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Hypolipidemic Activities and Nutritive Values of *Brassica napus* and *Eruca sativa* Seed Supplementation in Rats Fed a High Cholesterol Diet

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Abstract

The present study concerns the use of rapeseed (*Brassica napus*) and watercress (*Eruca sativa*) seeds commonly major consumed vegetables in food items as natural source of diets. To examine their effects on growth rate, nutritive values hypocholesterolemic diet fed rats, lipidemic, two groups of seven adult male albino rats were fed high-cholesterol diet supplements with 100 g/kg rapeseed (*Brassica napus*) and watercress (*Eruca sativa*) seeds (HCD-R and HCD-W respectively) for 8 weeks compared to high-cholesterol diet fed rats (HCD). Chemical analyses of the rapeseed (R) and watercress (W) seeds revealed differences between the ratios of protein (20 - 23%), lipid (28 - 33%), carbohydrate (36 - 43%) and phenolic constituents (2 - 3%). Rats fed with both experimental diets containing 100 g/kg diet of R and W seeds (HCD-R and HCD-W respectively), exhibited a higher significant increase in body weight gain, food intake and digestibility (Dapp) throughout the feeding period (2 - 8 weeks). Insignificant changes in feed efficiency (FE) and food conversion efficiency (FCE) were observed. Both experimental diets (HCD-R and HCD-W) evidence lowering effects in the levels of total lipids, total cholesterol, LDL-C and triglycerides in sera of rat as compared to control diet fed rats (HCD). The HCD-R and HCD-W diet (100 g/kg) had also a lowering effect on hepatic total lipids, total cholesterol, triglycerides and cholesterol ester levels. Highly significant increase in HDL-C was observed in the liver of rats fed HCD-R diet than those received HCD-W and HCD fed rats. According to these observations, the use of rapeseed (*Brassica napus*) and watercress (*Eruca sativa*) seeds can be recommended as natural sources for improving nutritional values of food supplements used as hypolipidemic agent and may be treated heart and cancer diseases.

Keywords: *Rapeseed; Watercress Seeds; Polyphenol; Hypercholesterolemic; Rat*

Introduction

Foods are important for people life on the earth includes different sources of food ingredients having many molecules used for digestion and absorption in small and large intestine of human and animals. The different components of food ingredients are complex and vary, used as substrate for fermentation activity of microorganisms in large intestine which can increase their beneficial effects on digestion, absorption and assimilation of food materials in small and large intestine of human and animals [1-3]. Plant foods containing different ingredients known for improving human health and may be responsible for mediating these health effects [3,4]. Protein, carbohydrate and lipid were found to be major components of different foods item in most diets. Diets rich in fruits, vegetables and grain have proved to be effective in reducing the incidence of most diseases as cancer, coronary heart disease, cardiovascular disease, atherosclerosis and hyperlipidemia were reported by several investigators [5-8]. Various food having bioactive molecules were found to be complex in digestion and absorption, resulting changes in nutritional, biochemical and physiological activities [4,9-12] found increase in body weight gain, food consumption, digestibility and growth rates in rats. Several studies have shown the beneficial effects of supplementing the rat diets [4,11], reported that the diet components can be used as hypocholesterolemic and hypolipidemic agents [12,13]. Among ancient people, plants were found to be used in food pharmaceutical and in medicine [14,15]. Plant seeds were considered as origin and major part of plants containing different chemical compounds, showed increases in recent years in functional food and in medicine [2,15-17]. Recent study used different plant seeds as food ingredients in diets of rats [18-21], evidence the and safflower seed constituents have nutritional quality and health benefits. Other studies used different seeds in diet supplements [13,17,18,21] showed seeds were found to be induced changes in nutritional and hepatic enzyme activities in rats. Plant seeds pumpkin and flax seed have rich nutritional and nutraceutical components used for protection against some diseases and health benefits [4,15]. Other investigators [22-25] provided evidence that the consumption of some constituents of plant seed results in treated and protection against chemically induced colon and hepatocellular carcinoma. Other studies indicated some seeds intake have effects on biochemical parameters resulting in protection and treatment of diabetes [26], cardiovascular [18] and other various diseases [27-29]. Different compounds were detected in plant seed used as antimicrobial, antiviral, anticancer and [8,20,28]. Many investigators [16,24,30] reported the plant seeds phytochemicals containing diets showed chemopreventive, antioxidant, anticancer and cytotoxic properties [31], may contribute to health-promoting effects [21,16] and could be used in preventive strategies to reduce the risk and inhibit or retard the development of chronic diseases]15,32,33]. Seeds were found to be contains fatty acids, phenolic and flavonoid compounds are responsible for biochemical and physiological effects leads to improve the health state of humans [25,34]. Several studies on plant seeds rich in polyphenols showed physiological and biological activities and have interest in food chemistry, pharmaceutical and in medicine [8,15,35-38] indicated the seeds rich in flavonoids content have protection effect against some diseases. Rapeseed (*Brassica napus*) and Watercress (*Eruca sativa*) seeds are commonly used as food or in medicine and consider a good sources of diet health-promoting ingredients contains fatty acids, phenolic and flavonoid compounds have different biological properties [23,37,39]. Current research in the field of food chemistry, pharmaceutical and drug therapy were done used pant seeds as a novel natural sources for production of functional food and drugs used for treatment different diseases in human and animals [13,17,21,31]. The present investigation was designed to investigate the effect of plant seeds (*Brassica napus* and *Eruca sativa*) containing diet for hypolipidemic produced when rats were fed high-cholesterol diet. Growth rates, nutritional and biochemical parameters were determined in the present study using male albino rats.

