits and cows contains roughage materials. However, the chemical composition of a mixture (1: 1: 1) of such manures (Table 2)

revealed acceptable values and could be considered as an ingredient for livestocks.

In general, the chemical composition of any feedstuff still the preliminary indicator on the possibility of using such material in feeding livestock, but the final evaluation can't obtained without receiving more information through digestibility and feeding trials.

Data of nutrient digestibility values of the tested materials are presented in Table (3). The results showed, generally, suitable nutrient digestibility for all tested manures. The CP was higher digestibility for CM (73.62 %) followed by that of RM (66.82 %) and PM (50.47 %) in a descending order. It likely seemed that the protein of CM and RM might be partly digested in rumen of cows and caecum of rabbits, therefore, it became easier in digestion by poultry than that of PM. It is worthy to note that a part of PM protein is non- protein nitrogen in addition that poultry are monogastric livestock, so the CP digestibility of PM by poultry was the lowest (50.47 %) compared to the other manures. In this respect, our results agreed with Dessouky, (1990) who found that the CP digestion coefficients of CM, RM and PM were 72.82, 66.29 and 47.59 %, respectively.

The EE digestibility of RM (81.77 %) surpassed those of PM (79.80 %) and CM (73.15 %) which recorded the lowest value. Similar results were reported by Ahmed, (1981) for CM (73.15 %), Taie *et al.*, 1992 for PM (79.0 %) and Dessouky, (1990) for RM(84.88 %).

The CF digestion coefficients were some what low and ranged between 12.07% (CM) and 16.86 % (RM). The differences may be due to the quality of fiber in each manure which is affected by many factors such as the

type & quality of eaten feed, age of animals or birds and the case of production. (Ahmed, 1981; Dessouky, 1990 and Taie *et al.*, 1992.).

Concerning with the feeding values, PM recorded the highest values of TDN (53.20 %), SV (55.02%) and ME (2226 Kcal / Kg), since most of nutrient digestion coefficients of such material were superior. These results disagree with those of Coon *et al.* (1978) for ME and Dessouky (1990) for TDN and ME who attributed the low feeding value of PM in their studies to its high content of fiber and ash. Rabbit manure followed PM in the measurements of feeding value being 47.04 %, 49.04% and 1969 Kcal / Kg for TDN, SV and ME respectively. The values of Dessouky (1990) for such material showed that TDN and ME of RM were 49.30 % and 2097 Kcal / Kg, respectively. The feeding values of CM recorded lower values than those of RM and PM, being 43.81 % TDN, 46.79 SV and 1833 Kcal ME / Kg. Such results are in harmony and within the published results of Ahmed (1981), Dessouky (1990) and Soliman (1992).

Laying hen performance:

Results of laying hen performance are summarized in Table (4). All treatments with hens of nearly similar initial body weight at 24 weeks of age. At the end of the experimental period (36 wks of age), no significant differences were detected among treatments either in BW or WG meaning that the dietary treatments did not affect BW measurement.

As shown in Table (4) significant differences were observed in EP, the group of birds fed on 15 % MM+ KZ (T_5) resulted in the highest value of EP (56.64 %) followed by those groups fed on 15 % MM (T_4), 10 % MM + KZ (T_3), 10 % MM (T_2), the control group (T_1), the group of 20 % MM + KZ (T_7) and the group of 20% MM (T_6), in a descending order.

No significant differences were detected among all treatments in EW indicating that the dietary treatments did not affect egg weight. While significant differences were found between treatments in EM. The T_5 group had the best value of EM and T_6 had the lowest value whereas the others were intermediate in this respect.

Except for group of T_6 all groups of hens consumed nearly similar amounts of feed during the experimental period where it consumed significantly (P> 0.05) the less amount of feed.

Concerning FC (FI/EM), it clearly observed that T_5 resulted in the best value followed by those of T_6, T_3, T_7, T_6, T_2 and T_1 in a descending order. Differences among T_5 and both of T_1 and T_2 only were significant (P> 0.05).

