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# Effect of Feeding Sunflower Meal on the Performance and Carcass Characteristics of Broiler Chickens

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The objective of the experiment was to evaluate the effect of feeding sunflower meal on the performance and carcass characteristics of broiler chickens. A total of six hundred day-old male Arbor Acre chicks were allotted to a completely randomized experimental design. There were four levels of 0%, 4%, 8%, and 12% sunflower meal with five replicates each for forty-two days trial.
The inclusion of different concentrations of sunflower meal did not alter the productive performance of the birds. There were not significant differences in body weight, feed intake, feed conversion ratio, mortality, and the European Production Efficiency Factor (E.P.E.F.) index among the experimental groups ($P \geq 0.05$). During 22-42 days of trial, the inclusion of 12 % sunflower meal was the highest in feed intake but it was only significant differences between the inclusion of 8 % sunflower meal group ($p<0.05$). However, the inclusion of 12 % sunflower meal had higher feed intake and mortality than the other groups for the whole period of trial ($p>0.05$). The E.P.E.F. index were 299.76, 320.25, 343.22, and 298.90 for the birds fed with 0 %, 4 %, 8 %, and 12 %, of sunflower meal in the diet, respectively.
The inclusion of sunflower meal from 4 %, 8 %, and 12 % had no effect on carcass percentage and cut yield of broilers. They were breast, fillet, three joint wings, thigh, and drumstick, including abdominal fat.

## 1. Introduction

Sunflower meal (*Helianthus Annuus*) is a by-product of the oil extraction industry for human consumption. It is used as an alternative source of protein in broiler diets. The chemical composition of sunflower meal is comparable with soybean meal, and it is higher than those in cottonseed or rapeseed meals. Sunflower meal-dehulled contains 45.4% crude protein and 2,320 kcal/kg. metabolizable energy (N.R.C., 1994). Even it has a low level of lysine content of 1.70 % but it is well balanced with its amino acid composition. The lysine can be supplemented in the diet to complete the nutrient requirement of broilers.
It is almost free of anti-nutritional factors. Nevertheless, the presence of polyphenolic compounds restricts its use in feed animal and poultry, as chlorogenic acid is the major molecule of polyphenolic compounds in sunflower meal as demonstrated by many researchers. It causes an observable reduction in the digestibility and bioavailability of the protein content of sunflower (Zatari, 1989).
However, it has a high level of fiber content which it contains 12.2%. A high fiber content of sunflower meal is not well-digested by chickens. It causes a bulky feed that lowers concentration of nutrients in the diet. It has poor palatability and reduces the feed intake of broilers. Also, there is a poor growth rate of broilers even when supplemented with lysine in the diets. Therefore, there is a need to limit the high inclusion rate of sunflower meal in broiler diets.
Senkoylu and Dale (2006) suggest that a very high inclusion level of sunflower meal tends to be bulky feed and might lead to a dietary nutrient dilution in young chicks because their digestive tracts are limited in capacity. The inclusion level of 46.4% sunflower meal in broiler starter diets depressed body weight, feed intake, and gain but not feed conversion of chicks. However, the inclusion level of 20 % to 30 % works as effectively as soybean meal in the starter diets of young chicks.
Also, Levic et al. (2005) reported that sunflower meal can replace soybean meal from 50 % to 100% in broiler diets with supplemented adequate amounts of lysine and energy, which can use sunflower meal in broiler diets at level of 10% to 30 %.