Materials and Methods

Materials

Seed samples

Fresh samples rapeseed (*Brassica napus*) and watercress (*Eruca sativa*) seeds obtained from local market here in Egypt, cleaned carefully with tap and distilled water, stored at 4°C till used.

Methods

Sample preparation

Dry of rapeseed (*Brassica napus*) and watercress (*Eruca sativa*) seeds samples separately were done [40], then ground to fine powders, keep in polyethylene bags and stored at room temperature until uses.

Chemical analysis

Brassica napus and *Eruca sativa* seed powder were used for determination of total carbohydrate [41], protein [42], total lipid [43,44], phenolic [45] and flavonoid [46]. Phenolic content was expressed as mg of Gallic Acid Equivalents (GAE). Flavonoid was measured as mg Catechin Equivalents (mg CE) by aluminum chloride colorimetric assay [47]. Triplicate samples of each test used and the mean values were calculated.

Diets

The composition of diets is shown in table 1. The control diet was high cholesterol diet (HCD) and the two experimental diets were supplemented with 10% (100 g/kg diet) of rapeseed (R) and watercress (W) seeds (HCD-R and HCD-W) respectively (Table 1).

Animal

Eighty-four male albino rats (*Rattus norvgicus*), 6 weeks of age, weighing about 108 ± 1.5g were purchased from the Egyptian Organization for Biological products and Vaccines and fed with a commercial diet for a period of two weeks. The 84 rats were divided into three groups (28 rats/group), individually housed in wire screen cages. The first group was fed seed powder-free diet (HCD) used as control diet and the other two groups (HCD-R and HCD-W) received one of the two experimental diets containing 100 g/kg of R and W seeds powder respectively as described in table 1. Rats were fed free access diets and tap water for 8 weeks feeding period. The animal room was temperature controlled (25 ± 1°C) and had a12-hour light-dark cycle. Every two weeks of experimental period (8 weeks), 7 rats from each group were weighed and recorded. Experimental protocol was done according to the method described previous [1,6,48,49].

Components (g/kg diet)	HCD	HCD-R	HCD-W
Starch	575.00	530.40	523.60
Cellulose	50.00	50.00	50.00
Sucrose	50.00	50.00	50.00
Casein	200,00	177.40	179,80
Maize oil	50.00	17.2	21.6
Mineral mixture*	40.00	40.00	40.00
Vitamin mixture*	20.00	20.00	20.00
Cholesterol	10.00	10.00	10.00
Cholic	5.00	5.00	5.00
Rapeseed (R)	0.00	100.00	-
Watercress (W)	00.0	-	100.00

Table 1: *Composition of hypercholesterolemic diet (HCD) and two experimental diets containing the two seed powder (HCD-P and HCD-C).*

Johnson and Gee, (1986). Council of European Communities (1986).*

Nutritional and metabolic parameters

Rat faeces were collected daily throughout the feeding period (8 weeks) and dried in an oven at 105°C, weighed and tested for nitrogen content. Weight gain, food intake, protein efficiency ratio (PER), feed efficiency (FE), apparent digestibility (Dapp) and food conversion efficiency (FCE) were calculated every 2 weeks of 8 feeding [6,48].

Biochemical assays

Blood samples were draw from the retroorbital venous plexus with heparinized capillary tubes every two weeks over the feeding period (8 weeks). Plasma was separated by centrifugation at 4000 rpm for 20 min using cooling centrifuge (Sigma 2K15). Separated plasma were used foe determination of total lipids [50], total cholesterol [51], high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C) and triglycerides [52]. Plasma phospholipids were determined according to the method of Takayama., *et al* [53]. Free cholesterol and cholesterol esters were also estimated [54].

Statistical

Statistical analyses were performed using student t-test [55]. A difference of $P < 0.05$ and $P < 0.01$ were considered significant (*) and higher significant (**) between rats fed rapeseed (*Brassica napus*) and watercress (*Eruca sativa*) seeds containing diet (HCD-R and HCD-W) and those fed hypercholesterolemic diet (HCD).