Generally, it could be noticed that using the mixture of manures to replace part of laying diets resulted in better performance measurements than the control. The best values reached by the substitution level of 15 % followed by those of 10 % and 20 %. It is worthy to note that the diets supplemented with Kemzyme revealed better results than unsupplemented ones. This could be explained on the basis that manures, as several investigators had reported, contain the residues of undigested and unabsorbed components in addition to the residues of hormones, drugs, digestible juices, cell walls, some vitamins, minerals and microorganisms. Such components are of relatively high value in poultry rations either for growth or egg production. Therefore, using manures to replace part of diet resulted in acceptable hen performance. The depression of results with 20 % substitution level might be due to the high fiber and high ash content of such level. However, the better results that appeared when diets were supplemented with Kemzyme might be due to the presence of Alfa-amylase, Beta-glucanase, Protease, Lipase, Cellulase and Bentonite enzymes in KZ, which helped in improving the utilization of diets contain manures.

The present finding are in good agreement with those of Lipestein and Bortein (1973); Oluyemi *et al.* (1979), Ahmed, (1981); Abdel-Hakim *et al.* (1991) and Soliman (1992) for CM, Flegal and Zindal (1971 & 1972); Biely *et al.* (1972); Trakulchange and Balloun, (1975); Galal *et al.* (1977); Hassan, (1984); Abdel-Moty *et al.* (1986); Abdel-Hakim *et al.* (1991) and El-Hussieny *et al.* (1994) for PM and Chawan *et al*. (1979); Elemele *et al.* (1980), Mendonca *et al.* (1980); Malavazzi *et al.* (1985) and Abdel-Hakim *et al.* (1991) for RM. They found that the best results of hen performance were found when manures were used at levels of 10 – 15 % of laying hen diets.

Egg quality:

As Shown in (Table 5), no significant differences were detected in either EW, YI, or HU parameters indicating that, with the exception of YC and ST, the dietary treatments did not affect the quality of the produced eggs. Concerning YC, it is noticed that increasing MM level in the diet gave significant improvement in yolk color score. This might be due to the presence of some pigment substances in MM such as xanthophylls. This

result is in agreement with those of Oluyemi *et al.* (1979), Ahmed (1981) and Soliman (1992). Concerning ST, except the group of T_6, no significant differences were found among all dietary treatments. It seemed that the high fiber content of T_6 affects calcium metabolism and / or the precipitation of calcium on the eggs produced from this group. However, supplementing the diet of such group with KZ (T_7) the measure of ST becomes similar to all other dietary treatments. In this respect Dessouky (1990) found no effects of either CM, PM or RM on shell thickness.

Economic efficiency (EEF):

Data of EEF (Table 6) revealed that T_6, T_5 and T_4 recorded the highest EEF valves followed by those of T_7, T_3, T_2 and T_1, which recorded the lowest value. It seems that increasing the substitution level of MM up to 15 % in the diet appeared to increase the net revenue. A depression in net revenue was occurred when the level of MM reached 20 % due the decrease in EP with such level. The lower cost of MM compared to the ration cost made any substitution level up to 20% more cheaper than the control. When assuming the EEF of the control group equals 100, the relative EEF of T_2, T_3, T_7, T_4, T_5 and T_6 recorded, in ascending order, higher values than the control. This might enhance the lowering of ever increasing cost of feeds for poultry and hence their final product either eggs or meat. In this respect most of authors mentioned above (in hen performance part) found that using manures (CM, PM or RM) resulted in economical benefits at the substitution levels of 10 – 15 % on the expense of laying hen diets.

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تأثير التغذية على مخلوط من روث البقر و زرق الدواجن و زبل الأرانب على الأداء الإنتاجي للدجاج البياض.