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Tavernari et al. (2008) used up to 20 % sunflower meal reduced feed intake, but it had no effect on weight gain, and improved feed conversion ratio of broiler. Musharaf (1991) reported that the inclusion of sunflower meal up to 20 %, and 25 % supplemented with lysine and methionine in the diet could be used for broiler diets. However, a poorer feed conversion ratio was found at the level of 25% sunflower meal.
While, Rama Rao et al. (2006) reported that replacement of soybean meal of up to 67 % in the starter and 100 % in the finisher diet or tentatively to 34.5 % and 29.6 % sunflower meal. It did not affect the weight gain. However, feed intake tended to increase with the sunflower meal-based diet. The digestibility of dry matter decreased with increased levels of sunflower meal in the diet. Therefore, it depressed the feed efficiency of the broiler at 21 and 42 days of age. However, the weight of giblets, abdominal fat, and length of intestine were not influenced by the incorporation of sunflower meal in the broiler diet.
Nassiri Moghaddam et al. (2012) used sunflower meal up to 21 % of broiler diets, and found that it had not negative effect on performance, but the gastrointestinal tract and gizzard weight were increased. The sunflower meal can be used up to 14 % in the diet without adversely affected on performance, the body weight, feed intake and feed conversion ratio were all improved. Sunflower meal can be included in the diet at the highest level as recommended by several researchers which it depends on the quality of product. This varies according to the variety of sunflower and the method of oil extraction (Jacob, 2014), and many results are different may regarding to the nutritive value of sunflower meal used in the diet, age of birds and feed formulation. This experiment was to determine the effect of sunflower meal in the diet on performances and carcass characteristics of broiler chickens.

## 2. Material and methods

### 2.1 Dietary treatments and birds management

A total of six hundred day-old male Arbor Acre chicks were individually weighed for the uniformity of initial body weight with the average of 45.32±0.34 gram/bird. They were randomly distributed into a completely randomized experimental design. There were four treatments of sunflowers meal at levels of 0%, 4%, 8%, and 12%, respectively with five replicates each.
The experimental diet was based on corn-soybean diet. They were isocaloric and isonitrogenous containing crude protein and metabolizable energy in accordance with the nutrient requirements of broiler chicken (N.R.C., 1994). The crude protein content was about 21.5 %, 19 %, 18 %, and the metabolizable energy were about 3,010, 3,175, and 3,225 kcal/kg for starter, grower and finisher diets, respectively. The chemical analysis of the experimental diets is indicated in Table 1.
Birds were raised in a controlled environmental house. It was divided into 1.3X2.3X0.5 m pens for each replicate. The concrete floor was covered with rice hull as bedding material. Each pen was equipped with a separate tube feeders and automatic drinkers. The birds were brooded by gas brooders at 32 ºC during the first week of age and reduced by 3 ºC in each week until a house temperature of 25 ºC was attained. Birds were vaccinated against Infectious Bronchitis and Newcastle Diseases by nasal drops at seven day-olds and against Infectious Bursal Diseases through drinking water at fourteen day-olds. A lighting program was provided for 23 h light and 1 h dark throughout the experiment. The mash form feed and water were provided ad libitum throughout the experiment.

### 2.2 Sample collection

On each week of the experiment, the body weight, feed intake and mortality of birds were measured. They were evaluated for feed conversion ratio and European Production Efficiency Factor (E.P.E.F.). When the birds were forty-two day-olds, four birds were randomly selected from each replicate. They were kept for six hours fasting and weighed individually for carcass evaluation of their yielded cut parts. They were breast, fillet, three joint wing, thigh, drumstick, and abdominal fat.

### 2.3 Statistical analysis

Data were analyzed for analysis of variance using the procedures of SAS statistical software (Statistical Analysis System, 2001). The difference means were compared by Tukey’s Test.

*Table 1: Nutrient contents of starter, grower and finisher diets with sunflower meal*