Results and Discussion

Chemical composition of seeds

Brassica napus and *Eruca sativa*) seeds used in the present study were analyzed for chemical composition as illustrated in table 2. Different contents of protein, lipid, carbohydrate, phenolic, flavonoid and ash were estimated in both seed used in the present study. Higher percentages of protein (22.6 and 20.2%) were found in *Brassica napus* and *Eruca sativa* respectively. The present results are closed related to those of other investigators [21,56,57]. High protein content in *Brassica napus* and *Eruca sativa* seeds were obtained by other investigators [19,21,31,58], found the protein contents in some plant seeds was 21.7%. Lipid levels were found to be higher in *Brassica napus* seeds (32.8%) than those of *Eruca sativa* (28.4%). Results in the present study are correlated to those found by several investigators [18,31,33,56]. Other investigators [2,21,19,59] found lower lipid percentages in chick peas (20.8%), dill (18.2%) and coriander (16.4%) seeds. Higher levels of carbohydrate were observed in *Eruca sativa* seeds (42.6%) than that of *Brassica napus seeds* (36.2%) which are similar to obtained by other investigators [21,31,33,56]. Phenolic and flavonoid contents were estimated in *Brassica napus* and *Eruca sativa* seeds as shown in table 2. Different variations were found between the two seeds with respect to their phenolic and flavonoid contents. The higher phenolic content was recorded in rapeseed and watercress (2.82 and 2.24 g% respectively). Our results of total phenolic contents in both seeds used in the present study are higher than those reported previous [16,39,58] showed total phenolic content was 12.7 to 25.6 mg/100g in some plant seeds. Phenolic content was varied from 15.9 mg/g to 22.7 mg/g in different plant seeds which are nearly similar to our results obtained (2 - 3%). Lower levels of phenolic contents (0.098 - 0.335 mg %) were observed in safflower and dill seeds [31,56]. Phenolic compounds were determined in some seeds at the level of 0.44 mg/g by other investigators [37,39]. Higher content of flavonoid level in *Brassica napus* (2.26 g%) than that of *Eruca sativa* seeds (1.88 g%). Our results are in a good agreement with those reported by other investigators [21,31,39]. Alam [58] reported the flavonoid content in three samples of *Eruca sativa* seed was ranged from 23 to 25% which are higher than our results of flavonoid content in *Eruca sativa* seeds. Several investigators [21,31,57] found lowest flavonoid contents in chickpeas, safflower, dill and coriander seeds (0.2 - 0.4 mg/g). Differences were observed in compositions of *Brassica napus* and *Eruca sativa* seeds may due to various environmental conditions as temperature and harvest season [19,21,60]. Thus, seeds were used in the present study as diet supplements to study their activities in hypercholesterolemic rats.

Ingredients	Rapeseed (*Brassica napus*)	Watercress (*Eruca sativa*)
Protein	22.6	20.2
Lipid	32.8	28.4
Carbohydrate	36.2	42.6
Ash (%)	3.32	4.68
Phenolic	2.82	2.24
Flavonoid	2.26	1.88

Table 2: *Chemical composition of Rapeseed (Brassica napus) and Watercress (Eruca sativa) seeds (g/100g). Mean values of three samples.*

Diets and nutritional values

Experimental diets were incorporated in the form of powder and the rats were without ill-health throughout the feeding period (8 weeks). Generally, rats fed both experimental diets for 8 weeks exhibited a higher significant increase in some nutritional parameters [10,61,62]. Weight gain, food intake and Dapp were significantly higher in the rats fed 2 experimental diets than those of rats fed seed free-control diet over the feeding period (2 - 8 weeks) as shown in table 3. No differences were observed in the values of PER, FE and FCE, when rats received seed free-control diet (HCD) and both experimental diets (HCD- W and HCD-W respectively) as shown in table 3. It can be observed that the diet containing watercress seed (HCD-W) had significant higher effect on weight gain and food intake more than that of diet containing rapeseed (HCD-R). Results obtained in the present study are inconsistent to those reported in other studies [62,63]. Other investigators [62,64] have previously reported the rapeseed and watercress had lowering effect on some nutritional parameters (food intake, FE, Dapp and FCE) and growth rate of rats [65]. Nutritional parameters-lowering effects of rats fed HCD-R and HCD-W supplemented diets for 8 weeks feeding period were recorded (Table 3). Significant lower in body weight, food intake, FCE and Dapp values in rats received both HCD-R and HCD-W supplemented diets was observed over the feeding period (2 - 8 weeks), compared to that given seed free-control diet [65,66]. It can be concluded, that these differences are related to the presence of different types and constituents in both seeds supplemented as well as the level of 100 g/kg diet containing protein, lipid, carbohydrate, phenolic and flavonoids [18,24,67,37] reported rapeseed and watercress were found to contains several phenolic compounds that contributed to the hypolipidemic and anticancer potentials. The values of PER, food intake and Dapp for rats given the 2 experimental diets were also higher than those mentioned previously by other investigators [6,10,65]. Diets rich in polyphenolic compounds showed decrease in protein digestibility and inhibitory effects in growth and food intake [47,68]. Other investigators found no effect in food intake and growth of several materials rich in polyphenols [18,58,69]. The presence rapeseed and watercress of different phytochemicals and nutritional benefits of rapeseed and watercress seeds make it a healthy diets that maintains the immunity and health of the body effective in cardiovascular problems [10,12,18].

