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Dietary effect of some plants on liver functions and lipid profile in experimental animals

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SUMMARY

The effect of some plants on liver function and lipid profile was investigated. Fourty male albino rats, Sprague Dawley strain were used. The rats were divided into five groups of eight rats each with similar 156-158g.mean total weight. The rats were fed the experimental diets at 14% protein level with different types of tested plants (chicory, sonchus and moringa) for four weeks. Food and water were provided ad-libitum. At the end of the experiment, rats were sacrificed under ether anesthesia and blood sample was taken from hepatic portal vein from each rat. Blood samples were subjected to the determination of serum and liver lipid profile, serum ALT, AST, ALP, MDA and erythrocyte –SOD .The results indicated that different types of tested plants had a great effect in all parametars studied. The lowest mean value for serum total lipids, triacylglycerols, total cholesterol and VLDL- cholesterol was found in group of rats fed high fat and high cholesterol diet (HFC. diet and moringa leaves) as compared with positive control group fed HFC. diet. But the lowest mean value for serum LDL-cholesterol and highest mean value for serum HDL- cholesterol was found in group of rats fed (HFC diet and sonchus) as compared with positive control group. While lipid pattern in liver showed a significant decrease in group of rats fed (HFC diet and moringa leaves) as compared with positive control group and other plant groups. Also, the lowest mean value in serum ALT, AST, ALP and MDA was found in group of rats fed (HFC diet and sonchus), but the highest mean value in erythrocyte-SOD was found in group of rats fed (HFC diet and sonchus) as compared with positive control group.

INTRODUCTION

Consuming a diet rich in plant foods will provide the body with a million of photochemical that have been associated with protection from chronic diseases. The presence of photochemical, in addition to vitamins and provitamins in fruits and vegetables has been recently considered of crucial nutritional importance in the prevention of chronic disease such as cancer, cardiovascular disease and diabetes. (chu et al., 2002). The leaves of moringa oleifera is claimed to posses cholesterol reducing effect and is used to treat patients with heart diseases and obesity in India (Ghasi et al., 2000).

Moringa oleifera leaves are eaten as vegetables without any side effects being reported. These leaves are also eaten commonly as a food by infants and children in South India, because the high content of β-carotenes helps to prevent the development of vitamin A deficiency as blindness. Also, roots are used as a substitute for horse radish. (Vlahov et al., 2002).

Moringa leaves were rich in vitamins A and C and were considered to be useful in catarrhal afflictions. They are also rich in amino acids including aspartic acid, glutamic acid, serine, glycine, threonine, α-alanine, valine, leucine, isoleucine, histidine, lysine, cystine, methionine, arginine and tryptophan. (Anwar and Bhanger, 2003). Chicory is known botanically as Chichorium intybus. Chicory seeds contain cellulose, nitrogenous matter and fat. Roots contain latex, minerals, mucilage and inulin. Inulin is the major component of chicory root and is a polymer of fructose with β-(2-1) glycosidic linkages. Also, chicory roots contain reducing sugars and sucrose (Siddhuraju and Becker, 2003).

Flowers contain glucoside cichorin, bitter principle lactucin, lactupicrin, betaine, choline, tannin, rutin, flavonoids and alkaloids. The levels of the sesquiterpene lactones (lactucin, lactupicrin and 8- deoxy lactucin) and the hydroxyl coumarin cichorriin were found to be the highest in the most activity growing regions of the chicory plant. From leaf extract, cyanidin-3-o-(6-o-malonyl-β-D-glucoside), quercetin-3-o-β-D-glucoside, several coumarin and cinnamic acid derivatives such as chicoric acid, caffeic acid and chlorogenic acid have been found (Chevallier,1996 and Norbaek et al., 2002). Cichoriin – 6 ' – p - hydroxyphenyl acetate, a new natural product, was isolated from chicory leaves (Kisiel and Michalska , 2002). Heibatollah, et al., (2008) who confirmed the hepatoprotective activity effect of the hydroalcholic extract of cichorium intybus on carbon tetrachloride induced liver damage in rats. .Su et al., (2002) and. Cambie, and Ferguson, (2003) reported that annual sow thistle is the

common name of Sonchus oleraceus.. Shoots and leaves are used as green vegetables. Leaves, contains high amount of vitamine C, sterols, caoutchouc and various phenolies.

