

## Effects of Feeding Olive Cake and Barley Radicle as fiber sources on lipids, cholesterol and fatty acids in Hen Eggs

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### Abstract

A total of 98 Lohman laying hens 54 weeks old were used in a 3 month experiment in 9 treatment groups and 7 replicates. The diets formulated by inclusion of olive cake (OC,5 and 10%) and barley radicle (BRP,10 and 20%) substituting parts of yellow corn and soybean meal protein respectively of a control diet.Both (OC and BRP) were tested each level alone along with the 4 possible combinations of the two materials using the same levels.

Results indicated that inclusion of the two levels of OC or BRP either alone or in combinations in hen diets resulted in decreases in plasma and egg yolk cholesterol,TG and LDL relative to the control.

### Introduction

The effects of dietary components on hypercholesterolemia and atherosclerosis have received much attention. Polyunsaturated fatty acids and dietary fiber appeared to lower the blood cholesterol level and events of atherogenic progress (Carroll and Hamilton, 1975 and Levy *et al.*,1976). Moreover, it has been hypothesized that fiber play a role in cholesterol metabolism my possible combination of its ability to decrease absorption of cholesterol, bind with bile salts in the intestinal tract, shorten the intestinal transit time and increase fecal sterol excretion (Kelley and Tsai, 1978). Several dietary fiber sources have been suggested to reduce egg cholesterol content (Mente *et al.*, 1974 and Weiss and Scott, 1979).

Olive cake (OC) which is a by product of olive oil industry contains high concentration of crude fiber (30-40% Francisco *et al.*, 1989) along with a relatively high content of residual unextracted oil that contains high concentration of polyunsaturated fatty acids, mainly linoleic and alfa-linolenic acids. Also, barley radicle i.e. barley rootlets or malt culms, a by product of brewing industry is of fibrous nature (15.6% CF on DM, McDonald *et al.*, 1995)

### Material and Methods

Nine experimental diets were formulated using olive cake or barley radicle as sources of fiber either alone or in combinations. The experimental diets were (1) The control diet which contained zero level of olive cake or barely radicle. (2) The same as the control but 5% of yellow corn (YC) was substituted by olive cake (OC). (3) The same as the control but 10% of YC was substituted by OC. (4) The same as the control but 10% of soybean meal protein (SBMP) was substituted by barely radicle protein (BRP). (5) The same as the control but 20% SBMP was substituted by BRP. (6) The same as the control but 5% of YC and 10% SBMP were substituted by OC and BRP, respectively. (7) The same as the control but 5% of YC and 20% SBMP were substituted by OC and BRP, respectively. (8) The same as the control but 10% of YC and 10% of SBMP were substituted by OC and BRP, respectively (9) The same as the control but 10% of YC and 20% of SBMP were substituted by OC and BRP, respectively. All diets were iso-caloric (2779 Kcal ME/kg) and iso-nitrogenous.

At the end of the experiment, four hens from each treatment were selected at random to collect blood samples via the wing vein using heparin as an anticoagulant and plasma was separated by centrifugation to determine cholesterol, triglycerides(TG),high density lipoprotein (HDL) cholesterol and low density lipoprotein.

Twelve eggs were collected from each group during the last 3 days of the experiment, weighted, cracked and the yolks were mixed in 3 pooled yolk samples (4 pooled yolks in each

sample). Yolk samples were analyzed for total cholesterol, triglycerides (Lowell *et al.*, 1973), high density lipoprotein (HDL) cholesterol (Eckel, 1977), low density lipoprotein (LDL) phospholipids (Kates, 1972, Kaur *et al.*, 1973) and total lipids (Bigh and Dyer, 1959). The extracted total lipids of each of the 3 pooled yolk samples (of each treatment) were then pooled again in one sample/ treatment which used for isolation of fatty acids (Farag *et al.*, 1990).

The data was analyzed as one way analysis of variance while differences among means were evaluated using Duncan's multiple range test (Duncan, 1955).

