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Utilization of Olive Pulp in Broiler Rations

إستخدام تفل الزيتون في علائق دجاج اللحم

E. Rabayaa*, J. M. Abo Omar& R. A. Othman****

**Department of Poultry Production, Ministry of Agriculture, **Department of Animal Production, Faculty of Agriculture, An-Najah N. University, Nablus, Palestine*

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Abstract

This research was conducted to study the effects of different levels of olive pulp on body weight gain, feed intake and feed conversion efficiency of broiler chicks.

A total of 160 day-old chicks were used in this research and were divided into five experimental groups with four replicates in each. Olive pulp was incorporated in four of the experimental groups at rates of 2.5, 5, 7.5 and 10% in both starter and finisher feeds to replace similar rates of yellow corn. Chicks were fed these diets during the entire feeding trial which lasted for 35 days.

Weight gain of chicks was the same in chicks consuming up to 7.5% of olive pulp. However, weight gain of chicks fed the level of 10% olive pulp had the lowest significant ($p<0.05$) weight gain. Similar trends were observed in chicks for feed intake, and feed conversion efficiency.

The research showed that olive pulp could be considered as potential low cost feed for broilers.

ملخص

اجريت هذه الدراسة لمعرفة مدى تاثير اضافة تفل الزيتون منزوع النوى على اداء صيصان اللحم من حيث الزيادة في الوزن، استهلاك العلف، و نسبة التحويل الغذائي.

استخدم في التجربة ١٦٠ صوص لحم بعمر يوم واحد، حيث قسمت الصيصان الى خمس مجموعات احتوت كل منها اربع مكررات. و قد تم استخدام التفل في علائق التجربة بنسبة ٢,٥ ، ٥ ، ٧,٥ ، و ١٠ % بدلا من نفس النسب من الذرة الصفراء في كل من العليقة الابتدائية و النهائية، و التي قدمت للصيصان لمدة ٣٥ يوما.

بينت الدراسة ان معدلات الزيادة في الوزن واستهلاك العلف والتحويل الغذائي كانت متشابهة في مجموعات الصيصان التي احتوت علائقها على التفل حتى نسبة ٧,٥ %، بينما أدى استخدام التفل بنسبة ١٠ % الى نقص جوهري في معدل الزيادة في الوزن لصيصان هذه المجموعة.

وتبين من الدراسة امكانية استخدام تفل الزيتون كمادة رخيصة الثمن في علائق دجاج اللحم حيث يمكن التوفير في حجم النفقات ذات العلاقة بالاعلاف، علاوة على المحافظة على البيئة من خلال استغلال التفل الذي يمكن اعتباره كملوث بيئي.

1. Introduction

Improved utilization of crop residues and by-products to be used in animal feeding deserves more attention. Examples of important crop residues and agricultural by-products in Palestine, Israel, Jordan and Egypt are: wheat straw, cotton, rice, citrus pulp, tomato pulp, poultry litter and olive cake.

Animal production sector plays an important role in the Palestinian economy. However, this sector is facing some obstacles, such as shortage of roughage and dependency on imports from the Israeli market for many materials used in animal rations. At the same time, disposal of agricultural wastes is becoming an environmental and health hazard in rural communities.

Agricultural wastes such as olive cake can be utilized in many ways to become an important source of beneficial materials especially to the agricultural community. Agricultural wastes could be used after proper treatment and handling as a source for animal feed [1- 2].

It could be utilized in an integrated farm approach where waste is not any more a waste but a natural source instead. However, the traditional agricultural activities performed by Palestinian farmers since ages are somehow a kind of integrated farming.

Studies showed that olive cake can be fed to livestock species without any harmful effect on health, blood parameters or carcass merits [3-7]. With high fiber content it is mainly suitable for ruminants. But there are also good results from experiments with monogastrics as pigs [8] and poultry [9].

The proportion of olive cake incorporated in livestock rations is variable. Ranged between 20 to 40% of the rations for sheep. Higher proportions of olive cake than indicated earlier will lower the digestibilities and affect the weight gain [5-6, 8].