MATERIAL AND METHODS

Materials: The present experiment was designed to study the effect of feeding chicory (Chichorium intybus) sonchus (Sonchus oleraceus, Sow thistle and milk thistle) and moringa (oil of ben tree, horse radish tree and habbah ghaliah) in dried form on serum and liver lipids in rats. Chicory and sonchus were washed with tap water several times and left to stand for 3 hours in the strainer. Plants were cut into small pieces, spread out in single layer on filter papers and allowed to dry at room temperature for 3 hours. Leaves of moringa tree were used only, cut and washed with tap water, strained then allowed to dry at room temperature .After that, these plants were dried in preheated air oven with fan at $100C^0$for 15 min., then temperature was lowered at $50C^0$ for 24 hour, then crushed by grinder and stored in plastic container at -$20C^o$ until used for preparation of the experimental diets.

Chemical analysis: Dried samples of chicory, sonchus, moringa leaves, were subjected to chemical analysis. Moisture, ash and total fiber contents were determined according to the A.O.A.C., (1980). Total protein was determined using macro-kjeldahl method and crude fat was determined using soxhelet method according to Pearson, (1991).Soluble carbohydrates content of these plants was calculated by the following : Soluble carbohydrates % = 100 – (protein% +fat %+fiber% +ash and moisture%).

BIOLOGICAL EXPERIMENT:

1- Diets: Casine was added at 14% level in all groups according to Reeves et. al., (1993), Inaddition the other ingredients of standard diet was prepared from fine ingredients per 100g. as the following:10% corn oil , 5% fiber, 3.5% salt mix.,1% vit.mix.,choline choliride 0.20% ,Dl-methionine 0.3% and starch to complete 100g according to the AIN, (1977.). .The high fat and high cholesterol diet was prepared by modifying standard diet to enhance the elevation of serum cholesterol and total lipid concentrations, as shown in table (1).

2- Animals: Adult male albino rats, Sprague Dawley strain with an average weight of 156 g. to 158g were used. Animals were kept in cylindrical wire-mesh cages. The stock diet was introduced to the rats in special feed cups to avoid scattering of feed for one week as a period of adaptation .Also feed and water were provided ad-libitum. Food consumption and animal weight were recorded twice a week. At the end of the

experiments, rats were sacrificed under ether anesthesia and blood sample was taken from hepatic portal vein from each rat in a centrifuge tube. Blood samples were placed in water bath at $37C^0$ to enhance clotting of blood and centrifuged at 3000 rpm for 20 min. to separate serum then kept in glass vial at-$20C^o$ until analysis. Liver was excised immediately, washed in cold saline solution (0.9% Nacl), blotted,weighed and stored at -$20C^o$ until analysis.

Table (1): Composition of the experimental diets (g/Kg diet).

Group	1	2	3	4	5
Ingredient	Negative control	Positive control	Chicory	Sonchus	Moringa
Casein (84%protein)	166.60	166.60	147.80	147.70	132.80
Sucrose	100.0	100.00	100.00	100.00	100.00
Corn oil	100.00	100.00	100.00	100.00	100.00
Hump fat(10%0)	-	100.00	100.00	100.00	100.00
Fiber (Cellulose)	50.00	-	30.14	32.00	36.34
Salt mix.	35.00	35.00	35.00	35.00	35.00
Vit. mix.	10.0	10.00	10.00	10.00	10.00
Choline chloride	2.00	-	-	-	-
DL-methionine	3.00	-	-	-	-
Cholesterol(1%)	-	10.00	10.00	10.00	10.00
Dried Chicory (10%)	-	-	100.00	-	-
Dried sonchus (10%)	-	-	-	100.00	-
Dried moringa leaves (10%)	-	-	-	-	100.00
Corn starch	533.40	478.40	367.10	365.30	475.86

Composition of salt mix. (g/kg mix.).

Ca HPO_4, 500; Nacl , 74; K citrate monohydrate ,220; k_2so_4,52; MgO,24; Mn carbonate, 3.5; Fe citrate ,6, Zn-carbonate,1.6; Cu-carbonate, 0.3 ; KIO_3, 0.01; $Na_2SeO_3.5\ H_2O$, 0.01;$CrK(SO_4)_2$.12

H_2O, 0.55 and glucose to complete 1000g according to the AIN,(1977).

-Composition of vitamin mix.(Per Kg mix.)