## Results and Discussion

Inclusion of the two levels of OC or BRP in hen diets either alone or in combinations resulted in decreases in plasma cholesterol (Table 1) relative to the control, ranging from 23.4% (10%OC + 10%BRP) to 67.1% (5% OC).

Table(1) Effect of fiber level in laying hen diets on cholesterol, TG, HDL, concentration of blood plasma.

Item	Fiber, %								
	3 Control	5			Overall mean of 5% fiber	6			Overall mean of 6% fiber
		5% OC	5%OC & 10% radicle	5%OC & 20% radicle		10%OC	10%OC & 10% radicle	10%OC & 20% radicle	
Cholesterol, mg/dl	91.8abA	42.5a	129.3b	77.5ab	83.1A	60.3a	99.0ab	83.3ab	80.8A
Triglycerides, mg/dl	762aA	190b	509ab	403bc	367B	554ac	386bc	424bc	455B
HDL, mg/dl	67.0aA	61.3a	21.5b	25.8b	39.1B	54.0a	25.5b	12.8b	26.1B

a,b,c,d, Means in the same row with different small letters are significantly different (P<0.05)

A,B Means in the same row with different capital letters are significantly different (P<0.05)

Results also indicated insignificant decreases in plasma triglycerides due to inclusion of OC or BRP either alone or in combinations except 5% OC or 20% BRP which resulted in significant decreases. The great decrease in hen plasma cholesterol due to BRP or OC feeding may be a result of increasing CF level due to barley radicle and olive cake feeding and more particularly may be due to the residual unextracted olive oil still present in the cake of the diets containing OC. Olive oil characterises by high proportions of useful components such as Omega groups (9 or 6 or 3). The inspection of the overall mean data indicated that increasing dietary crude fiber from 3 to 5 or 6%, using OC or OC + BRP as fiber sources, decreased plasma cholesterol concentration by 10.5 and 13.7 % respectively. The data of egg yolk lipids (Table 2) concentrations resulted in significant (P<0.05) decreases in egg yolk concentrations of total lipids, cholesterol, TG, LDL and phospholipids compared to the control. This decrease may be due to inclusion of olive cake which contains Omega groups (9 or 6 or 3). Laying hens fed barley were reported to produce eggs with less cholesterol than a corn fed control group (Qureshi *et al.*, 1984). Others proposed that hypocholesterolemic effect of barley is the result of its  $\beta$ -glucan content, which may increase intestinal viscosity (Davidson *et al.*, 1991).

Table (2) Effect of fiber level in laying hens diets on cholesterol, TG, LDL,HDL, Phospholipid and Total lipids of egg yolk lipid concentration.

Item	Fiber,%								
	3 Control	5			Overall mean of 5% fiber	6			Overall mean of 6% fiber
		5% OC	5%OC &10% radicle	5%OC &20% radicle		10%OC	10%OC &10% radicle	10%OC &20 %radicle	
Cholesterol,g/100g yolk	1.35aA	0.74b	1.19c	1.01d	0.98B	1.15c	1.01d	0.88e	1.01B
TG,g/100g yolk	9.8aA	5.3b	8.6c	7.3d	7.1B	8.4c	7.3d	6.3e	7.3B
LDL,mg/100gyolk	0.18aA	0.10b	0.16c	0.13d	0.13B	0.15c	0.13d	0.12e	0.13B
HDL,mg/100g yolk	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phospholipid g/100g yolk	3.0aA	1.6b	2.7c	2.2d	2.2B	2.6c	2.2d	2.00e	2.3B
Total lipids g/100g yolk	15.0aA	8.2b	13.3c	11.2d	10.9B	12.9c	11.2d	9.8e	11.3B

a,b,c,d,eMeans in the same row with different small letters are significantly different (P<0.05)

A,B Means in the same row with different capital letters are significantly different (P<0.05)

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