Diets	Time In weeks	Control diet Group	Experimental diets	
			HCD-R diet group	HCD-W diet group
		Mean ± SE	Mean ± SE	Mean ± SE
Initial body weight (g)	2	110.20 ± 0.70	109.80 ± 0.17	110.10 ± 0.84
	4	108.62 ± 1.32	110.95 ± 0.81	111.24 ± 0.80
	6	110.40. ± 0.86	109.10 ± 1.02	110.90 ± 1.18
	8	110.40 ± 1.20	111.11 ± 1.27	110.40 ± 1.51
Weight gain (g)	2	12.10 ± 0.80	14.92 ± 0.92**	16.40 ± 1.10**
	4	24.60 ± 1.60	28.86 ± 1.70**	30.46 ± 1.10**
	6	34.80 ± 1.80	40.20 ± 1.94**	44.40 ± 1.50**
	8	40.96 ± 2.90	48.40 ± 2.20**	52.82 ± 1.90**

Food intake (g)	2	44.80 ± 2.20	58.16 ± 2.60**	56.16 ± 4.20**
	4	76.38 ± 7.50	84.80 ± 8.40**	88.70 ± 3.40**
	6	120.39 ± 9.60	128.26 ± 11.2**	130.92 ± 12.46**
	8	130.83 ± 12.40	148.42 ± 13.50**	1156.80 ± 11.62**
Protein efficiency ratio (PER)	2	2.20 ± 0.10	2.16 ± 0.12	2.10 ± 0.03
	4	2.18 ± 0.01	2.18 ± 0.01	2.18 ± 0.02
	6	2.20 ± 0.08	2.30 ± 0.06	2.18 ± 0.04
	8	2.30 ± 0.01	2.20 ± 0.04	2.20 ± 0.02
Feed efficiency (FE)	2	0.30 ± 0.02	0.28 ± 0.02	0.30 ± 0.01
	4	0.28 ± 0.03	0.28 ± 0.02	0.29 ± 0.04
	6	0.29 ± 0.01	0.26 ± 0.04	0.28 ± 0.02
	8	0.30 ± 0.02	0.26 ± 0.03	0.28 ± 0.02
Apparent digestibility (Dapp)	2	90.80 ± 0.40	92.84 ± 0.22**	92.90 ± 0.26**
	4	92.60 ± 0.50	94.80 ± 0.14**	94.82 ± 0.30**
	6	94.80 ± 0.32	96.40 ± 0.30**	96.96 ± 0.38**
	8	96.20 ± 0.26	98.18 ± 0.28**	98.80 ± 0.40**
Food conversion efficiency (FCE)	2	29.11 ± 0.20	28.99 ± 0.10	28.27 ± 0.60
	4	29.93 ± 0.54	28.62 ± 0.62	28.98 ± 0.44
	6	28.98 ± 0.40	29.00 ± 0.21	29.88 ± 0.86
	8	29.97 ± 0.88	29.04 ± 0.46	28.04 ± 0.91

Table 3: *Initial body weight, weight gain, food intake, PER, FE, Dapp and FCE of rats fed seed-free control and two experimental diets. (Mean values of 7 rats/each 2 weeks/group).*
**: Significant (P< 0.05).*
***: Highly significant (P<0.01)*

Serum parameters

Serum lipid of the rats fed seed free-control and the 2 experimental diets are illustrated in table 4. The present results showed significant increase in total lipid, LDL-C and triglycerides levels in rats fed seed-free control diet with increasing the feeding period (2-8 weeks), particularly at 6, 8 weeks feeding. Serum total cholesterol, HDL-C and phospholipids throughout the feeding period (8 weeks) showed different changes over the feeding period (2 - 8 weeks). The rats fed both HCD-R and HCD-W diets containing R and W seed respectively, had higher significant decrease in the levels of serum total lipid, total cholesterol and LDL-C, as compared to those received seed free-control diet throughout the 8 weeks of feeding. Moreover, the experimental diets containing *Brassica napus* and *Eruca sativa* seeds (HCD-R and HCD-W) showed significant decrease in rat serum triglycerides levels. Insignificant changes were observed in serum phospholipids level of rats fed seed-free control and both experimental diets. The significant decrease in the levels of total lipid, HDL-C, LDL-C and triglycerides in serum of rats received HCD-W seed-containing diet was higher than that of rats fed HCD-R seed containing diet. Both seed containing diets showed similar lowering effect in the level of total cholesterol and phospholipids. The HCD-R and HCD-W seed-containing diets had significant increase on the level of serum HDL-C. Similar results were reported by other investigators [62-66], reported consumption of seed diet supplements, showed reducing hypercholesterolemic, hyperlipidemic and atherosclerosis in human and animals. Results showed the diets contains different levels and sources of carbohydrate and lipid constituents may be effect on key enzymes of carbohydrate and lipid metabolism [6,10,17,67]. Hypocholesterolemic agent used in clinical trial in last decade showed the potential effect of plant seeds or compounds isolated fraction [1,5]. The most finding in the present study were the cholesterol and triglycerides lowering effect, of the HCD-R and HCD-W seed-containing diets, in sera of rats throughout 8 weeks feeding period (Table 4). The present seed sources (R and W) also may be effective in the treatment of hypercholesterolemia due to its containing phenolic and flavonoids in higher levels (Table 2). Our finding in the present study are in accordance with the findings reported previous by other investigators [58,68]. Several investigators [18,66,69] stated positive correlation between the incidence of coronary atherosclerosis and plasma LDL-C concentration that consider a cardiovascular risk factor. Moreover, the HCD-R and HCD-W seed-containing diets showed higher significant decrease in the levels of LDL-C and triglycerides resulting reduce the risk factors of cardiovascular and lowering the incidence of coronary atherosclerosis [62,63,67].

