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The Impact of Partial and Total Replacement of Soybean with Peanut Meal on Broilers Performance

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Abstract
An experiment was performed to show the Impact of replacing soybean meal with peanut meal on broiler growth performance. Three hundred lohman broiler males were obtained and reared for 42 days in an environmentally controlled poultry house. Birds were divided into three groups, each group assigned to 20 experimental units and allocated to 5 identical pens (20 birds / 1m^2). Birds were offered ad libitum feed and water throughout the experimental period. Three different experimental diets were formulated as follows: T_0; 0% peanut meal, T_{50}; 50% soybean meal, and 50% peanut meal, and $T_{100;}$ 100% peanut meal. Birds body weight was measured every two weeks at the same time. Feed intake, average daily gain, and feed conversion ratio was calculated at the end of the experiment. The body weight was greater ($p < 0.05$) for birds that received peanut meal at 100% level (T_{100}) more than birds consumed T_0 and T_{50} diets at 14-28 days and at days 28-42. At day 28 - 42, feed intake was greater ($p < 0.05$) for broilers that had T_{100} diet than broilers which consumed T_0 and T_{50}. Average daily gain (ADG) and FCR was not affected ($p > 0.05$) by the different experimental diets. Therefore, feeding peanut meal had a positive effect on broiler growth performance and might be considered as an excellent protein source in broiler rations.
Keywords: broiler, growth performance, peanut meal, soybean meal

1. Introduction

Broiler production is considered as one of the most important resources for animal protein as it has a short production interval when compared to other livestock (Babatunde, 1980). However, the cost of production of broiler meat might increase and remain high due to the continuous increase in feed cost. Feed accounts for up to 70 % of the total cost of broiler production (MOA, 2014). Adequate nutrients, such as protein, are of the major inputs necessary for improving growth performance for poultry.

The feed industry in Jordan uses soybean meal (SBM) as a protein source in broiler rations because producers are more familiar with using it in the feed, while peanut meal (PNM) is considered an inferior protein supplement. Peanut-meal is deficient in some amino acids, such as Methionine (Met) and Lysine (Lys). These deficiencies might be controlled by using synthetic forms of Met, and Lys that are available commercially with adequate prices which allow producers to use it in livestock feeds. Peanut meal found to be lower in price than SBM, so it is possible that adding amino acids to peanut meal might convert it to a competitive ingredient with SBM in poultry feeds (Costa et al., 2001). Although peanut meal considered as a high protein source for poultry feed, it has an anti-nutritional properties and it is highly oxidative if not stored well in controlled environment. Moreover, PNM is highly susceptible to aflatoxin contamination which is very harmful to poultry health and reduces production (Sayda et al., 2011).

A number of previous studies have examined the effects of varying ratio of PNM and SBM in broiler diets on their performance. El Boushy and Raterink (1989) found that as the percentage of PNM in the diet increased from 5 to 15%, growth was decreased and feed efficiency was not improved even with a slight surplus of Lys and Met supplements in the diet offered to the birds. The PNM used in the mentioned study tested negative for aflatoxin but was high in iron. Another study performed by Suswanto and Jones (1996) showed that a mixture of PNM and SBM (a ratio of 65:35) with the addition of meat and bone meal in the diet (43%) improved birds performance. They also found that the metabolizable energy of the diet was increased linearly with inclusion of PNM which might be one of the reasons for improving the growth rate of the birds. In our area, few studies were performed to examine the effect of adding peanut meal to broilers diets; therefore, the aim of this study was to investigate the effect of replacing soybean with peanut meal (partially and totally) on broilers growth performance.