| Nutrient composition (%) | Level of SFM in diet (% ) | | | |
|---|---|---|---|---|
| | 0 | 4 | 8 | 12 |
| | 1 to 21 days | | | |
| Metabolizable energy (kcal/kg) | 3,010 | 3,010 | 3,010 | 3,010 |
| Crude protein (%) | 21.62 | 21.59 | 21.52 | 21.61 |
| Ether extract (%) | 5.46 | 5.46 | 5.46 | 5.46 |
| Crude fiber (%) | 3.32 | 3.32 | 3.32 | 3.32 |
| Calcium (%) | 0.96 | 0.96 | 0.96 | 0.96 |
| Available phosphorus (%) | 0.68 | 0.68 | 0.68 | 0.68 |
| Sodium chloride (%) | 0.46 | 0.46 | 0.46 | 0.46 |
| | 22 to 35 days | | | |
| Metabolizable energy (kcal/kg) | 3,175 | 3,175 | 3,175 | 3,175 |
| Crude protein (%) | 19.11 | 19.29 | 19.37 | 19.11 |
| Ether extract (%) | 5.21 | 5.96 | 6.36 | 6.93 |
| Crude fiber (%) | 3.42 | 4.14 | 4.84 | 5.03 |
| Calcium (%) | 1.25 | 1.04 | 1.02 | 1.03 |
| Available phosphorus (%) | 0.61 | 0.60 | 0.58 | 0.59 |
| Sodium chloride (%) | 0.36 | 0.43 | 0.41 | 0.43 |
| | 36 to 42 days | | | |
| Metabolizable energy (kcal/kg) | 3,225 | 3,225 | 3,225 | 3,225 |
| Crude protein (%) | 18.28 | 17.98 | 17.87 | 17.71 |
| Ether extract (%) | 4.65 | 5.14 | 5.70 | 5.91 |
| Crude fiber (%) | 3.14 | 3.81 | 4.07 | 4.45 |
| Calcium (%) | 0.91 | 0.93 | 0.99 | 1.05 |
| Available phosphorus (%) | 0.58 | 0.58 | 0.56 | 0.56 |
| Sodium chloride (%) | 0.41 | 0.38 | 0.41 | 0.38 |

## 3. Experimental results

The productive performance parameters of broiler fed diets containing various levels of sunflower meal are presented in Table 2.

### 3.1 During 1 to 21 days of age

The inclusion of sunflower meal did not alter the productive performance of young birds. There were not significant differences in body weight, feed intake, feed conversion ratio, and mortality among the experimental groups (P≥0.05). The birds fed with 0 %, 4 %, 8 %, and 12 %, of sunflower meal in the diet had an average body weight of 1,071.67, 1,074.83, 1,109.33, and 1,337.05 grams/bird, feed intake was 1,321.17, 1,311.33, 1,347.25, and 1,337.05 gram/bird, and feed conversion ratio was 1.28, 1.27, 1.26, and 1.28, respectively. Although the mortality of the birds was not significantly different among experimental groups, however the inclusion of 12 % sunflower meal in the diets had a mortality of 0.83 % while the other groups had no mortality. A previous study of Tavernari et al. (2008) used up to 20 % sunflower meal reduced feed intake in the starter phase, but it had no adverse effect on weight gain, and improved feed conversion ratio of broilers.

### 3.2 During 22 to 42 days of age

The inclusion of sunflower meal in the diet had effect on the feed intake of the birds but it had no effect on body weight, feed conversion ratio, and mortality (p≤0.05). The inclusion of 12 % sunflower meal had higher feed intake than 8% sunflower meal, but both of them were not significantly different with the other groups. The birds fed with 0 %, 4 %, 8 %, and 12 %, of sunflower meal in the diet had feed intake 3,637.37, 3,602.11, 3,502.72, and 3,730.91 gram/bird, and the feed conversion ratio was 2.47, 2.38, 2.21, and 2.48, respectively. Although, mortality of the birds had not significant differences among the experimental group, however the inclusion of 12 % sunflower meal in the diets had a mortality rate of 3.33 % and it was higher than the other groups. According to the study of Araujo et al. (2011), broiler fed with 15 % sunflower meal during 22-42 days

of age reduced broiler weight gain but did not affect feed intake. However, the worst feed conversion ratio was obtained in broiler fed diets formulated on total amino acid basis and 15 % sunflower meal. The use of sunflower meal in the diet did not influence the carcass yields but the digesta viscosity was increased due to the higher content of non-starch polysaccharides in sunflower meal.

### 3.3 During 1 to 42 days of age

The inclusion of different concentrations of sunflower meal did not alter the productive performance of the birds. There were no significant differences in body weight, feed intake, feed conversion ratio, mortality, and E.P.E.F. index among the experimental groups (P≥0.05).

