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EFFECT OF FEEDING DIETS CONTAINING IRRADIATED OLIVE CAKE ON CARCASS TRAITS AND BLOOD HAEMATOLOGICAL PARAMETERS OF GROWING NEW ZEALAND WHITE RABBITS.

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SUMMARY

A total of twelve male New Zealand White (NZW) rabbits slaughtered at 16 weeks of age, were taken from 4 equal groups (3 rabbits/ group) according to their final live body weight, to studied carcass traits, blood plasma parameters and cecum activity. The growing rabbits were fed the control diet (diet without olive cake), or the diet containing 15 % either non- or irradiated olive cake, at 20 or 60 kGy. Accordingly, a total of 4 experimental diets were used. The experimental diets were formulated to be iso-nitrogenous (~ 17% CP) and iso-caloric (~ 2500 kcal DE/kg diet). The results revealed that 15% dietary OC had no adverse effect on carcass, edible giblets and total edible parts (%). Feeding rabbits on diets containing 15% OC, with gamma irradiation (20 kGy) gave the best empty carcass%, total edible parts% and least non edible parts compared with rabbits fed the control diet. Olive cake at 15% either with or without gamma irradiation (20 or 60 kGy) had no adverse effect on blood plasma parameters. They also had no significant effect on cecum TVFA or cecum pH but significant effect on cecum ammonia concentration was observed. The results indicated that some microorganisms may be sensitive and decreased by OC active constituents such as, aerobic total count. The results suggested that irradiation processing of OC at 20 kGy eliminate the harmful effect of its glucosinolates on blood chemistry.

Keywords: *New Zealand White male rabbits, olive cake, carcass traits, blood plasma parameters and cecum activity.*

INTRODUCTION

The increase in human population in Egypt over the last decades has greatly influenced the demand for food products of animal origin hence the livestock producers at large are having difficulties in meeting the demand for animal products by the ever-growing population. The Food and Agricultural Organization (FAO, 1985) recommended a minimum of 56 g of animal protein intake per person per day. Rabbits are one of such animal species have high growth rate with short generation intervals, early maturity, high

feed efficiency, an early marketing age and require a small land area; therefore rabbits can be grown by low income producers (Cheeke, 1980 and Hernàndez *et al.*, 2006). Baymen (1984) reported that rabbit meat rank highest in protein and lowest in fat content (cholesterol) and calories compared to beef, chicken and mutton. Few studies had been carried out in Egypt to study carcass quality and yield in relation to feeding irradiated feeds.

Irradiated foods are those that have been deliberately processed with certain types of radiation energy to bring out some desirable properties (for example, to inhibit sprouting or to destroy food poisoning bacteria). Irradiation makes it possible to keep food longer and in better condition. Irradiated foods are wholesome and nutritious. Food irradiation could replace chemical fumigants (such as ethylene oxide, propylene oxide, and methyl bromide) and vapor heat processes, resulting in a reduction or elimination of chemical residues in food and less harm to the environment. Therefore, the present study was conducted to recycle such this agro industrial waste through irradiation treatment and using it as safety animal feed.

The main target of the present study was to evaluate and improve the utilization of olive cake and the possibility of replacing part of clover hay in rabbit diets by olive cake untreated or treated with gamma irradiation (to eliminate the harmful effect of its glucosinolates).

MATERIALS AND METHODS

The present work was designed and carried out during the period from January to March 2007 at Food Irradiation Research Department, National Center for Radiation Research and Technology (NCRRT), Nasr City, Cairo, Egypt, in co-operation with the Faculty of Agriculture at Moshtohor, Benha University, Egypt. Olive cake was provided by a private factory of olive squeeze in Al-Salhyia City, Sharkia Governorate, Egypt. Olive cake was sun-air dried for seven days, ground in a hummer mill and then packed in polyethylene bags (1000 gauge, 0.25 mm thickness), and sealed by heat. Each polyethylene bag contained about 2 kg.