Thiamin Hcl, 60Omg; Riboflavin,600mg; Pyridoxine Hcl,700mg ; Nicotinic acid , 3g ; Ca-pantothenate ,1.6 g ; Folic acid,200mg;Biotin,20mg;vit.B_{12},1 mg ; vit. A, 400000 IU;vit.E,5000 IU;vit.D_3,100000 IU;vit.K,5mg; and glucose to complete 1000 g according to the AIN,(1977).

The groups of rats are: **Group 1**) Negative contro: Fed standard diet containing casein at 14% (84%protein) **Group 2:** Fed high fat and high cholesterol (HFC) diet (Positive control). **Group 3:** Fed HFC diet +10% dried chicory **Group 4:** Fed HFC diet +10% dried sonchus **.Group 5:** Fed HFC diet +10% dried moringa leaves.

BIOCHEMICAL ANALYSIS:

Serum and liver total lipids were determined by to Frings and Dunn, (1970) and total cholesterol was determined by enzymatic colorimetric method according to Richmond, (1973).Serum HDL-cholesterol was determined by using precipitating reagent according to Lopes-Virella et al., (1977).Serum LDL-cholesterol was calculated according to Friedewald et al., (1972) .Serum VLDL-cholesterol concentration was calculated according to Friedewald et al., (1972) by the following equation:

Serum VLDL-cholesterol concentration (mg/dl=Triacylglycerols/5)

Serum and liver triacylglycerols were determined by enzymatic colorimetric method according to Fossati and Prencipe (1982). Extraction of lipids from liver according to —Bligh and Dyer, (1959). S-ALT and S-AST were determined according to Reitman and Frankle,(1957). Serum alkaline phosphatase was determined by kinetic method according to Rec-GSCC,(1972).The lipid peroxidation level was monitored by determing the end products of lipid peroxidation, (MDA) by the (TBA) method according to Draper and Hadley, (1990). Erythrocyte-Superoxide Dismutase (SOD) was calculated as described by Winterbourne et al., (1975).

SOD (Units/ml blood) =% of inhibition x 6.34

Statistical Analysis: The data were subjected to statistical analysis using one way classification and least .significant differences (L.S.D) according to (Snedecor and Cochran, 1980).

RESULTS

Table (2) shows the proximate analysis for dried chicory, sonchus, moringa leaves. It was found that moringa leaves contain the highest percentages of protein (33.80 g%) and ash (14.20g%). But chicory contains the highest percentages of crude fiber

(19.86g%) and sonchus contains the highest percentages of moisture (13.4 g. %).These variations may be due to the different types of plants, and various conditions of cultivation and climates.

I: BIOCHEMMICAL RESULTS:

Table (3) and figures (1, 2 and 3) represent the values of serum total lipids, triacylglycerols and total cholesterol of male rats fed the experimental dietary plants. The data showed highly significant differences in lipid pattern between groups of rats fed the experimental dietary plants and positive control group ($P<0.01$). Also experimental dietary plant groups showed a decrease in all parameter of lipid than positive control group. The lowest mean values were observed in group of rats fed HFC diet and moringa leaves ranged from 426.00 to 430.00 mg /dl (mean ± S.E, 428.50 ± 0.654) ;129.98 to 133.12 mg/dl(mean ± S.E, 131.36 ±0.396) and 93.99 to 97.81 mg /dl (mean ±S.E,96.00±0.501) for total lipids, triacylglycerols and total cholesterol respectively .

Table (4) and figures (4, 5 and 6) show the effect of experimental dietary plants on serum VLDL-, LDL- and HDL- cholesterol .There were highly significant difference in serum VLDL-, LDL-, and HDL- cholesterol for all groups fed dietary plants ($P<0.01$). The lowest mean values for serum VLDL-cholesterol were found in group of rats fed HFC diet and moringa leaves ranged from 25.99 to 26.62 mg/ dl (mean ± S.E, 26.27 ±0.079) as compared with positive control group. Table (4) and figure (5) also show that the lowest mean values for serum LDL-cholesterol were found in group of rats fed HFC diet and sonchus ranged from 23.14 to 26.32 mg/ dl (mean ± S.E, 24.37± 0.398) as compared with positive control group. But, the highest mean values for serum HDL-cholesterol were found in group of rats fed HFC diet and sonchus ranged from 45.05 to 48.16 mg /dl (mean ± S.E, 46.80±0.395) as compared with positive control group.

Table (5) and figures (7, 8 and 9) show the effect of the experimental dietary plants on liver total lipids, triacylglycerols and total cholesterol. There were highly significant differences in liver total lipids, triacylglycerols and total cholesterol for all groups of rats ($P<0.01$). The lowest mean values for liver total lipids were found in group of rats fed HFC in moringa leaves and ranged from 29.80 to 31.20 mg / g tissue (mean ± S.E, 30.60±0.217) as compared with positive control group.