*Table 2: Performance of broilers fed diets containing sunflower meal[1/]*

| Performance | Level of SFM in diet (% ) | | | |
|---|---|---|---|---|
| | 0 | 4 | 8 | 12 |
| | 1 to 21 days | | | |
| Body weight (g/b) | 1,071.67±37.54 | 1,074.83±28.66 | 1,109.33±40.36 | 1,083.72±49.08 |
| Feed intake (g/b) | 1,321.17±54.74 | 1,311.33±26.75 | 1,347.25±66.49 | 1,337.05±58.85 |
| FCR | 1.28±0.04 | 1.27±0.04 | 1.26±0.02 | 1.28±0.05 |
| Mortality (%) | 0.00±0.00 | 0.00±0.00 | 0.00±0.00 | 0.83±1.67 |
| | 22 to 42 days | | | |
| Body weight (g/b) | 2,549.54±113.03 | 2,590.33±85.31 | 2,697.75±64.33 | 2,593.97±134.27 |
| Feed intake (g/b) | 3,637.37±51.13$^{ab}$ | 3,602.11±119.08$^{ab}$ | 3,502.72±31.55$^{b}$ | 3,730.91±141.45$^{a}$ |
| FCR | 2.47±0.2 | 2.38±0.22 | 2.21±0.15 | 2.48±0.27 |
| Mortality (%) | 2.49±1.67 | 0.00±0.00 | 2.49±1.67 | 3.33±4.67 |
| | 0 to 42 days | | | |
| Body weight (g/b) | 2,549.54±113.03 | 2,590.33±85.31 | 2,697.75±64.33 | 2,593.97±134.27 |
| Feed intake (g/b) | 4,958.54±93.24 | 4,913.44±141.64 | 4,849.97±83.72 | 5,067.96±160.76 |
| FCR | 1.98±0.11 | 1.93±0.11 | 1.82±0.07 | 1.99±0.14 |
| Mortality (%) | 2.49±1.67 | 0.00±0.00 | 2.49±1.67 | 4.15±6.31 |
| E.P.E.F. | 299.76±32.26 | 320.25±28.37 | 343.22±28.35 | 298.90±42.30 |

[1/]Means followed by different letters in the same row are statistically different (P≤0.05)

The birds fed with 0 %, 4 %, 8 %, and 12 %, of sunflower meal in the diet had an average body weight of 2,549.54, 2,590.33, 2,697.75, and 2,593.97 grams/bird, feed intake were 4,958.54, 4,913.44, 4,849.97, and 5,067.96 gram/bird, and feed conversion ratio were 1.98, 1.93, 1.82, and 1.99, mortality were 2.49, 0.00, 2.49, and 4.15, the E.P.E.F. were 299.76, 320.25, 343.22, and 298.90, respectively.

The inclusion of 8 % sunflower meal had higher body weight and consumed less feed than the other groups. The inclusion of 12 % sunflower meal was the highest mortality among the experimental group, while the inclusion of 8 % sunflower meal had no mortality. Although, E.P.E.F. index had no statistical differences among the group, but the inclusion of 8 % and 4 % sunflower meal was higher in E.P.E.F. than the 0 % and 12 % groups.

This result was similar to the study of Abdelrahman and Saleh (2007). While, the previous study of Homayouni and Shivasad (2003) revealed that the inclusion of 8% and 16 % sunflower meal had no detrimental effect on weight gain and feed intake on the effect of adding sunflower meal at levels of 0 %, 5 %, 10 %, and 15 % to broiler starter and finisher rations on the performance and cost of broiler production. The inclusion of 10 % sunflower meal can be used efficiently in broiler rations without any adverse effect on broiler performance. It was the highest body weight at six weeks and it was not different in cumulative feed intake and feed conversion ratio with the minimal cost. Anyway, the inclusion of 15 % was comparable to the control group with the lowest cost of production.of broilers. On the other hand, feed conversion ratio was poor with 16% sunflower meal in the diet.

These contrast with the report of Araujo et al. (2013) that the increasing dietary addition of sunflower meal at levels of 0 %, 8 %, 16 %, and 24 % between 21-42 days of age reduced weight gain and worsened feed conversion ratio.

The productive performance of broilers can be improved with full-fat sunflower meal as the study of Salari et al. (2009) which found that weight gain, feed intake, and feed conversion ratio were improved when broiler fed

full-fat sunflower seed at level of 0 %, 7 %, 14 %, and 21 % in the starter and finisher diets between 1-49 days of age.