Several studies were conducted to study the chemical composition and nutritive value of olive cake. It was concluded that protein content in olive cake is 5.1- 6.5% [10-11], while that percent in olive pulp is 8-12.8% (7,12-13). Olive pulp tended to have low levels of lysine, methionine and histidine [7].

Levels of fat in olive cake vary according to pressing method. The traditional method of pressing results in olive cake of 14-23% fat [11]. While extraction of oil using solvents gives cakes of about 5% fat.

The total digestible nutrient values of olive cake were in average 36 and 65% for olive cake and olive pulp, respectively [14].

The metabolizable energy content of olive cake is 4-4.5MJ/kg dry matter [15]. Olive cake is considered to be rich in calcium, copper and cobalt but poor in phosphorus, magnesium and sodium, and with fair levels of manganese and zinc.

Several studies were conducted in Palestine and neighboring countries to investigate the effect of feeding olive cake on fattening animals. Studies indicated that addition of 20% olive cake in replacement of barley had no harm effects on animals performance or carcass merits [3,16] and the digestive tract measurements, but caused increase in the contents of the digestive tract especially at levels higher than 20% of the ration [3].

Some research activities aimed to feed olive cake to non-ruminants as pigs [8] and to broilers [9].

The content of toxic materials such as phenol or aromatics are confirmed, the influence of nutritive value is not yet cleared [6].

The necessity of preservation is reported.

The cake has a high proportion of lignin fraction so that the increase of digestibility is recommended. In in-vitro studies, there are several methods of treatments (enzymatic, alkali, radiation), presented in satisfying results [18]. The transfer into practical condition are so far missing.

The utilization of olive by-products as animal feed is undoubtedly a good way of recycling this waste products. But there is a need to formulate optimized rations for different animal uses to avoid metabolic disorders caused by the unbalanced rations of energy and protein and to reduce the tasty factors which might limit feed intake and then the animal performance that leads to low profitability.

Most of the research conducted done had focused on feeding olive by-products to ruminants. Studies concerning feeding olive pulp to monogastrics are limited.

The objectives of this study are to investigate the performance of broiler chicks fed different levels of olive pulp as an olive by-product, and its effect on feed intake and feed conversion efficiency.

2. Materials and Methods

2.1 Collection and preparation of olive pulp

Raw olive cake was collected from local olive pressing factory. This factory is a semi automatic one. Most of olive pressing factories in Palestine belong to semi automatic type. The material was collected during the olive pressing season then transported to the experimental site at the Faculty of Agriculture farm in Tulkarem. Olive cake was spread on a plastic sheath for sun- drying, mixing of the sample was performed every few hours to assure an efficient drying of the material. The material was covered during night to avoid moisture. Four days after, when the material was air- dried, then separation of seeds started. A 2-mm sieve was used in this process where most of the seeds were removed. Olive pulp obtained by sieving was placed in tight plastic sacs for later use.

2.2 Chemical analysis

Samples of olive pulp were used to determine the following [19]: Moisture content, ash content, crude protein content, crude fat content, crude fiber content, the nitrogen free extract content which was determined by difference, %NFE = %100 – (% ash + % crude fat + % crude fiber + % crude protein), neutral detergent fiber, acid detergent fiber, phosphorus, calcium, and gross energy.

2.3 Ration preparation

The experimental rations were formulated at the experiment site. Raw ingredients were bought from local market then mixed into rations to meet the NRC [20] requirements. Two types of rations were formulated, the starter ration which was fed from day 1 to day 22, and a finishing diet which was fed from age of 23 days till the termination of the experiment at 35 days.

The rations used in the experiment as shown in Tables (1) and (2) were:

1. basal diet without olive pulp.
2. basal diet with 2.5% olive pulp.
3. basal diet with 5% olive pulp.
4. basal diet with 7.5% olive pulp.
5. basal diet with 10% olive pulp.

Olive pulp was added to replace similar percentages of corn and wheat.

The feed and water were provided ad-libitum.

2.4 Performance experiment

A total of 160 day- old chicks were bought from a commercial hatchery and immediately transferred to the experimental site. Chicks were divided into five groups of 32 chicks in each. Each group was partitioned into 4 replicates with 8 chicks in each. Chicks were housed on a floor of a suitable size house and were managed as any commercial broiler flock.

Table 1: Starter experimental rations used in the experiment.