Positive control group had the highest mean values in liver total lipids [45.40 to 47.20 mg / g tissue (mean ± S.E, 46.17 ± 0.225)]. From table (5) and figure (8), it is clear that the lowest mean values for liver triacylglycerols were found in group of rats fed HFC diet moringa leaves and ranged from 12.60 to 13.20 mg /g tissue (mean ±S.E, 12.90± 0.084) as compared with

positive control group which had the highest mean values and ranged from 20.80 to 21.60 mg/ g tissue (mean ±S.E, 21.19 ± 0.106). But, liver total cholesterol showed the lowest mean values in group of rats fed HFC diet and moringa leaves and ranged from 7.90 to 8.50 mg /g tissue (mean ±S.E ,8.24± 0.084) as compared with positive control group which had the highest mean values and ranged from 13.80 to 15.20 mg/ g tissue (mean ±S.E, 14.45 ± 0.202).

Table (6) and figures (10, 11 and 12) show the effect of the experimental dietary plants on serum ALT, AST and ALP. There were highly significant differences in serum-ALT, AST and ALP between groups of rats fed the experimental dietary plants (P<0.01). Group of rats fed HFC diet and sonchus showed highly significant decrease in serum –ALT [16.60 to 18.60 U / L (mean ± S.E, 17.67± 0.240)] ; serum AST [29.90 to 32.40 U / L (mean ± S.E, 31.34 ±0.295)] and serum- ALP [136.50 to 139.20 U / L (mean ± S.E, 137.77 ±0.341)] when compared to positive control group which had the highest mean values [23.60 to 25.40 U / L (mean ± S.E, 24.54 ±0.223) for serum- ALT; 40.60 to 44.40 U / L (mean ± S.E, 42.62± 0.522) for serum-AST and 155.80 to 162.60 U / L(mean ± S.E, 158.41± 0.768) for serum – ALP].

Table (7) and figures (13 and 14) show the effect of the experimental dietary plants on serum malondildehyde (MDA) and erythrocyte- superoxide dismutase (SOD). There were highly significant differences in serum MDA and erythrocyte-SOD for all groups fed different types of plants (P<0.01). The lowest mean values for serum MDA were found in group of rats fed HFC diet and sonchus and ranged from 1.61 to 1.72 U mol/L(mean ±S.E, 1.68± 0.013) as compared with positive control group which had the highest mean values 3.87 to 3.98 U mol/L (mean ±S.E, 3.93 ± 0.015) . Table (7) and figure (14) also showed that the highest mean values in erythrocyte- SOD were found in group of rats fed HFC diet and Sonchus as copared with positive control group.

DISCUSSION: The experiment indicated that; there was a highly significant decrease in serum total lipids among experimental dietary groups as compared with positive control group (P<0.01). The highest decrease was found in group of rats fed on high fat and high cholesterol diet (HFC) and dried noringa leaves (428.50 ± 0.0654mg/dl) among group of rats fed experimental diets as shown in table (3) and figure (1). This reduction in serum total lipids may be due to presence of dietary fibers and phytochemical compounds which act as powerful antioxidants in these plants. These results agree with the study of Kirby et al., (1981), who stated that dietary fiber can lower serum total lipids, particularly in hypercholesterolemic patients. The effect is

variable and probably depends on the type of fiber ingested. The present study indicated that there were highly significant differences in serum triacylglycerols between experimental dietary groups and positive control group (P<0.01). There was a highly significant decrease in serum triacylglycerols among experimental dietary groups .The highest decrease of mean value for serum triacylglycerols among groups fed experimental diets was found in group of rats fed HFC diet and dried moringa leaves (131.36 ± 0.396mg/dl) as compared with positive control group (160.13 ± 0.507 mg/dl) (table 3) and figure (2) .