Diets	Time	Control diet	Experimental diets	
	In	group	SCFP diet	BFP diet
	Weeks		Group	Group
		Mean ± SE	Mean ± SE	Mean ± SE
Total lipid (mg%)	2	444.60 ± 6.10	368.20 ± 3.20**	348.40 ± 3.40**
	4	456.50 ± 3.30	350.40 ± 3.20**	348.90 ± 3.80**
	6	454.90 ± 3.76	310.50 ± 3.60**	304.20 ± 3.40**
	8	464.40 ± 3.20	286.70 ± 3.86**	278.30 ± 4.60**
Total cholesterol (mg%)	2	132.44 ± 1.40	112.90 ± 0.20**	110.30 ± 0.20**
	4	130.30 ± 1.80	116.30 ± 2.10**	106.30 ± 1.80**
	6	124.80 ± 0.80	108.60 ± 1.20**	104.80 ± 2.10**
	8	158.50 ± 1.40	100.30 ± 0.90**	96.90 ± 2.90**
HDL-C (mg%)	2	30.25 ± 0.40	32.04 ± 0.20*	34.86 ± 0.30
	4	32.84 ± 0.20	34.80 ± 0.60*	32.90 ± 0.80
	6	30.25 ± 0.60	32.40 ± 0.54*	34.80 ± 0.60
	8	40.92 ± 0.90	36.16 ± 0.80*	32.84 ± 0.84
LDL- C (mg%)	2	42.60 ± 2.10	34.90 ± 2.20**	32.74 ± 4.20**
	4	48.12 ± 6.10	20.40 ± 6.06**	22.70 ± 6.00**
	6	48.20 ± 8.20	16.70 ± 4.10**	14.40 ± 4.34**
	8	52.86 ± 6.90	14.30 ± 4.66**	12.36 ± 3.96**
Triglycerides (mg%)	2	148.20 ± 3.44	136.30 ± 4.40*	132.96 ± 6.10*
	4	156.43 ± 6.10	144.34 ± 6.12	130.90 ± 8.04*
	6	160.40 ± 6.12	130.90 ± 8.08*	128.62 ± 6.80*
	8	176.84 ± 8.40	126.98 ± 8.08*	122.46 ± 8.24*
Phospholipids (mg%)	2	8.96 ± 0.58	8.30 ± 0.48	8.90 ± 0.80
	4	10.18 ± 0.92	10.56 ± 1.14	10.80 ± 0.98
	6	12.04 ± 2.22	8.90 ± 1.92	8.20 ± 1.88
	8	12.88 ± 1.94	9.40 ± 1.30	9.90 ± 1.84

Table 4: *Total lipid, total cholesterol, free cholesterol, HDL-C, LDL-C, triglyceride and phospholipid in sera of rats fed seed free-control and two experimental diets.*
*(Mean values of 7 rats/each 2 weeks/group). *: Significant (P < 0.05). **: Highly significant (P < 0.01).*

Liver parameters

The present results (Table 5) show that total lipid, total cholesterol, cholesterol ester and triglycerides levels in the liver of rats given HCD-R and HCD-W seed-containing diets, are higher significant decrease than those received seed-free control diet over the feeding period (8 weeks). Insignificant decrease was detected in free cholesterol and phospholipids levels in liver of rats fed both HCD-R and HCD-W seed-containing diets as compared to those fed seed free-control diet over the feeding period (8weeks). Higher reduction in hepatic total lipid, total cholesterol, cholesterol ester and triglyceride levels were observed in rats given HCD-R and HCD-W seed-containing diets [1,10,67] reported the reduction of these parameters in liver was up to 33%. These results are in accordance to those reported by other workers [8,9,12]. On contrast other investigators [1,63,69] found elevated in the level of these hepatic lipid components, in sera of rats fed on some seed supplemented to the diet. Insignificant change was observed in the levels of free cholesterol and phospholipids in liver of rats given HCD-R and HCD-W seed-containing diets over the feeding period (8weeks). Similar results were reported by other investigators using different seeds [10,17,64].

Diets	Time In Weeks	Control diet group	Experimental diets	
			HCD-R diet group	HCD-W diet group
		Mean ± SE	Mean ± SE	Mean ± SE
Total lipid (mg/g)	2	20.80 ± 0.60	16.90 ± 0.20**	14.40 ± 0.60**
	4	22.40 ± 0.80	16.20 ± 0.66**	14.90 ± 0.40**
	6	24.80 ± 0.20	20.80 ± 0.80**	18.42 ± 0.20**
	8	28.96 ± 0.94	22.60 ± 0.90**	20.50 ± 0.80**
Total cholesterol (mg/g)	2	2.34 ± 0.10	1.90 ± 0.06**	1.36 ± 0.08**
	4	2.60 ± 0.20	1.64 ± 0.08**	1.40 ± 0.04**
	6	2.30 ± 0.10	1.40 ± 0.04**	1.08 ± 0.02**
	8	2.20 ± 0.22	1.20 ± 0.02**	1.02 ± 0.04**
Free-cholesterol (mg/g)	2	1.30 ± 0.10	1.22 ± 0.10	1.20 ± 0.20
	4	1.60 ± 0.20	1.48 ± 0.02	1.32 ± 0.10
	6	2.18 ± 0.40	1.40 ± 0.20	1.42 ± 0.18
	8	2.52 ± 0.40	1.60 ± 0.10	1.48 ± 0.20
Cholesterol ester (mg/g)	2	12.20 ± 0.10	10.40 ± 0.10**	10.90 ± 0.10**
	4	10.60 ± 0.20	10.60 ± 0.30**	10.40 ± 0.20**
	6	12.96 ± 0.30	10.90 ± 0.20**	10.20 ± 0.20**
	8	14.10 ± 0.28	12.04 ± 0.16**	12.08 ± 0.14**
Triglycerides (mg/g)	2	4.60 ± 0.20	3.40 ± 0.20**	3.20 ± 0.30**
	4	4.24 ± 0.40	2.86 ± 0.30**	2.56 ± 0.20**
	6	3.90 ± 0.20	2.98 ± 0.30**	2.84 ± 0.30**
	8	3.68 ± 0.40	2.60 ± 0.20**	2.30 ± 0.20**
Phospholipids (mg/g)	2	6.90 ± 0.90	6.44 ± 0.40	6.10 ± 0.64
	4	8.94 ± 1.10	8.28 ± 1.20	8.16 ± 1.18
	6	8.90 ± 1.04	8.60 ± 1.10	8.30 ± 0.98
	8	10.10 ± 1.42	8.90 ± 0.90	8.98 ± 1.04