Radiation Treatment:

Packed olive cake was subjected at ambient temperature to gamma irradiation from Co-60 source at NCRRT. The irradiation facility used was Egypt's Mega Gamma-1 type "J-6500". The applied doses were 0, 20 and 60 kGy. Radiation dose was calibrated using small pieces of the radiochromic film (McLaughlin *et al.*, 1985), at the time of experimentation. The raw and processed samples were stored at conditioned room (at about 18 °C) until used. The biological evaluation of raw and processed olive cake was carried out by executing feeding experiments using diets containing the studied level of olive cake irradiated at 0, 20 and 60 kGy.

Experimental Animals and Diets:

Eighty male New Zealand White (NZW) rabbits weaned at 5 weeks of age were used in this experiment. Rabbits were divided into 4 equal groups (20 rabbits/ group) according to

their initial live body weight (~740 g). The experimental period, extended from 5 to16 weeks of age. The growing rabbits were fed the control diet (diet without olive cake), or fed diet containing 15% either non or irradiated olive cake at 20 or 60 kGy. Accordingly, a total of 4 experimental diets were used in this study. The experimental diets were formulated to be iso-nitrogenous (~ 17% CP) and iso-caloric (~ 2500 Kcal DE/Kg diet). All diets were pelleted and contained adequate levels of nutrients to satisfy the nutrients requirements of growing rabbits according to Agriculture Ministry Decree (1996). The composition and calculated analysis of the experimental diets are shown in Table (1).

Table (1): Composition and calculated analysis of the experimental diets (as fed).

Ingredients %	Control diet	Olive cake diet
Clover hay (12% CP)	30.00	0.0
Olive cake[1]	0.0	15.00
Yellow corn	21.00	12.57
Barely	2.20	13.50
Soybean meal (44%CP)	18.00	20.00
Wheat bran	22.37	27.00
Wheat straw	-	5.50
Molasses	3.50	3.50
DL-Methionine	0.13	0.13
Vit. & Min. mix.[2]	0.30	0.30
Common salt (NaCl)	0.45	0.45
Dicalcium phosphate	1.70	1.70
Limestone	0.35	0.35
Chemical composition [3]		
Crude protein (CP), %	16.98	16.93
Ether extract (EE), %	2.64	3.32
Nitrogen free extract (NFE), %	49.18	49.46
Ash, %	5.84	5.45
Organic matter (OM), %	82.16	82.80
Digestible energy, (Kcal/Kg)	2505.30	2500.00
Crude fiber (CF), %	13.36	13.09
NDF, %	47.03	30.18
ADF, %	17.10	15.85
Lignin ,%	3.72	6.55
Calcium, %	1.07	0.934
Total phosphorus, %	0.76	0.76
Methionine, %	0.40	0.37
Lysine, %	0.75	0.85

1-Incoroporated at the same level for those irradiated at 20 and 60 kGy.

2-Supplied per kg. of diet: Vit. A 2000000 IU; Vit. D3 150000 IU; Vit. E 8.33g, Vit. K 0.33g, Vit. B1 0.33g, Vit. B_2 1.0g, Vit. B6 0.33g, Vit. B12 1.7mg, Vit. B_5 8.33g, Pantothenic acid 3.33g, Zn 11.79, Fe 12.5, Cu 0.5g,, Co 1.33mg, Se 16.6 mg, Mg 66.79mg, Niacin 8.33mg, Biotin 33mg, Folic acid 0.83g, Choline chloride 200g,, Mn 5g.

3-According to Feed Composition Tables for Animal and Poultry Feedstuffs Used in Egypt (2001).

Carcass Traits:

At the end of the feeding trial (16 weeks of age) three rabbits representing eac treatment were randomly chosen to study the different carcass traits. Rabbits were faste for approximately 12-16 hours, individually weighed (to record the pre-slaughter weight and thereafter slaughtered by severing the neck with a sharp knife according to the Islami Religion. After complete bleeding of rabbits, the slaughtered weight was recorded, anc instantly the head was separated. Skinning was carried out by removing the skin including the tail and feet. Thereafter, the carcass was opened down and all entrails were removed. The empty carcass without head, liver, kidneys, heart and lungs were weighed and recorded separately. Weights of the carcass, coat and head were recorded. The carcass was separated into fore-quarters, chest, loin and hind-quarters and their weights were also recorded according to Cheeke (1987). All weights were taken to the nearest gram. Meat of each carcass was separated from the bones and weighed to determine the weight of boneless meat and bones. Then, the meat of each carcass was minced, dried, reweighed, ground and stored at 4°C for chemical analysis. Individual blood samples from the marginal vein (from the same slaughtered rabbits) were collected into dry clean centrifuge tubes containing few drops of heparin solution and centrifuged at 3000 rpm for 20 minutes to separate blood plasma. Plasma samples were collected and stored in a deep freezer at approximately -20°C ±1 until the time of biochemical analyses to estimate blood parameters. Various chemical analyses were conducted using commercial kits and measuring the optical density by spectrophotometer, following the same steps as described by manufactures.