Group	Control	2.5%	5%	7.5%	10%
Diet Composition					
Yellow Corn	21	18.5	16	13.5	11.
Wheat	32	32	32	32	32
Soy Bean Meal	39	39	39	39	39
Dicalcium Phosphate	1.6	1.6	1.6	1.6	1.6
Limestone	1.4	1.4	1.4	1.4	1.4
Oil	4	4	4	4	4
Premix	1	1	1	1	1
Olive Pulp	0	2.5	5.0	7.5	10
Chemical Analysis:					
Dry Matter	89	88.7	88.6	88.4	88.9
Crude Protein	22.5	22.6	22.6	22.7	22.6
Crude Fiber	4	5.5	5.7	6.0	6.1
Me	3050	3000	3100	3100	3100
Ash	6.5	6.5	6.9	7.0	7.1
Calcuim	1.2	1.1	1.2	1.2	1.2
Phosphorus (Total)	.8	.7	.7	.7	.7
Methionine + Cystine	.55	.55	.55	.55	.55

Table 2: Finisher experimental rations used in the experiment.

Group	Control	2.5%	5.0%	7.5%	10.0%
Ration composition:					
Yellow corn	15.0	12.5	10.0	7.5	5.0
Wheat	44.4	44.4	44.4	44.4	44.4
Soy bean meal	31.4	31.4	31.4	31.4	31.4
Dicalcium phosphate	1.6	1.6	1.6	1.6	1.6
Limestone	1.5	1.5	1.5	1.5	1.5
Oil	5.0	5.0	5.0	5.0	5.0
Premix	0.9	0.9	0.9	0.9	0.9
Olive pulp	0	2.5	5.0	7.5	10.0
Chemical analysis:					
Dry matter	88.0	87.8	87.9	87.6	87.9
Crude protein	19.4	19.5	19.7	19.7	19.6
Crude fiber	4.3	5.8	5.8	6.2	6.1
ME	3150	3100	3100	3100	3100
Ash	5.7	5.8	6.0	6.3	6.3
Calcium	0.8	0.8	1.0	1.0	1.0
Phosphorus	0.6	0.6	0.5	0.5	0.5
Methionine + cystine	.5	.5	.5	.5	.5

During the growing period, chicks were treated and vaccinated according to the recommended practices in commercial operations. Chicks were weighed at weekly basis till end of the experiment that lasted for 35 days.

Feed intake, body weight and mortality were weekly recorded, and weight gain and feed conversion efficiency were then calculated.

The statistical design used was the complete randomized design (CRD). All data were statistically analyzed by the analysis of variance (ANOVA) followed by means separation using the Duncan's multiple range test, using a SAS package [21].

3. Results and Discussion

3.1 Composition of olive pulp

The composition of olive pulp is shown in Table (3). The values of nutrients determined by the chemical analysis are consistent with those reported by other researchers [9].

Comparing to nutrient composition of olive cake with olive pulp showed that removing of the seeds in olive pulp increases the crude protein content by about 5%. The removal of seeds also decreases the fiber content by at least 20%.

Table 3: Composition of olive pulp used in the feeding trial (%).

Nutrient	%
Dry matter	87.0
Crude protein	10.2
Crude fiber	24.0
Neutral detergent fiber	26.0
Acid detergent fiber	34.0
Crude fat	12.0
Calcium	.6
Phosphorus	.1
Ash	7.5

3.2 Body weight

The broiler performance during the feeding trial is shown in Table (4).

The feeding trial showed that olive pulp in rations had an effect that started from the first week of consuming the experimental diets. At age of 7 days, the control chicks and chicks receiving 2.5% olive pulp had the highest ($p<0.05$) body weights compared to other feeding groups. At this stage of the feeding trial, the chicks on 7.5 and 10% of olive pulps diets had the lowest ($p<0.05$) weight gain compared to other feeding groups.

This trend was maintained during the second week of the feeding trial where both control and 2.5% olive pulp had the highest gain compared to other groups, and the 10% olive pulp group with the lowest gain. For the rest of the feeding period, which lasted for 35 days, all groups of chicks gained the same as the control chicks except the chicks receiving the highest portion of olive pulps.