Table 5: *Total lipid, total cholesterol, free cholesterol, cholesterol ester and phospholipid in liver of rats fed seed free- control and 2 experimental diets. (Mean values of 7 rats/each 2 weeks/group). *: Significant (P< 0.05). **: Highly significant (P < 0.01).*

Conclusion

It can be concluded the use of *Brassica napus* and *Eruca sativa* seeds in the diet (100g/kg diet) exhibited the higher significant decreases in sera and hepatic lipid components, suggesting that these seeds could be used as agents for protective and treatment of hyperlipidemia and coronary heart diseases. Moreover, *Brassica napus* and *Eruca sativa* seeds containing phytochemicals as polyphenols and fatty acids compounds that use regularly in consumed foods, may be reduce the risk of death from many diseases including cancer.

Bibliography

1. Moharib SA and Awad IM. "Antioxidant and hypolipidemic activities of Spinach (*Spinocia oleracea*) dietary fibre and polyphenol supplementation in rats fed a high cholesterol diet". *Advances in Nutrition and Food Science* 34 (2012): 14-23.
2. Kim MJ., *et al*. "Nutritional value, bioactive compounds and health benefits of lettuce (*Lactuca sativa* L.)". *Journal of Food Composition and Analysis* 49 (2016): 19-34.
3. Rufino MSM., *et al*. "Açaí (*Euterpe oleraceae*) 'BRS Pará': A tropical fruit source of antioxidant dietary fiber and high antioxidant capacity oil". *Food Research International* 44 (2011): 2100-2106.
4. Kujawski R., *et al*. "Diet based on oil of seeds of Brassica napus. Implications for the prevention and treatment of prostate diseases/ Dieta Na Bazie Oleju Z Nasion Brassica Napus. Implikacje W Prewenc". *Herpa Potanica* 60 (2014): 76-88.
5. Terpstra AHM., *et al*. "Hypocholesterolemic effect of dietary psyllium in female rats". *Annals of Nutrition and Metabolism* 44 (2000): 223-228.
6. Moharib SA. "Hypolipidemic effect of dietary fibre in rats". *Advances in Nutrition and Food Science* 28 (2006): 1-8.
7. Jiménez JP., *et al*. "Effects of grape antioxidant dietary fiber in cardiovascular disease risk factors". *The Journal of Nutrition* 24 (2008): 646-653.
8. Hervert-Hernández D., *et al*. "The contribution of fruits and vegetables to dietary intake of polyphenols and antioxidant capacity in a Mexican rural diet: Importance of fruit and vegetable variety". *Food Research International* 44 (2011): 1182-1189.
9. Moharib SA. "Studies on intestinal enzyme activity and nutritive values of dietary fibres in rats". *Bull. Fac. Agric Cairo University* 51 (2000): 431-446.
10. Jwanny EW., *et al*. "Biological evaluation of data waste dietary fibre and Endomycopsis fibuligera protein with rats". *Bioresource Technology* 56 (1996): 201-205.
11. Borchani C., *et al*. "Effect of drying methods on physico-chemical and antioxidant properties of date fibre concentrates". *Food Chemistry* 125 (2011): 1194-1201.
12. Gallaher CM., *et al*. "Cholesterol reduction by glucomannan and chitosan is mediated by changes in cholesterol absorption and bile acid and fat excretion in rats". *Journal of Nutrition* 130 (2000): 2753-2759.
13. Alireza G., *et al*. "The effect of total extract of Securigera securidaca L. seeds on serum lipid profiles, antioxidant status, and vascular function in hypercholesterolemic rats". *Journal of Ethnopharmacology* 126 (2009): 525-532.
14. Harvey AL. "Natural products in drug discovery". *Drug Discovery Today* 13 (2008): 894-901.
15. Goyal A., *et al*. "Flax and flaxseed oil: an ancient medicine and modern functional food". *Journal of Food Science and Technology* 59 (2014): 1633-1653.