Cecum Activity:

Individual samples of cecum contents (from the same slaughtered rabbits) were taken and used immediately for the estimation of cecum pH (using a digital pH meter) and cecum microflora (bacteria), aerobic total bacterial counts, *Salmonella* and *Shigella*. Media used (material) for counting the total bacterial counts, *Salmonella* and *Shigella* was formulated according to nutrient agar medium (Difco manual, 1989) and followed the technique reported by British Standard Institution (1991). Another sample of cecum content was strained through four folds of gauze and divided into two portions: - The first portion was used immediately for the estimation of ammonia nitrogen concentration according to the Conway method (1958). The second portion was preserved by addition of 1 ml N/10 HCl and 2 ml orthophosphoric acid to each 2 ml of cecum contents juice for determination of total volatile fatty acids (Eadie *et al.*, 1967).

Statistical Analysis:

Data were analyzed using the general linear models procedure to establish the differences between means using SAS software version 9.1 (SAS Institute, 2004). The model used was: $Yij = \mu + Ti + E\,ij$

Where: Yij = the observation of ij. μ = the overall mean.

Ti = the effect of i (treatments). Eij = the experimental random error.

Data of percentages were subjected to arc-sin transformation to approximate normal distribution before being analyzed. Variables having a significant F- test were compared

using Duncan's multiple rang test (Duncan, 1955). All statements of statistical significance were based on probability ($P < 0.05$).

RESULTS AND DISCUSSION

Effect of Gamma Irradiation on:

Carcass Traits:

The effect of 15% dietary olive cake (without or with irradiation) on carcass traits is presented in Tables (2, 3 and 4). Feeding diets containing irradiated olive cake (20 or 60 kGy) at 15% had significant effect on all carcass traits studied (pre-slaughter, empty carcass without head, total edible parts, edible giblets and non edible parts either in grams or as percentages of pre-slaughter weight, (Table 2). However, addition of 15% olive cake with 20 kGy gave higher percentages of total edible parts. Results in Table (3) showed that adding 15% olive cake (with irradiation) had no significant effect on fur, liver, kidneys, heart and lungs% of rabbits. Whereas, head percentage of rabbits fed the diet with 15% olive cake and irradiated at 20 kGy was lower ($P < 0.05$) than that loin of rabbits fed the diet with 15% olive cake either without irradiation or irradiated at 60 kGy. Weights of different carcass cuts percentages (fore-quarters, chest, lion and hind quarters relative to fasted weight) and boneless meat% varied slightly with treatment effect Table (3). Addition of 15% olive cake with 20 kGy and control diet gave higher percentages of boneless meat%. Results presented in Table (4) showed that DM, CP, EE and ash contents of rabbit meat differed slightly with treatments but the differences were always not significant. In this respect, studies on the carcass composition of rabbits showed that the skeletal muscle comprised 70 to 74% of the carcass weight, bones 15 to 18% and internal organs 8 to 10% (Scharner and Kuhmer, 1974). Afifi *et al.* (1987) reported that the proximate composition of rabbit meat (on DM basis) was 89.28 to 89.84% for protein, 5.41 to 6.49% for fat and 4.21 to 4.84 % for ash. They added that the chemical analysis of the boneless meat varied slightly with increasing the dietary crude protein from 16.00 to 21.33%. Tortuero *et al.* (1989) fed New Zealand white rabbits, on a diet containing 0, 10, 20 or 30% olive pulp. They found that carcass yield and liver weight were not affected by olive pulp, but rabbits given 20 or 30% olive pulp showed significant differences in kidney weight. Also, El-Kerdawy (1997) and Kadi *et al.* (2005).