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تشتمل هذه الدراسة على جزئين:-
في الجزء الأول تم تقدير التركيب الكيمائي و القيمة الغذائية لكل من روث البقر و زرق الدواجن و زبل الأرانب كمواد علف للدجاج البياض بأجراء تجارب هضم غير مباشرة أستخدم فيها الذرة الصفراء كعليقه أساسية . و أشارت النتائج إلي احتواء هذه المواد على نسب لابأس بها من المركبات الغذائية و كذلك معاملات الهضم و القيم الغذائية مقارنة بما نشر في هذا المجال . و كانت قيم الطاقة الممثلة 1833 ، 2226 ، 1969 كيلو كالورى / كجم من روث البقر و زرق الدواجن و زبل الأرانب على التوالي .
في الجزءالثانى أجريت تجربة تغذية أستخدم فيها عدد 189 من الدجاج سلالة المعمورة عمر 24 أسبوع قسمت ألي 7 مجموعات × 3 مكررات × 9 طيور ، (و قد احتوي المكرر الواحد على عدد 8 دجاجات بياضة و ديك) و تم تركيب عدد 7 علائق تجريبية أحتوت العليقة الاولى على ذرة و كسب فول صويا كمصدر رئيسى للطاقة و البروتين و أستخدم مخلوط من روث البقر و زرق الدواجن و زبل الأرانب (بنسبة 1:1:1) في باقى العلائق بنسبة 20،15،10 % بدون اضافة او اضافة مخلوط تجاري من الأنزيمات (كيمزيم) و كانت المعاملات كآلاتي:
1- عليقه (1) للمقارنة و تتكون أساسا من الذرة الصفراء و كسب فول الصويا كمصادر رئيسيه للطاقة و البروتين.
2- عليقه (2) مثل عليقه المقارنة مع استبدال 10% منها بمخلوط الروث.
3- عليقه (3) مثل عليقه المقارنة مع استبدال 10% منها بمخلوط الروث مع إضافة كيمزيم بنسبة 5.و%.
4- عليقه (4) مثل عليقه المقارنة مع استبدال 15% منها بمخلوط الروث.
5- عليقه (5) مثل عليقه المقارنة مع استبدال 15% منها بمخلوط الروث مع إضافة كيمزيم بنسبة 5.و%.
6- عليقه (6) مثل عليقه المقارنة مع استبدال 20% منها بمخلوط الروث.
7- عليقه (7) مثل عليقه المقارنة مع استبدال 20% منها بمخلوط الروث مع إضافة كيمزيم بنسبة 5.و%.
أخذت قياسات الأداء الانتاجى و الكفاءة الاقتصادية و جودة البيض على مدى 3 شهور مدة التجربة.
أوضحت التجارب تفوق المجموعة آلتي تناولت 15 % مخلوط روث سواء بإضافة أو بدون إضافة مخلوط الأنزيمات كيمزيم في جميع مقاييس الأداء الإنتاجي (المعاملات 4،5) تلاها المعاملات 3،2،7،1،6 بترتيب تنازلي . و كانت هناك بعض الفروق المعنوية في بعض مقاييس جودة البيض . و من وجهة النظر الاقتصادية فأن ترتيب المعاملات لقيم الكفاءة الاقتصادية كان المعاملة 5 ثم 4، 3 ، 7 ، 6 ، 2 و أخيرا مجموعة المقارنة التي أعطت أقل كفاءة اقتصادية.
الخلاصة انه عندما تؤخذ مقاييس الكفاءة الإنتاجية للدجاج البياض في الاعتبار بالإضافة ألي الكفاءة الاقتصادية فان استخدام مخلوط من روث البقر و زرق الدواجن و زبل الأرانب (1:1:1) بنسبة 15 % محل علائق البياض يعتبر نتيجة طيبة من الناحية العملية و يؤدى ألي خفض سعر المنتج النهائي و تتضح فوائد ذلك اكثر في حالة ارتفاع أسعار أعلاف الدواجن.