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CARCASS COMPOSITION AND VISCERAL ORGAN MASS OF BROILER CHICKS FED DIFFERENT LEVELS OF OLIVE PULP

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تأثير المستويات المختلفة من تفل الزيتون على مكونات الذبائح و وزن الاحشاء لصيصان اللحم

ملخــص: أجريت هذه التجربة لدراسة تاثير اضافة تفل الزيتون بنسب مختلفة في علائق صيصان اللحم على مكونات الذبائح و اوزان الاحشاء. استخدم في التجربة 250 صوص بعمر يوم واحد، حيث قسمت الصيصـــان الـــى خمـــس مجموعات احتوت كل منها خمسة مكررات. اضيف تفل الزيتون الى كل من العليقة الابتدائية و النهائية بمعدل: 25، 50 ، 75 و 100 غم/كغم من العليقة على حساب نفس الكميات مـــن الذرة الصفراء . في نهاية التجربة التي استمرت 35 يوما تم عشوائيا اخذ اربعة صيصان من كل مجموعة و تم ذبحها بالطريقة المتبعة في المسالخ. تبين من تحليل التباين(الخطي و التربيعي) انه ليس لاضافة تفل الزيتون اثر يذكر على اوزان الاحشاء، و وزن القناة الهضمية، و قطع الذبائح و مكوناتها، بينما كان لتفل اليتون اثر معنوي على نسبة التصافي.

Abstract: The current investigation was conducted to study the effects of olive pulp on the carcass composition, gastrointestinal tract, and visceral organ mass of broiler chicks.
A total of 250 one-day-old chicks were used in this research and were divided into five experimental groups with five replicates in each. Olive pulp was incorporated in four of the experimental groups at rates of 25, 50, 75 and 100 g/kg in both starter and finisher feeds to replace similar amounts of maize. Diets were fed for 35 days. At the end of the experiment, four birds of each group were slaughtered in similar routine followed in regular slaughterhouses. Regression analysis (linear and quadratic) showed that level of olive pulp had no significant effects on visceral organ mass, gastrointestinal tract weight, carcass cuts, carcass composition, and dressing percent. However, chicks consuming 100 g olive pulp/kg had heaviest ($P<0.05$) average live weights.

Keywords: Visceral organs; Carcass composition; Broilers; Olive pulp.

Introduction

Olive pulp is the remainder of olive cake (the raw material resulting from extraction of olive oil) after the removal of the seed fractions. It can be achieved by sieving the dry olive cake to separate most of the seeds. About 0.3 of cell wall fraction will be removed by sieving (Abo Omar, 2000).

Olive pulp may be a suitable raw material in livestock diets, and help to save cereals which can be used for human consumption. Feasibility studies have shown that there is good intake for many livestock species without any harmful effect on health, blood parameters or carcass merits (Chaabane et al., 1997; Blomeyer, 1976). With high fiber content, it is mainly suitable for ruminants. However, thre are also good results from experiments with non-ruminants as pigs and poultry (Abo Omar, 2000; Rabayaa, 2000; Abu Ghazala, 2004).

The proportion of olive pulp in livestock rations is variable. There seems to be a limit between 200 and 400g/kg (Abo Omar and Gavoret, 1995). Higher proportions cause lower digestibility and less weight gain.

Several studies were conducted to study the chemical composition and nutritive value of olive pulp. It was concluded that protein was 8-12.8% (Nefzaoui, 1982). Olive pulp tended to have low levels of lysine, methionine and histidine. Levels of fat in olive pulp vary according to pressing method. The tradition method of pressing results in olive pulp of 14-23% fat, while extraction of oil using solvents gives pulp of about 5% fat (Nefzaoui, 1982).

The dry matter digestibility of olive pulp was 70%. An improvement of about 4% in dry matter digestibility was reported when olive pulp was added to broiler rations at rate of 50g/kg. the metabolizable energy content of olive pulp was 4-4.5MJ/kg dry matter (Nefzaoui, 1982). Olive pulp is considered as a good source of calcium, copper, and cobalt but poor in phosphorus, magnesium and sodium, and with fair levels of manganese and zinc (Harb, 1986).