Some Blood Haematological Parameters:

Blood is a liquid tissue which flows through a network of closed circulating system. It consists of three classes of blood cells recognized as: erythrocytes or red blood cells, leucocytes or white cells and thrombocytes or platelets. Blood fulfill a number of functions, most of which are: carrying nutrient substances from the alimentary canal to the different tissues, transporting oxygen from the lungs to the tissues, removing the waste products of metabolism from the tissue to the organs of excretion, transporting the secretions of the endocrine glands and aids in the equalization of the water content of the body. In addition to the above mentioned functions, blood having a high specific heat, it is important and in equalization of body temperature. It is also concerned with the regulation of the hydrogen ion concentration in the organism and assists in the body defenses against

microorganisms, (Dukes, 1964 and Rastogi, 1985). Some of these functions could be partially or even totally hampered by the presence of toxic or harmful substances which could be generated up on radiation processing up to 60 kGy. This is why hematological examinations were undertaken on male New Zealand White rabbits maintained for eleven weeks (sub-chronic study) on a feeding regime during which they were supplemented with either raw or irradiated olive cake at a dose level of 20 or 60 kGy. Table (5) represents the hematological parameters of male New Zealand White rabbits fed the experimental diets containing raw and irradiated olive cake at 20 or 60 kGy.

Table (2): Effect of the experimental diets on carcass traits (mean ±SE) of rabbits at 16 weeks of age.

Treatments	Carcass traits								
	Pre-slaughter weight (Fasted)	Empty carcass		Dressed (Total edible parts)		Edible giblets		Non-edible parts	
	(g)	(g)	%	(g)	%	(g)	%	(g)	%
Control	2106.7^{c} ±34.80	1060.0^{b} ±18.02	50.32^{b}	1151.0^{b} ±20.07	54.64^{b}	91.00^{b} ±3.60	4.32^{c}	955.7^{b} ±20.27	45.36^{b}
15%olive cake diets									
0 kGy	2230.0^{b} ±15.27	1063.3^{b} ±6.66	47.68^{c}	1176.3^{b} ±5.17	52.75^{c}	113.0^{a} ±1.52	5.07^{a}	1053.7^{a} ±17.41	47.25^{a}
20 kGy	2366.7^{a} ±33.82	1243.3^{a} ±24.55	52.53^{a}	1357.0^{a} ±25.73	57.34^{a}	113.66^{a} ±2.60	4.80^{ab}	1009.7^{a} ±14.94	42.66^{c}
60 kGy	2203.3^{b} ±14.52	1100.0^{b} ±16.07	49.93^{b}	1199.3^{b} ±18.04	54.43^{b}	99.33^{b} ±2.02	4.51^{bc}	1009.7^{a} ±14.94	45.57^{b}

a,b and c means in the same column with different superscripts are significantly (P ≤ 0. 05) different SE=Standard error

Total edible parts wt. = Empty carcass wt. (without head) + edible giblets wt.

*Edible giblets wt. = Liver+ Kidneys wt. + Heart wt. Total edible parts %= Total edible parts wt / Fasted wt. *100*

Table (3): Effect of the experimental diets on carcass traits and carcass cuts of rabbits.

a, b and c means in the same column with different superscripts are significantly (P ≤ 0. 05) different.

Treatments	Carcass traits (%)						Carcass cuts (%)				
	Fur	Head	Liver	Kidneys	Heart	Lungs	Fore-quarter[2]	Chest[1]	Loin[1]	Hind-quarter[1]	Boneless meat[2]
Control Diet	9.65	4.98^{ab}	3.20^{b}	0.68	0.44	0.78	7.05	12.05	12.10	19.15^{b}	69.00^{a}
15%olive cake diets											
0 kGy	9.50	5.23^{a}	3.87^{a}	0.79	0.40	0.73	6.90	10.80	11.80	18.70^{b}	67.15^{c}
20 kGy	8.80	4.51^{b}	3.76^{a}	0.68	0.37	0.62	7.10	12.20	12.60	20.70^{a}	68.70^{ab}
60 kGy	9.15	5.07^{a}	3.52^{ab}	0.62	0.36	0.68	6.90	11.90	11.40	20.50^{a}	68.35^{b}

[1] On relative to pre-slaughter weight *[2] Meat weight / dressed weight*100*

Erythrocytes (Red Blood Cells, RBC's) Count:

The red blood cells contain a protein known as hemoglobin the function of which is oxygen and carbon dioxide transport and regulation of pH of blood (Rastogi, 1985). The reduction below normal of the number of red blood cells or in the hemoglobin content of the blood causes anemia (Dukes, 1964).