16. Boivin D., *et al*. "Antiproliferative and antioxidant activities of common vegetables: A comparative study". *Food Chemistry* 112 (2009): 374-380.

17. Andrea S Rossi., *et al*. "Dietary chia seed induced changes in hepatic transcription factors and their target lipogenic and oxidative enzyme activities in dyslipidaemic insulin-resistant rats". *British Journal of Nutrition* 109 (2013): 1617-1627.

18. Maha I A., *et al*. "Anti-oxidant, anti-inflammatory and anti-cancer activities of avocado (Persea americana) fruit and seed extract". *Journal of King Saud University – Science* 30 (2018): 1-5.

19. Jukanti A K., *et al*. "Nutritional quality and health benefits of chickpea (Cicer arietinum L.)". *British Journal of Nutrition* 108 (2012): 11-26.

20. Park GH., *et al*. "Anticancer activity of the sfflower seeds (Carthamus tinctorius L.) through inducing cyclin D1 proteasomal degradation in human colorectal cancer cells". *The Korean Journal of Plant Resources* 29 (2016): 297-304.

21. Zia-Ul-Haq MS., *et al*. "Nutritional and compositional study of Desi chickpea (Cicer arietinum L.) cultivars grown in Punjab, Pakistan". *Food Chemistry* 105 (2007): 1357-1363.

22. Boyd LA., *et al*. "Assessment of the antigenotoxic, antiproliferative, and antimetastatic potential of crude watercress extract in human colon cancer cells". *Nutrition and Cancer* 55 (2006): 232-241.

23. Abd el Monem M., *et al*. "Anticarcinogenic effect of Raphanus sativus on 1, 2 Dimethyl hydrazine (DMH) induced colon cancer in rats". *The Egyptian Journal of Hospital Medicine* 51 (2013): 473- 486.

24. Moharib SA. "Antioxidant and anticancer activities of Carthamu stinctorius and Portulaca oleracea seed oils in vitro and in vivo using DMH- induced colon cancer rats". *EC Veterinary Science* 6 (2021): 15-31.

25. Popovic M., *et al*. "Effect of parsley (Petroselinum crispum (Mill.) Nym. ex A.W. Hill, Apiaceae) extracts on some biochemical parameters of oxidative stress in mice treated with CCl4". *Phytotherapy Research* 21 (2007): 717-723.

26. Shyamapada M and Manisha M. "Coriander (Coriandrum sativum L.) essential oil: Chemistry and biological activity". *Asian Pacific Journal of Tropical Biomedicine* 5 (2015): 421-428.

27. Bostancioˆglu R B., *et al*. "Assessment of anti-angiogenic and anti-tumoral potentials of Origanum onites L. essential oil". *Food and Chemical Toxicology* 50 (2010): 2002-2008.

28. Yu JQ., *et al*. "Anticancer, antioxidant and antimicrobial activities of the essential oil of LycopuslucidusTurcz.var. hirtus Regel". *Food Chemistry* 126 (2011): 1593-1598.

29. Chenni A., *et al*. "Effect of aqueous extract of Ajuga iva supplementation on plasma lipid profile and tissue antioxidant status in rats fed a high-cholesterol diet". *Journal of Ethnopharmacology* 109 (2007): 207-213.

30. Choedon T., *et al*. "Chemopreventive and anti- cancer properties of the aqueous extract of flowers of Buteamonosperma". *Journal of Ethnopharmacology* 129 (2010): 208-213.

31. Moharib SA and Tadrus PH. "Anticancer and cytotoxic activities of the produced seed oils against various cancer cell lines". *Palgo Journal of Medicine and Medical Science* 1 (2020): 1-18.

32. Zeng YW., *et al*. "Strategies of functional food for cancer prevention in human being". *Asian Pacific Journal of Cancer Prevention* 14 (2013): 1585-1592.

33. Chen H and Liu RH. "Potential mechanisms of action of dietary phytochemicals for cancer prevention by targeting cellular signaling transduction pathways". *Journal of Agricultural and Food Chemistry* 66 (2018): 3260-3276.

34. Dwivedi C., *et al*. "Chemopreventive effects of dietary mustard oil on colon tumor development". *Cancer Letters* 196 (2003): 29-34.

35. Reyes-Caudillo E., *et al*. "Dietary fibre content and antioxidant activity of phenolic compounds present in Mexican chia (Salvia hispanica L.) seeds". *Food Chemistry* 107 (2008): 656-663.

36. Mukherjee K., *et al*. "Advances in cancer therapy with plant based natural products". *Current Medicinal Chemistry* 8 (2001): 1467-1486.

37. Cartea ME., *et al*. "Phenolic compounds in Brassica vegetables". *Molecules* 16 (2010): 251-280.

38. El Hilaly J., *et al*. "Acute and chronic toxicological studies of Ajuga iva in experimental animals". *Journal of Ethnopharmacology* 91 (2003): 43-50.

39. Ayaz FA., *et al*. "Phenolic acid contents of kale (Brassica oleraceae L. var. acephala DC.) extracts and their antioxidant and antibacterial activities". *Food Chemistry* 107 (2008): 19-25.

40. AOAC. Official Methods of Analysis of the Association of Official Analytical Chemists". 19th Editionn., Association of Official Analytical Chemists, Washington, DC., USA (2012).