Some research activities aimed at feeding olive pulp, a high fiber ingredient, to broilers. Diets with different levels of fiber showed certain influence on gastrointestinal tract weight, length and content (Abo Omar, et al, 1994; Johnson, 1985; Abo Omar, 1995; Pecas et al, 1983; Younoszai, et al, 1978). At the same time, variable effects of olive cake on visceral organs like heart, kidneys, lungs, spleen, esophagus and liver were identified in lambs consuming different levels of olive pulp (Abo Omar, et al, 1994; Abo Omar and Gavoret, 1995).

Luminal nutrition plays a major role in maintaining stimulation of both small intestine structure and enzyme levels (Johnson, 1985). Dunaif and Sheeman (1981) reported that the activities of several enzymes in the rat intestine are changed in response to fiber addition. Different sources of protein, carbohydrates and lipid did not change or influence the growth of small intestine, cecum or colon of rats but some types of fiber did exert an influence.

The different levels of olive cake had no effect on carcass cuts of broilers carcass when fed olive pulp at levels up to 100g/kg (Abo Omar and Gavoret, 1995).

Nearly all of the research done had focused on feeding olive by- products to ruminants. Studies concerning this by-product to non-ruminants are limited.
The objectives of this project are to investigate the effect of olive pulp on broiler internal parameters as gastrointestinal measurements, visceral organs, and carcass cuts.

Materials and methods

Raw olive cake was collected from local olive fruit pressing factory. This factory is a semi-automatic which is the major type of olive pressing factories in Palestine. The material was collected during the olive pressing season of 2000 and then transported to the experimental site at the Faculty of Agriculture farm in Tulkarem, Palestine. Olive cake was spread on a plastic sheath for sun drying for three days. 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 accumulation. When the material was air-dried, most of seed fractions were removed using a 2-mm sieve. Olive pulp obtained by sieving was placed in tight plastic sacs for later use.

Samples of olive pulp were used to determine the following: dry matter (DM), ash, crude protein (CP), crude fat (EE), crude fiber (CF), nitrogen free extract (NFE), neutral detergent fiber (NDF), acid detergent fiber (ADF), phosphorus, calcium, and gross energy according to A.O.A.C. (1990) procedures.

The experimental rations were formulated at the experiment site. Raw ingredients were bought from local market then mixed into rations to fit the NRC (1984) requirements. Two types of rations were formulated, the starter and the finishing diets. The starter diets were fed from day 1 to day 22. Starting from age of 23 days, finishing diets were fed till the end of the experiment (day 35).

The diets used in the experiment as shown in Table (1) were as follows:

1. Basal diet without olive pulp.
2. Basal diet with 25g/kg olive pulp.
3. Basal diet with 50g/kg olive pulp.
4. Basal diet with 75g/kg olive pulp.
5. Basal diet with 100g/kg olive pulp.

Olive pulp was added to replace similar percentages of corn. The food and water were provided ad-libitum

Table 1. Starter and finisher experimental diets used in the experiment (g/kg)

Group	Control		Group 1		Group 2		Group 3		Group 4	
Diet composition	S	F	S	F	S	F	S	F	S	F
Maize	210	150	185	125	160	100	135	75	110	50
Wheat	320	444	320	444	320	444	320	444	320	444
Soy bean meal	390	314	390	314	390	314	390	314	390	314
Dicalcium phosphate	16	16	16	16	16	16	16	16	16	16
Sand	14	17	14	17	14	17	14	17	14	17
Oil	40	50	40	50	40	50	40	50	40	50
Premix	10	9	10	9	10	9	10	9	10	9
Olive pulp	0	0	25	25	50	50	75	75	100	100
Chemical analysis:										
Dry matter	890	880	887	878	886	879	884	876	889	879
Crude protein	225	194	226	195	226	197	227	197	226	196
Crude fiber	40	43	55	58	57	58	60	62	61	61
NFE	510	541	487	517	477	512	468	499	471	503
Crude fat	50	45	54	50	57	52	59	55	60	56
Ash	65	57	65	58	69	60	70	63	71	63
Calcium	12	8	11	8	12	10	12	10	12	10
ME (MJ/kg)	12.9	13.3	12.9	13.3	12.9	13.3	12.9	13.3	12.9	13.3
Phosphorus	8	6	7	6	7	5	7	5	7	5