Table (4): Effect of the experimental diets on chemical composition of rabbits meat (on DM basis).

Treatments	Meat composition (%)			
	DM	CP	EE	Ash
Control diet	97.13	68.48	13.34	4.28
15%olive cake diets				
0 kGy	97.06	68.66	13.83	3.61
20 kGy	96.60	70.44	15.18	3.96
60 kGy	96.30	68.69	13.71	3.71

Table (5): Effect of the experimental diets on some blood haematological parameters (mean ±SE) of rabbits at 6 and 11 weeks of age.

Blood Parameters	Control diets	15% olive cake diets		
		0 kGy	20 kGy	60 kGy
Experimental duration (6 weeks)				
RBC (106 /UL)	4.00±0.129	3.95±0.095	4.27±0.154	4.02±0.239
HB (g/dl)	11.32±0.451	11.12±0.457	11.65±0.340	11.55±0.330
Hematocret (%)	35.00±1.29	34.75±1.25	36.50±1.04	35.00±1.68
Experimental duration (11 weeks)				
RBC (106 /UL)	4.70±0.152	4.26±0.088	4.66±0.233	4.46±0.145
HB (g/dl)	11.46±0.425	10.96±0.600	11.40±0.360	11.40±0.264
Hematocret (%)	37.00±2.30	38.33±1.33	36.00±2.64	35.33±2.33

SE=Standard error

The statistical analysis of the hematological data collected after feeding rabbits for 6 or 11 weeks on diets containing 15 % raw and irradiated olive cake up to 60 kGy shows that the groups received raw or irradiated olive cake at a dose level of 20 or 60 kGy have almost the same numbers of RBC's with no significant differences (P>0.05) between the groups of rabbits fed the control diet and those received processed olive cake at a dose level of 20 or 60 kGy (Table 5). The RBC's counts of rabbits were found to be 4.00 and 4.7 (106 /µl) after feeding on the above processed cake, respectively.

Hemoglobin (HB):

The data presented in Table (5) demonstrate that their is a considerable variation with no significant differences (P>0.05) in hemoglobin value among rabbits fed raw and irradiated olive cake at 20 and 60 kGy when compared with those fed the control diet, after six and eleven weeks of feeding.

Packed Cells Volume, (Hematocrite, PCV):

Results of PCV for rabbits maintained on diets containing 15 % raw and irradiated olive cake at 20 or 60 kGy are shown in Table (5). It can be seen that PCV values seem to follow the same trend observed with RBC's, count and Hb values. The above cited results indicate no real effect of irradiation at dose levels of 20 and 60 kGy on haematological plasma parameter. The same results were obtained by El-Niely (1996 and 2001). From the previous data for hematological values, it could be concluded that no significant effect could be revealed due to the consumption of irradiated olive cake processed at 20 and 60 kGy. However, in general, depending on the previous results of performance, radiation treatment at 20 kGy offers a good treatment for olive cake to elevate its nutritional value through reducing the content of glucosinolates by 31.27%, and consequently elevated its effects and enhanced its growth rate.

Some Blood Biochemical Parameters:

Data presented in Table (6) showed no significant differences in plasma glucose, total lipids, total cholesterol and triglycerids concentration fed control diet of rabbits received diets containing 15% raw or irradiated olive cake at dose level 20 or 60 kGy after 6 or 11 weeks of feeding period. Similar results were obtained (Tables 7 and 8) for the levels of protein fractions (total protein, albumin, globulin and A/G ratio), liver enzymes (ALT, AST and alkaline phosphatase) and kidney function (creatinine, urea and uric acid) for rabbits fed the control diet or consumed diets having 15% olive cake either raw or irradiated at 20 or 60 kGy for 6 weeks, Whereas, extending the feeding period for 11 weeks exhibited significant effects for raw or irradiated olive cake at up to 60 kGy on certain biochemical parameters such as triglycerids, total protein, albumin, A/G ratio and creatinine. Where the levels of triglycerid, total protein, albumin and A/G ratio were slightly decreased. El-Kerdawy (1997) reported that levels of total lipids and total cholesterol decreased ($P<0.01$) in blood serum of rabbits consumed diets including 10 or 15% olive pulp. Mousa and Abdel-Samee (2002) found that blood globulin, total lipids, glucose and creatinine concentrations and GOT and GPT activities did not differ significantly among NZW rabbits fed 0, 10 or 20% olive pulp. Feeding 10% olive pulp diets significantly ($P<0.05$) decreased the levels of serum total protein and albumin compared with rabbits fed the control diet or those fed 20% olive pulp. Urea-N and cholesterol concentration increased ($P<0.05$) in blood serum of groups fed diets containing 10 or 20% olive pulp compared with the control group. It can be concluded that up to 20% olive pulp may be included in the diet of growing rabbits without adverse effects on their blood biochemical changes except urea-N and cholesterol. The data of the above blood biochemical parameters of rabbits fed irradiated olive cake up to 60 kGy did not show any significant differences between rabbit groups after 6 weeks of feeding. While, at the end of experimental feeding period (11 weeks), significant changes were found in some parameters in rabbits fed irradiated olive cake at 60 kGy. These results are in a good agreement with those reported by Mekkawy *et al.*, (2000) and Hamza (2001). However, there was significant increase in serum total protein of rabbits kept on normal fat diet irradiated with dose level of 60 kGy for 6 weeks in comparison with those kept on non irradiated diet, and significant decrease in the same parameter for rabbits fed the same processed cake for 11 weeks. It was established that plasma proteins were changed according to the level of nutrition. This alteration may be attributed to the change in plasma volume with no change in the albumin/globulin ratio. The increase may be caused by dehydration and the decrease from over loading with water (El-Niely, 1996).

Table (6): Effect of the experimental diets on some blood haematological parameters (mean ±SE) of rabbits at 6 and 11 weeks of age.

Blood Parameters	Control diets	15% olive cake diets		
		0 kGy	20 kGy	60 kGy
Experimental duration (6 weeks)				
Glucose (mg/dl)	152.2±4.64	163.7±2.86	162.7±1.65	164.2±6.25
Total lipids (g/dl)	253.5±9.28	249.5±10.18	251.0±6.21	236.5±8.91
Cholesterol (mg/dl)	135.2±2.75	133.0±3.16	131.5±7.96	127.5±8.96
Triglyceride (mg/dl)	125.2±3.68	121.5±10.98	124.0±8.69	104.5±4.17
Experimental duration (11 weeks)				
Glucose (mg/dl)	167.33±7.53	156.6±10.74	163.3±4.48	165.6±7.83
Total lipids (g/dl)	258.6±7.05	245.3±4.80	251.0±6.80	239.6±4.05
Cholesterol (mg/dl)	131.6±8.64	121.0±6.55	124.3±8.00	121.3±10.26
Triglyceride (mg/dl)	124.6±5.36^{a}	116.3±5.20^{a}	123.6±1.20^{a}	97.33±3.75^{b}

a and b means in the same raw with different superscripts are significantly ($P \leq 0.05$) different, SE=Standard error

Table (7): Effect of the experimental diets on plasma protein fractions (mean ±SE) of rabbits.

Blood Parameters	Control diets	15% olive cake diets		
		0 kGy	20 kGy	60 kGy
Experimental duration (6 weeks)				
Total protein (g/dl)	6.25±0.155	6.10±0.122	6.10±0.212	6.27±0.188
Albumin (g/dl)	3.92±0.094	3.85±0.064	3.70±0.177	3.95±0.064
Globulin (g/dl)	2.32±0.085	2.25±0.064	2.40±0.040	2.32±0.125
A/G ratio	1.69±0.058	1.71±0.032	1.54±0.054	1.70±0.068
Experimental duration (11 weeks)				
Total protein (g/dl)	6.33±0.120^{a}	5.70±0.115^{b}	6.40±0.152^{a}	6.26±0.088^{a}
Albumin (g/dl)	3.90±0.100^{ab}	3.60±0.115^{b}	3.70±0.115^{b}	4.10±0.115^{a}
Globulin (g/dl)	2.43±0.088	2.10±0.001	2.36±0.202	2.16±0.033
A/G ratio	1.60±0.074^{b}	1.71±0.054^{ab}	1.57±0.090^{b}	1.89±0.080^{a}

a and b means in the same raw with different superscripts are significantly ($P \leq 0.05$) different, SE=Standard error