Furthermore, the inclusion of sunflower meal should be in the form of a pellet diet that will improve the productive performance of broilers. Zatari and Sell (1990) reported that the inclusion of sunflower meal at levels of 0, 10, and 20% in the form of mash and pelleted diet for broilers seven weeks of age. Growth of birds were parallel to increases in feed consumption caused by pelleting, irrespective of the level of sunflower meal in the diet. The inclusion of 10 %, and 20% sunflower meal reduced weight gain but the growth of birds given the pelleted diet containing 10 %, and 20% sunflower meal was comparable with the birds given the pelleted control diet. The improvement was most evident in diets containing 20% sunflower meal. The pelleting diets containing sunflower meal improved weight gain, increased feed consumption and improved feed efficiency. The improvement in weight gain and feed efficiency could be attributed to increased feed consumption, an increase in MEn concentration of the diet and improved utilization of nutrients.

However, several researches of sunflower meal inclusion in the broiler diets are different in results which suggest this may be in regard to the quality of product, the nutritive value of sunflower meal, age of birds and feed formulation.

### 3.4 Carcass characteristic

The carcass percentage and yield cut parts of broiler fed diets containing various levels of sunflower meal are presented in Table 3. The inclusion of different levels of sunflower meal did not affect the carcass percentage and yield cut of the birds. There were no significant differences in carcass, carcass percentage, breast, fillet, three joint wing, thigh drumstick, and abdominal fat among the experimental groups (P≥0.05). The birds fed with 0 %, 4 %, 8 %, and 12 %, of sunflower meal in the diet had an average of whole carcass without giblets, breast, fillet, three joint wings, thigh, drumstick, and abdominal fat were 82.46 %, 22.54 %, 4.31 %,10.52 %, 15.14 %, 11.86 %, and 1.94 %, respectively. This finding was similar to the reports of Homayouni and Shivasad (2003), and Tavernari et al. (2008) which used sunflower meal levels of 0 %, 16 % and 20 %, respectively, which did not affect the carcass percentage and cut yield of broilers. However, Homayouni and Shivasad (2003) revealed that the inclusion of 8% and 16 % sunflower meal was increased the weight of gizzard with the level of sunflower meal in the diet. While, the study of Salari et al. (2009) found that the inclusion of full-fat sunflower meal in the diet at level of 0 %, 7 %, 14 %, and 21 % had no affect on breast, thigh, gastrointestinal tract and gizzard weight percentages. However, the abdominal fat weight tended to be decreased. Araujo et al. (2013) reported that the addition of sunflower meal at levels of 0 %, 8 %, 16 %, and 24 % linearly affected carcass, breast, breast fillet, and abdominal fat weights.

*Table 3: Carcass and cut yield of broiler fed diets containing SFM at 42 days of age (% of BW)*[1/]

| Carcass and cut yield (%) | Level of SFM in diet (% ) | | | |
|---|---|---|---|---|
| | 0 | 4 | 8 | 12 |
| Whole carcass without giblets | 82.46±1.34 | 81.78±1.77 | 81.61±2.36 | 82.02±1.06 |
| Breast | 22.54±1.99 | 24.72±0.86 | 23.29±1.62 | 23.52±0.97 |
| Fillet | 4.31±0.26 | 4.29±0.48 | 4.19±0.38 | 4.24±0.31 |
| Three joint wings | 10.52±0.48 | 9.97±0.67 | 10.06±0.58 | 10.33±0.19 |
| Thigh | 15.14±1.67 | 15.11±1.17 | 14.97±0.94 | 15.85±0.36 |
| Drumstick | 11.86±0.36 | 12.35±1.73 | 11.82±0.25 | 11.63±0.20 |
| Abdominal fat | 1.94±0.32 | 1.38±0.33 | 1.89±0.41 | 2.16±0.31 |

[1/]Means in the same row are not statistically different (P≤0.05)

## 4. Conclusions

The inclusion of sun flower meal in the diets at level of 4 %, 8 %, and 12 % had no effect on the productive performance of broilers in terms of body weight, feed intake, FCR, and mortality. However, the inclusion of 8 % sunflower meal in broiler diets resulted in the best E.P.E.F. index. The carcass percentage and cut yield of broilers was not affected by the inclusion rate of sunflower meal in the diets.

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