S: starter; F: finisher±

A total number of 250 one-day-old unsexed Hybro broiler chicks were bought from a commercial hatchery. Birds were randomly distributed into five groups of 50 birds in each. Each group was partitioned into 5 replicates with 10 birds in each. Birds were housed on a floor of a suitable size house and were managed as any commercial broiler flock. During the growing period, birds were treated and vaccinated according to the recommended practices in commercial operations.

At the end of 35 days of age, four birds were taken randomly from each replicate. Chicks were killed according to the routine practices adopted in commercial boiler slaughterhouse. Weights of visceral organs like liver, heart, kidneys, were recorded as percent of live body weight.

Total cool carcass weight was recorded then each carcass was split into four cuts. Breasts and thighs were each cut and weight was recorded. Both breast and thigh cuts were dissected to separate meat and bone components. Weights of wings, neck, head, and feet were also recorded.

The experimental design used in the experiment was the complete randomized design (CRD) and all data were statistically analyzed by regression (linear and quadratic effects) using the SAS package (SAS, 1988). The regression analysis was conducted as a contrast analysis after the

ANOVA. When ANOVA did not show a significant effect, it was not valid to make the multiple comparisons.

Table 2. Effects of different levels of olive pulp on broilers visceral organs and gastrointestinal tract segments (M (% live weight) + SE)

Olive pulp level	Gizzard	Liver	Heart	esophagus	crop	Lung	trachea	provintriculus	SI	cecum
0	3±0.1	2±/08	0.6±.04	0.1	0.1	0.6±.03	0.06	0.1	3.6±.2.	0.3
2.5	3±0.1	2.1±.09	0.59±.o4	0.1	0.1	0.6±.03	0.06	0.1	3.5±.3	0.35
5.0	3.1±0.1	2±.08	0.6±.03	0.09	0.1	0.6.03	0.06	0.1	4.0±.2	0.4
7.5	3.1±0.1	2.2±.08	0.58±.02	0.1	0.09	0.58±.04	0.06	0.1	3.9±.2	0.39
10.0	3±0.1	2±.06	0.6±.02	0.09	0.1	0.59±	0.06	0.1	4.0±.3	0.4
P	0.4	0.5	0.6	0.5	0.7	0.7	0.9	0.9	0.2	0.4
Linear	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Quadratic	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
R2	-	-	-	-	-	-	-	-	-	-

Table 3. Effect of olive pulp on carcass cuts, live weight (% of live weight) and dressing percent

Level	Thighs	Breast	Neck	Wing	Back	Feet	Head	Live wt.(g)	Carcass wt(g)	D%*
0	21.8±0.09	20.5±.1	5.7	8.6±.01	13.2±.06	4.6	2.3	1675±15	1163±13	70
2.5	22.4±0.1	21.5±.1	5.6	8.7±.02	13.6±.04	4.7	2.3	1634±14	1168±12	72
5	23.2±.1	21.0±.1	6.0	8.0±.01	13.4±.05	5.0	2.4	1616±15	1184±14	73
7.5	23.6±.09	21.9±.09	6.3	8.7±.01	14.1±.04	4.4	2.1	1636±16	1184±13	72
10	22.9±.09	21.2±.08	5.7	8.4±.02	13.8±.05	5.0	4.9	1459±15	1066±13	73
P	0.37	0.58	0.59	0.12	0.07	0.21	0.02	0.05	0.08	0.05
Linear	NS	NS	NS	NS	NS	NS	0.01	0.004	NS	0.002
Quadratic	NS	NS	NS	NS	NS	NS	0.002	0.05	NS	0.001
R2	-	-	-	-	-	-	0.77	0.78	-	-

*D%: dressing percent

Results and discussion

Level of olive pulp had an influence on broiler chicks. Chicks consuming olive pulp at the level of 75g/kg had the highest (P<0.05) live weights compared to chicks consuming other diets (Table 3). Regression analysis showed that the optimum level of olive pulp was 74g/kg.