Albumin, an important part of plasma proteins is more readily affected than globulin by such nutritional factors e. g. restricted directly protein intake. It is well known that liver is the main source of albumin synthesis and liver protein is very labile with a high rate of turnover (West and Bruggen, 1970). This means that the change in plasma albumin reflects the status of protein and its turnover in liver which can be considered as a good index for any fluctuation that may occur under different experimental condition (El-Niely, 1996). Mekkawy *et al.*, (2000), observed no significant differences in serum total protein, albumin, globulin and albumin/globulin ratio among rabbits fed irradiated guava by-product at dose of 3 kGy. The data of serum glucose of rabbits fed irradiated normal or

high fat diets showed non-significant changes after 30 days which turn to be significant in rabbits kept on normal fat after 60 days of feeding. Hamza (2001) showed that serum glucose was not affected by supplemented irradiated tomato wastes at 75 kGy or 100 kGy to the broiler diet. The statistical analyses showed non-significant changes in serum ALT, AST and alkaline phosphates (ALP) for rabbits fed processed olive cake at 20 and 60 kGy after 6 weeks of feeding. This indicated that there is no liver injury induced as a result of feeding rabbits irradiated complete diets having different fat levels.

Table (8): Effect of the experimental diets on liver and kidney functions (mean ±SE) of rabbits.

Blood Parameters	Control diets	15% olive cake diets		
		0 kGy	20 kGy2	60 kGy
Experimental duration (6 weeks)				
Liver functions:				
ALT (U/ l)	29.75±2.25	29.50±2.10	30.25±2.56	30.50±3.01
AST (U/ l)	40.75±3.54	41.75±2.56	41.25±1.796	41.75±2.56
Alkaline phosphates (U/ l)	26.00±3.39	29.25±2.49	30.00±0.912	30.50±2.90
Kidney functions:				
Creatinine (mg/dl)	1.42±0.256	1.67±0.188	1.57±0.306	1.27±0.232
Urea (mg/dl)	30.25±1.376	32.00±1.95	31.50±1.707	30.75±2.28
Uric acid (mg/l)	4.17±0.103	4.10±0.070	4.27±0.110	4.37±0.217
Experimental duration (11 weeks)				
Liver functions:				
ALT (U/ l)	29.33±2.40	30.00±3.46	30.00±2.08	32.00±2.88
AST (U/ l)	43.00±3.21	44.33±2.33	46.33±2.60	49.00±2.51
Alkaline phosphates (U/ l)	27.00±3.60	28.00±1.15	29.00±1.52	29.66±1.76
Kidney functions:				
Creatinine (mg/dl)	1.66±0.120^{c}	1.86±0.120b^{c}	1.26±0.185^{b}	1.73±0.120^{a}
Urea (mg/dl)	31.33±2.72	32.33±2.40	37.66±2.90	37.33±2.02
Uric acid (mg/l)	4.23±0.202	4.30±0.100	4.53±0.233	4.73±0.185

a, b and c means in the same raw with different superscripts are significantly ($P \leq 0.05$) different, SE=Standard error

Cecum Activity:

The effect of feeding rabbits the control diet or diets containing 15% raw or irradiated olive cake (20 or 60 kGy) on cecum activity (total volatile fatty acids, TVFA's, ammonia concentrations and pH) and cecum microbes (total count) were determined when rabbits were slaughtered at the end of the growing period (16 weeks of age). The results are shown in Table (9). The experimental diets (control, 15% olive cake raw or irradiated at 20 or 60 kGy) had no significant effect on total volatile fatty acids, pH values and total count of microbs in cecum contents of rabbits. Whereas, the experimental diets exerted significant effect on ammonia contents in the cecum of rabbits. Rabbits fed the 15% dietary olive cake irradiated at 20 kGy showed the highest ammonia level in the cecum followed by those fed the control diet, then those fed 15% dietary olive cake irradiated at 60 kGy. The lowest level of ammonia was shown by rabbits fed the 15% raw olive cake. These findings in agreement with Alicata *et al.* (1986) who indicated that olive cake could be used in diets of

rabbits, and cleared the effect of all products on microflora activity in the caecum and volatile fatty acids in caecum contents in rabbits. Vernay (1987) showed that when the rabbit excreted soft feces the mean values of pH along the hind- gut became slightly acidic, changing from 6.4 to 6.0, while the pH values increased throughout the length of the colon, from 6.5 to 7.7 when animals produced hard feces.