41. Dubois M., *et al*. "Colorimetric method for determination of sugars and related substances". *Analytical Chemistry* 28 (1956): 350-356.

42. Lowry OH., *et al*. "Protein measurement with the Folin phenol reagent". *Journal of Biological Chemistry* 193 (1951): 256-275.

43. Folch J., *et al*. "A simple method for the isolation and purification of total lipids from animal tissue". *Journal of Biological Chemistry* 226 (1957): 497- 509.

44. Pantis DJ., *et al*. "Altitudinal variation in total lipid and soluble sugar content in herbaceous plants on mount Olympus (Greece)". *Vegetatio* 72 (1987): 21-25.

45. Singleton VL., *et al*. "Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin- Ciocalteu reagent". *Methods in Enzymology* 299 (1999): 152-178.

46. Nabavi SM., *et al*. "Determination of antioxidant activity, phenol and flavonoids content of Parrotia persica". *Mey Pharmacology online* 2 (2008): 560-567.

47. Zhishen H., *et al*. "The determination of flavonoid contents in mulberry and their scavenging effects on superoxide radicals". *Food Chemistry* 64 (1999): 555-559.

48. Johnson IT and Gee JM. "Gastrointestinal adaptation in response to soluble non-available polysaccharides in the rat". *British Journal of Nutrition* 55 (1986): 497-505.

49. Council of European Communities. Council instructions about the protection of living animals used in scientific investigations. Official Journal of the European Communities (JO 86/609/CEE) L 358 (1986): 1-18.

50. Knight JA., *et al*. "Chemical basis of the sulfophos-phovanillin reaction for estimating total serum lipids". *Clinical Chemistry* 18 (1972): 199-202.

51. Trinder P. "Simple turbidimetric method for the determination of serum cholesterol". *Annals of Clinical Biochemistry* 6 (1969) 165-166.

52. Lopes-Virella MF., *et al*. "Cholesterol determination in high-density lipoprotein separated by three different methods". *Clinical Chemistry* 23 (1977): 582-584.

53. Takayama M., *et al*. "A new enzymatic method for determination of serum choline containing phospholipids". *Clinica Chimica Acta* 79 (1977): 93-95.

54. Wybenga DR and Inkpen JA. "In: Editors (editions) "Principle and Technics" 2nd Edition. Harper and Row Publishers, New York, San Francisco and London (1979): 1421.

55. Fisher RA. "Statistical method for research workers, Edinburg et. 14, Oliver and Boyd (1970): 140-142.

56. Ahmadzadeh S., *et al*. "Investigation of oil properties and seed composition in some safflower lines and cultivars". *Journal of Food Biochemistry* 38 (2014): 527-532.

57. Delfan-Hosseini S., *et al*. "Effect of extraction process on composition, oxidative stability and rheological properties of purslane seed oil". *Food Chemistry* 222 (2017): 61-66.

58. Alam Z. "Phenolic profile and antioxidant potential of wild watercress (Nasturtium officinale L.)". *Zeb Springer Plus* 4 (2015): 714-721.

59. Guo G., *et al*. "Antioxidant and Antiproliferative Activities of Purslane Seed Oil". *Journal of Hypertension* 5 (2016): 1-6.

60. Takadas F and Doker O. "Extraction method and solvent effect on safflower seed oil production". *Chemical Engineering Research and Design* 51 (2017): 9-17.

61. Feng D and Zuo J. "Nutritional and anti–nutritional composition of rapeseed meal and its utilization as a feed ingredient for animal. Guangzhou: College of Animal science, South China Agricultural University (2003): 265.

62. Gill CI., *et al*. "Watercress supplementation in diet reduces lymphocyte DNA damage and alters blood antioxidant status in healthy adults". *The American Journal of Clinical Nutrition* 85 (2007): 504-510.

63. Taraz Z., *et al*. "Effects of Replacement of Soybean Meal with Rapeseed Meal on Organs Weight, Some Blood Biochemical Parameters and performance of Broiler chicks". *International Journal of Poultry Science* 5 (2006): 1110-1115.

64. Wondimagegne B., *et al*. "Feeding Detoxified Ethiopian mustard (Brassica carinata) seed cake to sheep: Effect on intake, digestibility, live weight gain and carcass parameters". *Scientific Journal of Animal Science* 5 (2016): 346-352.

65. Piotr K., *et al*. "Chemical composition of rapeseed products and their use in pig nutrition". *Polish Journal of Natural Sciences* 31 (2016): 545-562.

66. Choi H.B., *et al*. "Influence of rapeseed meal on growth performance, blood profiles, nutrient digestibility and economic benefit of growing finishing pigs". *Asian-Australasian Journal of Animal Sciences* 28 (2015): 1345-1353.

67. Bennami-Kabochi NH., *et al*. "Therapeutic effect Olea europea var. Oleaster leaves on lipid and carbohydrate metabolism in obese and prediabetic sand rats (Psammomys obesus)". *Annales Pharmaceutiques Françaises* 58 (2000): 4271-4277.

68. Aires A., *et al*. "Phytochemical characterization" (2013).

69. Kozłowska H., *et al*. "Bioactive compounds in rapeseed sprouts". *Oilseed Crops* 24 (2003): 31-39.

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