2. Materials and Methods

2.1 Experimental birds and Management practices

One day old of three hundred lohman broiler males were obtained from a local hatchery and reared for 42 days in an environmentally controlled poultry house at the research station of the Faculty of Agriculture at Jerash University. Chicks were divided into three groups; each group was assigned to 20 experimental units and reared in 5 identical pens (20 birds / 1m^2). Each pen was provided with an adequate number of thermostatically controlled heaters and fans for air circulation and distribution. A thermometer was used to monitor the

temperature. Birds were offered *ad libitum* feed and water. Temperature was decreased gradually during the experimental period from 32 ºC at one day old to reach 22 ºC at the end of the experiment.

2.2 Experimental rations, setting, and measurements

Three different experimental diets were used to investigate the effect of replacing soybean meal with peanut meal on broiler productive traits. At the first three days of bird age, they were fed a commercial broiler starter diet that contained 3026 Kcal ME/kg and a 22.1% crude protein, after this; one group were kept on the same diet throughout the experimental period. The other two groups of birds were offered the experimental diets which had the different levels of peanut meal (Table 1).

Peanut meal was prepared by purchasing the nuts, then dried, toasted, and milled to a finely ground material. After that, peanut meal was added to the rations in different percentages as shown in Table 1. The experimental diets used in this experiment are:

Treatment 1 (T_0): Control diet, without an addition of peanut meal (0% peanut meal).

Treatment 2 (T_{50}): Adding soybean meal and peanut meal (50% soybean meal, and 50% peanut meal).

Treatment 3 (T_{100}): Replacing soybean meal with peanut meal (100% peanut meal).

The proximate chemical composition of peanut meal was analyzed using the AOAC (1990) procedures (Table 2). The experimental diets were offered to the birds after the 3 days of adaptation and birds were weighed. Weighing the birds was repeated every two weeks at the same time until the end of the experimental period. Feed intake was calculated by recording feed offered and feed refusals. Average daily gain (start weight-final weight/ number of days) and feed conversion ratio (feed intake/ average daily gain) was calculated at the end of the experiment.

Table 1. Ingredients and calculated chemical composition for broiler experimental diets.

Diet	T_0	T_{50}	T_{100}
Ingredients and composition			
Yellow corn	61.5	65.1	64.6
Soybean meal (44 %)	35.8	16.5	0
Peanut meal	0	15.6	32.8
Dicalcium-phosphate	1.05	1.05	1.05
Premix[1]	0.2	0.2	0.2
DL-methionine	0.1	0.1	0.1
Choline	0.1	0.1	0.1
Salt	0.3	0.3	0.3
Coccidostats	0.05	0.05	0.05
Nutrient chemical composition[2]			
ME (kcal kg^{-1})	3026	2998	2973
Crude Protein	22.1	22.0	22.3

[1]: 1 kg of premix contains: 12000000 IU vitamin A, 2500000 IU vitamin D3, 10000 mg vitamin E, 2000 mg vitamin K3, 1000 mg Vitamin B1, 5000 mg vitamin B2, 10 mg vitamin B12, 30000 mg Nicotinic acid, 3000 mg Ca-pantothenate, 1000 mg folic acid, 50 mg biotin, 40000 mg Fe, 5000 mg CU, 60000 mg Mn, 100 mg I, 60000 mg Zn, 150 mg Co, 10000 mg B.H.T.

[2]: The chemical composition of nutrients for each feed ingredient was calculated using NRC tables (1994).

Table 2. Chemical Composition of peanut meal.

Nutrient	Amount
Crude Protein %	44.2
ME (kcal kg^{-1}) [1]	2.655
Crude Fiber %	7.50
Crude Fat %	1.54
Ash %	5.02

[1]: The chemical composition of nutrients for each feed ingredient was calculated using NRC tables (1994).

2.3 Statistical Analysis

Data were analyzed using PROC MIXED of SAS (version 9.1, SAS Institute, Inc. Cary, NC, USA) with bird considered the experimental unit for the treatment × week effects. The mean separation was performed using an F-protected t-test. Treatment means are reported as least square means by using Tukey test and differences were referred to as tendencies are those having a $P \leq 0.05$.