From this study it could be concluded that, irradiation processing of 15% OC at 20 kGy can eliminate the harmful effect of its glucosinolates on blood chemistry, carcass traits and cecum activity.

Table (9): Effect of the experimental diets on cecum activity (mean ±SE) of rabbits.

Treatments	Cecum activity				
	T`VFA (ml eq/100 ml)	Ammonia (mg/100ml)	pH	Total count	*Salmonella & Shigella*
Control diet	23.33±6.984	52.66±3.480^{ab}	6.833±0.166	89.33±8.006	ND
15%olivecake diets					
0 kGy	17.33±3.282	34.33±4.484^{b}	6.500±0.288	64.00±8.544	ND
20 kGy	22.00±3.605	62.00±1.732^{a}	6.833±0.166	84.66±7.512	ND
60 kGy	19.00±3.214	49.33±9.134^{ab}	6.833±0.166	88.66±11.89	ND

a and b means in the same column with different superscripts are significantly ($P \leq 0.05$) different. SE=Standard error, Number of bacterial cells per gram of cecum content (×105 CFU/g). ND =Not detected

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تأثير التغذية علي علائق تحتوى على تفل الزيتون المشعع على صفات الذبيحة والدم في الأرانب النامية

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تم ذبح 12 أرنب ذكر نيوزيلندي أبيض عند 16 أسبوع من العمر من 4مجموعات (3 أرانب من كل مجموعة) حسب متوسط الوزن النهائي لكل مجموعة وذلك لدراسة صفات الذبيحه وخصائص الدم ونشاط الأعور. تم تكوين العلائق التجريبية بحيث تحتوي علي 15% تفل زيتون غير معامل أو معامل بالأشعاع (20 أو60 كيلو جراى) وكانت العلائق الأربع المستخدمه متساوية تقريبا في البروتين (حوالي ١٧ ٪) والطاقة المهضومة (حوالي ٢٥٠٠ كيلو كالورى / كجم عليقة)0

أوضحت النتائج انه لم يكن هناك تأثير ضار علي نسب الذبيحة , الأجزاء المأكولة الداخلية وكذلك الأجزاء المأكولة الكلية مع اضافة تفل الزيتون إلا أن العلائق التي إحتوت علي تفل الزيتون المعامل (20 كيلو جراي) أدت إلي الحصول علي أفضل القيم مقارنة بعليقة الكنترول. أوضحت الدراسة أن تغذية الأرانب على علائق تفل الزيتون الخام والمعامل بجرعه 20 و 60 كيلو جراى لم يكن لها أي تأثير ضار علي مقاييس الدم ، كما لم يكن لها أى تأثيرات غير مرغوبة تؤثر بالسلب على صحة الحيوانات. لم يكن هناك تأثير معنوي علي محتوي الأعور من الأحماض الدهنية الطيارة وتركيز أيون الهيدروجين بينما كان هناك تأثيرا معنويا علي تركيز الأمونيا, عند تغذية الأرانب على علائق تفل الزيتون الخام والمعامل بجرعة 20 ، 60 كيلو جراى. كما أوضحت النتائج اختلاف في تأثير المعاملة الاشعاعية لتفل الزيتون علي العد البكتيري الكلي وأدت إلي تناقص أعدادها.

ويخلص من هذه الدراسة أن المعالجة الإشعاعية بجرعة مقدارها 20 كيلو جراى لتفل الزيتون قد أدت الى خفض محتواه من الجلوكوسينولات الضارة وأن إحلاله محل الدريس فى علائق الارانب لم يكن لة أى تأثير ضار على النواحى الفسيولوجية وكيمياء الدم.