Level of olive pulp had no significant linear or quadratic effect on weights of the edible organs: liver, heart, gizzard (Table 2). Similar findings were reported when broilers were fed diets high in fiber in replacement of corn (Kamel et. al., 1981). However, Pecas et al., (1983) reported a significant increase in liver weights of pigs fed on high fiber diets.

Also, levels of olive pulp had no significant effect on the weights of of the inedible organs: esophagus, crop, lungs, provintriculus, trachea (Table 2). Weights recorded for these organs were the same as those of broilers consuming regular broiler diets. However, researchers found that fiber levels had certain influence on gastrointestinal tract and its accessory organs. Abo omar and Gavoret (1995); Rabayaa (2000) and Abu Ghazala (2004) showed the effect of different levels of fiber on these parameters. Even though fiber had variable effects on the measured parameters, fiber differently exerted its effect.

The chicks consuming olive cake at rate of 50g/kg had higher, weights of small intestine compared to other treatment groups, followed by those consuming 100 and 75g/kg olive pulp rations, respectively. Similar findings were observed when olive cake diets were fed to broiler chicks and in rats receiving a high fiber diets (Dunaif and Sheeman, 1981).

The highest weight of large intestine was in the chicks consuming 100g/kg olive pulp in their diets, while the lowest weights were for chicks consuming the control diet. Similar trend was observed for weights of cecum, where the control chicks had the lowest cecum weights. However, high fiber levels when fed to pigs, increased the colon and rectum weights (Pekas et al., 1983).

The level of olive pulp had no significant effect on carcass cuts (neck, feet, back, thigh and breast) weights. However, level of olive pulp had both significant linear and quadratic effect on head weights. Variable effects were observed as shown in Table 3.

The best weights of thighs, breast, neck, and back cuts were observed in carcasses of chicks receiving 75g/kg of olive pulp. At the same time, these chicks had the lowest weights of non-edible cuts as head and feet. These findings may explain the increased body gain and feed conversion efficiencies observed in the chicks receiving 75g/kg of olive pulp compared to other chicks in other experimental groups.

The level of olive pulp in diets had no significant effect on carcass contents of meat (lean), bone and a bone/meat ratio (Table 4).

Table 4. Effect of different levels of olive pulp on broiler carcass composition (meat and bone) and meat/bone ratio (%of live weights)

Level	Breast meat	Breast bone	Ratio	Thigh meat	Thigh bone	Ratio
0	17.6±1.0	2.9±.02	6.1	17.0±.8	5.0±.05	3.4
2.5	18.8±0.9	2.9±.01	6.5	17.1±.9	3.0±.05	5.7
5.0	16.4±0.9	3.1±.02	5.3	17.8±.9	4.5±.04	4.0
7.5	22.8±0.8	2.9±.01	7.9	17.8±.8	4.9±.06	3.6
10.0	21.0±0.8	3.1±.01	6.8	17.9±.8	4.0±.06	4.5
P	0.87	0.65	0.54	0.32	0.09	0.51
Linear	NS	NS	NS	NS	NS	NS
Quadratic	NS	NS	NS	NS	NS	NS
R2	-	-	-	-	-	-

As indicated earlier, the broiler chicks on 75g/kg olive pulp diets had the heaviest meat as indicated by breast or thigh meat contents.

There are several factors that affect the dressing percent of an animal. Of these is the type of diet which will have influence on performance of that animal. The diets used in this experiment had variable levels of fiber and showed variable effects on broiler chicks' performance.

Broiler chicks consuming the diet containing 75g/kg of olive pulp had the highest ($P>0.05$) dressing percent, while those consuming the 100g/kg level of olive pulp had the lowest percentages (Table 3).

Conclusion

Feeding olive pulp to broilers at the level of 75g/kg had positive effect on their performance. The level of this ingredient had variable effects on most of the parameters measured. This experiment indicated that feeding olive pulp up to 75g/kg of the broilers rations will be of no harmful effects and might be economically feasible.

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