3. Results

An experiment was conducted to evaluate the effect of replacing soybean meal with peanut meal on broiler performance. Table (3) shows the effect of the different experimental diets on broiler body weight. The results showed that body weight gain was not affected by the different treatments at the first 14 days of the experimental period. After day 14 until the end of the experimental period, body weight was significantly different ($p < 0.05$) with birds consumed the different treatments. The body weight was greater ($p < 0.05$) for birds receiving 100 % of peanut meal (T_{100}) when compared to birds which consumed the control diet (T_0 = 0% of peanut meal) and T_{50} (50% soybean meal, and 50% peanut meal) at 14-28 days and at 28-42 days with 1077.2 g and 2144.6 g, respectively. Birds body weight was not significantly different ($p > 0.05$) when consumed T0 and T50 at day 14 until day 42 (992.60g vs. 1025.0g at day 14- 28; 1931.0g vs. 1973.2g at day 28- 42, respectively).

Table 3. Effect of replacing soybean meal with peanut meal on broiler body weight (grams) during the experimental period.

	Body weight (gm/bird/days)		
Diets*	**0-14 day**	**14-28 day**	**28-42 day**
T_0	349.8	992.60 **b**	1931.0 **b**
T_{50}	332.2	1025.0 **b**	1973.2 **b**
T_{100}	346.4	1077.2 **a**	2144.6 **a**
Significances	N.S	**	**

*. Diets are: T^0 = 0% peanut meal; T^{50}: 50% soybean meal, and 50% peanut meal; T^{100}: 100% peanut meal.
**. Means with different superscripts in the same column are significantly different $p<0.05$.
N.S. Means are not significantly different when $p<0.05$.

The effect of replacing soybean meal with peanut meal on broiler feed intake during the experimental period is shown in Table 4. Feed intake was not significantly different ($p >0.05$) for birds consumed the different diets from day 0 until 28 days. At day 28 - 42, feed intake was greater ($p < 0.05$) for broilers consumed the T_{100} diet than broilers consumed the T_0 and T_{50} diets with 2054 g/bird/day for birds fed T_0 diet, while feed intake was 1972 g/bird/day and 1934 g/bird/day for birds consumed T_0 and T_{50} diets, respectively.

Table 4. Effect of replacing soybean meal with peanut meal on broiler feed intake (grams) during the experimental period.

	Feed Intake (gm/bird/days)		
Diets*	**0-14 day**	**14-28 day**	**28-42 day**
T_0	424.6	1355	1972 **b**
T_{50}	426.2	1347	1934 **b**
T_{100}	413.0	1371	2054 **a**
Significances	N.S	N.S	**

*. Diets are: T^0 = 0% peanut meal; T^{50}: 50% soybean meal, and 50% peanut meal; T^{100}: 100% peanut meal.
**. Means with different superscripts in the same column are significantly different $p<0.05$.
N.S. Means are not significantly different when $p<0.05$.

Table 5 shows the effect of replacing soybean meal with peanut meal on broiler average daily gain (ADG). Average daily gain was not affected ($p > 0.05$) by the different experimental diets. Birds consumed the different diets had almost the same ADG from day 0-14 with 304 g, 314 g, and 321g for birds consumed T_0, $T5_0$, and T_{100} diets, respectively. The ADG was improved with birds consumed the different diets after day 14 until the end of the experimental diet but was not significantly differ ($p > 0.05$).

Table 5. Effect of replacing soybean meal with peanut meal on broiler average daily gain (grams) during the experimental period.

	Average daily gain (gm/bird/days)		
Diets*	**0-14 day**	**14-28 day**	**28-42 day**
T_0	304	755	887
T_{50}	314	766	898
T_{100}	321	772	905
Significances	N.S	N.S	N.S

*. Diets are: T^0 = 0% peanut meal; T^{50}: 50% soybean meal, and 50% peanut meal; T^{100}: 100% peanut meal.
N.S. Means are not significantly different when $p<0.05$.