These findings indicate that feeding olive pulp to broilers at rates up to 7.5% will be beneficial and without any harm effects on chicks body weight.

However, it might be of more advantage to start feeing the experimental diets, especially the higher rates of olive pulp, in the broiler growing diets instead of being added to the starter diets as at this stage of growth digestive system of chicks will be of more efficiency.

This result is in consistence of those reported by other workers when broilers were fed high fiber diets, such as tomato dried pulp, date pits, dried citrus pulp and olive pulp [10, 22].

3.3 Feed intake

The experiment showed that there was no significant differences among the experimental groups in regard to feed intake, Table (5). However.

Table 4: Body weight development of broilers in the olive pulp feeding trial (g).

Group	Control	2.5%	5.0%	7.5%	10.0%
Weeks					
Initial weight	39.3	39.5	40.2	40.4	40.5
Weight at 7 days	127.1 ab*	130.3 a	117.0 bc	109.7 cd	100.4 d
Weight at 14 days	337.7 a	343.9 a	326.1 ab	302.1 b	249.3 c
Weight at 21 days	689.9 a	655.4 a	639.9 a	634.2 a	553.6 b
Weight at 28 days	1180.5 a	1131.3 a	1107.7 a	1127.3 a	987.5 b
Weight at 35 days	1675.3 a	1634.0 a	1616.5 a	1648.5 a	1459.0b

*Means within a raw followed by the same letter are not significantly different at p = 0.05 according to Duncan's multiple range test.

Chicks receiving the 10% level of olive pulp consumed less feed compared to other experimental groups. The reason behind that lower intake might be the high level of olive pulp which caused decreased feed appetite. El Moghazy and El Boushy [22] reported similar intake when high fiber diets were fed to broilers.

Table 5: Effect of feeding olive pulp on the feed intake, body weight gain, cost of gain and the conversion efficiency of broilers.

Treatment	Control	2.5%	5%	7.5%	10%
Feed intake (g/week)	87.7	88.0	91.6	87.8	84.7
Body weight gain(g/week)	46.7 a*	45.6 a	45.0 a	45.6 a	40.5 b
Cost of gain(NIS)**	2.05	2.06	2.1	1.99	2.1
Conversion efficiency	1.88	1.9	2.0	1.92	2.1
cost of 1 kg gain (NIS)	3.34	3.3	3.37	3.2	3.0

*Means within a raw followed by the same letter are not significantly different at p = 0.05 according to Duncan's multiple range test.

**NIS = 0.2 US $.

3.4 Body weight gain

Feeding olive pulp at rates up to 7.5% caused similar gain in broiler chicks receiving the commercial diet. The chicks receiving the 10% olive pulp had the lowest body gain. The reduced intake observed in chicks of this group might be the reason behind that. However, the high fiber intake by these chicks might caused rapid rates of passage in chicks digestive tracts which caused the depression in body weight gain.

3.5 Feed conversion efficiency

The efficiency of feed conversion was statistically the same in all treatments, but lower efficiency was observed in the chicks receiving the highest olive cake level. However, the difference between the highest and the lowest conversion efficiency values is .21. The values of feed conversion indicated that olive pulp can be added to broiler diets to levels up to 7.5% without any negative effect on feed conversion efficiencies.

3.6 Cost of gain

The cost per kg gain is indicated in table 5. This cost was the lowest for chicks consuming the 7.5% olive cake level. The incorporation of olive pulp at this rate in broiler diets will save similar amounts of corn. While taking other chicks performance parameters which were not negatively affected by this level of olive pulp, lots of savings can be achieved through feeding olive pulp especially at the rate of 7.5% compared to the broiler commercial diet. Anyhow, if we assume that the annual broiler production in Palestine is 60 million kg of broiler meat, and knowing that the cost gain per kg is 1.99 New Israeli Sheqel (NIS), as indicated by our findings, then about 4.2 million NIS can be saved to our broiler farmers each year.

4. Recommendations

1. More research is recommended to assure the positive effects of feeding olive pulp to broilers.
2. The stage of broiler growth at which olive pulp should introduced needed confirmation.
3. It is recommended to conduct digestibility studied in chicks utilizing olive pulp in order to explain the outcome in more details.

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