Feed conversion ratio (FCR) was calculated (Table 6). The replacement of soybean meal with peanut meal had no effect ($p > 0.0$) on birds FCR. Feed conversion ratio was better for birds consumed the different diets at 0-14 days of the experimental period, then it was reduced in from day 14 until the end of the experiment.

Table 6. Effect of replacing soybean meal with peanut meal on broiler feed conversion ratio (FCR) during the experimental period.

Diets*	FCR (%)		
	0-14 day	14-28 day	28-42 day
T_0	1.39	1.79	2.22
T_{50}	1.36	1.76	2.15
T_{100}	1.29	1.78	2.27
Significances	N.S	N.S	N.S

*. Diets are: T^0 = 0% peanut meal; T^{50}: 50% soybean meal, and 50% peanut meal; T^{100}: 100% peanut meal.
N.S. Means are not significantly different when $p<0.05$.

4. Discussion

An experiment was conducted to find the effect of feeding peanut meal to broiler growth performance. At this experiment, the body weight gain and feed intake were affected and were greater ($p < 0.05$) for birds fed rations containing 100% of peanut meal at the end of the experimental period, while ADG and FCR were not affected with birds fed the different experimental diets. Dieumou et al. (2013) reported an opposite results. Birds fed SBM based diets consumed significantly ($p < 0.001$) more feed (94.64 vs 110.71 g) than those fed PNM based diets. Moreover, Mustafa et al. (2012) showed that the growth performance of birds fed SBM were significantly better ($p < 0.05$) than those fed PNM. These results agree with the findings reported by researchers which used diets containing different percentage of plant protein from different sources and obtained significant ($P < 0.05$) effects on broiler growth and economic parameters. The better growth rate and intake of birds on PNM diets observed in this work might be due to better palatability, nutrient digestibility, and the more balanced amino acid profile found in the peanut meal.

Moreover, Ghadge et al (2009) reported that the superior performance of birds fed 75% and 100% of SBM was due to the high content of lysine and methionine in the diets. Those findings were in close agreement with the Dogan and Aghaz (1989), and Aziz et al. (2001). Moreover, Ghadge et al (2009) found that birds fed treatments contained 100% of PNM had the lowest body weight gain. The author refereed this result to the high content of crude fiber in PNM, and how peanut meal as a sole protein source was not efficient for good body weight gain. On the other hand, Pesti et al. (2003) concluded that feeding PNM increased the production of laying hens by increasing the feed intake and improving egg production and quality. Adeniji (2007) found that replacing peanut meal with other protein sources such as Maggot meal did not improve broilers performance and concluded that feeding peanut meal is better for growth performance.

Costa et al. (2001) studied the effect of feeding peanut meal as a protein source for broilers. It was reported that as the level of PNM to SBM increased in the diet, body weight gain decreased but FCR increased, and those results were noticeable with the highest level of PNM at the mentioned experiment. El Boushy and Raterink (1989) observed also a reduction in performance resulting from the increasing of PNM percentage in the diet in young birds. They reported that using SBM for the first 9 d and PNM for the last 9 d increased body weight gain to the same stage of performance as the based diet did during 18 d period of the experiment.

Feed conversion ratio (FCR) in the current study was not affected ($p > 0.05$) by the different experimental diets, although it seemed better for young birds which consumed the different diets during the half period of the experiment (from 0 – 28 days). This result is opposite to which reported by other researchers (Costa et al., 2001; Suswanto and Jones, 1996). It was found that older birds were better able to perform when fed PNM, which consistent with many other observations that amino acid requirements decrease with age (NRC, 1994). In addition, the older chicks might be better in digesting PNM or might tolerate the toxic factors that found in the PNM diets. The reason that ADG and FCR were not impacted by the different experimental diets at this study might be due to the similarity of the protein level in the diets (CP = 22%). Protein source in the current experiment did not have a significant effect on broilers growth performance, therefore, dietary protein level must be carefully selected when nutritionists consider feeding PNM for increasing its effects on live weight gain, and overall performance.

5. Conclusion

It was concluded that feeding peanut meal at a high level (100% of peanut meal as a protein source) in the birds rations improved final body weight and feed intake, while did not affect FCR and ADG. Therefore, replacing soybean meal with peanut meal had a positive effect on broiler growth performance as it might be considered as an excellent protein source for bird's rations formulation.

References

Adeniji, A. A. (2007), "Effect of Replacing Groundnut Cake with Maggot Meal in the Diet of Broilers", *International J. Poultry Sci*. 6 (11): 822-825.

AOAC. (1990), Official Methods of Analysis, 15th ed. Association of Official Analytical Chemists, Washington, DC.

Aziz, M.A., Khandakar, Z.A. & Islam, M. (2001), "Effect of replacing protein fish meal, soybean on the performance of; broiler chicken", *Indian J. Nut.* 1891: 23-28.

Babatunda, G. M. (1980). "Role of Nigerian poultry industry in potein; bridging the animal protein gaps", *Inaugural lecture*, University of Ibadan, Ibadan Nigeria.

Costa E. F., Miller, B. R., Pesti, G. M., Bakalli, R. I., & Ewing, H. P. (2001), "Studies on Feeding Peanut Meal as a Protein Source For Broiler Chickens", *Poultry Sci.* 80:306–313.

Dieumou, F. E., Adegbola, T. A., & Doma, U. D. (2013), "Growth performance, carcass characteristics and economics of production of broilers fed diets with two sources of protein and two levels of wheat offal", *J. Cereals Oilseeds*. 4(4): 42-47.

Dogan, K., & Aqahzadeh, A.M. (1989), "Research on the use of sunflower and soybean oil meals in broiler rations" *Dogaturk Tarimve or Manilik Degisi*. 2: 182-193.

El Boushy, S. R., & Raterink R. (1989), "Replacement of soybean meal by cottonseed meal and peanut meal or both in low energy diets for broilers", *Poultry Sci.* 68:799–804.

Ghadge, V.N., Upase, B. T., & Patil, P.V. (2009), "Effect of Replacing Groundnut cake by soybean meal on Performance of Broilers", *Veterinary World* 2 (5): 183-184.

MOA. (2014), Ministry of agriculture, annual report-livestock. http://www.moa.gov.jo/ar-jo/home.aspx

Mustafa, R. A., Hakim, A. S., Azizullah, M., Rab, N. S., Hidayatullah, S. N., & Ahmed U. (2012), "Effect of various protein source feed ingredients on the growth performance of broiler", *Int. J. Med. Plant Res,* 1(4):038-044.

NRC. (1994), National research council.. Nutrient requirement of poultry. 9th Rev. ed. Nat Acad. Press, Washington, DC, U.S.A.

Pesti, G. M., Bakalli, R. I., Driver, J. P., Sterling, K. G., Hall, L. E., & Bell E. M. (2003), "Comparison of Peanut Meal and Soybean Meal as Protein Supplements for Laying Hens", *Poultry Sci*. 82:1274–1280.

Sayda, A. , Ali, M ., Abdalla, Hyder O., & Abasaid, M.A. (2011), "Sunflower Meal as an Alternative Protein Source to Groundnut Meal in Laying Hen's Ration", *Egypt. Poult. Sci.* 31(4): 745-753.

SAS. (2000). SAS user's guide: statistics version 9th ed, SAS Institute, Inc. Cary, NC, USA.

Suswanto, H., & Jones G.P.D. (1996), "The replacement of soybean meal with peanut meal in broiler diets containing animal protein concentrate", Page 211 *in*: Proceedings of the Australian Poultry Science Symposium. World's Poultry Science Association (Australian Branch), Sydney NSW, Australia.