The reduction in serum triacylglycerol concentrations may be due to insoluble fiber as shown in the study of Anderson et al., (1994). Bakry, (2002) studied; the effect of carrots, cabbage and cauliflower on serum lipids of rats fed high cholesterol diet .It is clear that carrots, cabbage and cauliflower were found to reduce serum triacylglycerol content in all treated groups as compared to positive control which had the highest mean value in serum triacylglycerols .This effect of carrots, cabbage and cauliflower may be due to its dietary fiber, vegetable protein and other components which play a great role in reduction serum lipid. The present study indicated that there were highly significant differences in serum total cholesterol between experimental dietary groups (P<0.01) as shown in tables (3) and figures (3). It was clear that serum total cholesterol of positive control rats increased significantly as compared to the other groups of rats. The highest decrease in serum total cholesterol concentration was found in group of rats fed (HFC) diet and dried moringa (96.00±0.501 mg/dl) among group of rats fed experimental diets as compared with positive control group (124.53±0.527 mg/dl) (table 3 and figure 3).

The reduction in serum total cholesterol concentrations was associated with reduction in serum very low density lipoproteins (VLDL)-and low density lipoproteins (LDL)- cholesterol with increasing concentration of serum high density lipoproteins (HDL)- cholesterol as shown in tables (4) and figures (4,5,6) among experimental dietary groups when compared with positive control group (P<0.01). Positive control group had the highest mean values for serum VLDL- and LDL- cholesterol (32.03±0.102 and 62.22±0.513 mg/dl, respectively); also it had the lowest mean value for serum HDL-cholesterol (30.29±0.230 mg/dl) among group of rats fed experimental diets as compared with negative control group which had the lowest mean values for serum VLDL- and LDL- cholesterol (24.098 ± 0.060 and 12.06 ± 0.517 mg/dl, respectively) , and the highest mean value for serum HDL-cholesterol (51.52±0.315mg/dl). Also group of rats fed (HFC)diet and dried

sonchus had the lowest mean values for serum VLDL- and LDL- cholesterol (26.49±0.082 and 24.37±0.398 mg/dl, respectively), and the highest mean value for serum HDL - cholesterol (46.80±0.395mg/dl) among group of rats fed experimental dietary plants [table (4) and figures (4,5and 6)]. Where, Saluja et al., (1978) isolated β-sitosterol from the stem of a hybrid variety of *moringa oleifera*. Beta (β) - sitosterol is a plant sterol with a structure similar to that of cholesterol, except for the substitution of an ethyl group at C_{24} of its side chain. It is believed that it lowers cholesterol by lowering plasma concentrations of LDL-cholesterol.Therefor β-sitosterol may be a bioactive phytoconstituent in the leaves of *moringa oleifera*. (Ghasi et al., 2000). Kim and Shin, (1998) were studied the effect of chicory extract or inulin on serum cholesterol in rats for four weeks .Their results found that serum total cholesterol were lowered in group of rats fed chicory or inulin but not significant. Also, serum HDL- cholesterol concentration was significantly higher in rats fed chicory extract and inulin, and LDL-cholesterol concentration was lower in rats fed inulin than in control.Therfore, the ratio of HDL/LDL-cholesterol was significantly higher in rats fed chicory extract and inulin than in control. The results indicated that the improved lipid metabolism was observed in rats fed chicory extract (mainly inulin component) may be caused by an alternation in the absorption and/or synthesis of cholesterol, which might result from the changes in cecal fermentation and by an increase in fecal excretion of lipid, cholesterol and bile acids.

A study by Ghasi et al., (2000) found that crude extract of *moringa oleifera* leaves had a significant lower effect on serum cholesterol concentration compared to the high-fat fed group .This reduction may be due to presence of plant sterol. Volpe et al., (2001) studied the effects of yoghurt enriched with plant sterol on serum lipids in patients with moderate hypercholesterolaemia. Their results indicated that the yoghurt enriched with plant sterols significantly reduced serum total cholesterol and LDL-cholesterol levels and LDL- cholesterol : HDL- cholesterol ratio .They concluded that a low-fat yoghurt-based drink moderately enriched with plant sterols may lower total cholesterol and LDL-cholesterol effectively in patients with primary moderate hypercholesterolaemia.

Also a study by Tapola et al., (2004) was done to investigate the effect of plant sterol and ,mineral (calcium,magnesium,and potassium) enrichment in low fat and low-salted meat products compared with control meat products, on serum total cholesterol and lipoprotein lipids in subjects with mildly to moderately increased serum cholesterol

concentration .Their results found that the meat products enriched with non-esterified tall oil-derived plant sterol decreased the serum cholesterol by 4.9% and the LDL-cholesterol by 4.6% compared with the control meat products without added plant sterols .The cholesterol lowering property of plant sterols is based on the inhibition of absorption of both biliary and dietary cholesterol from the small intestine. Thus, the plant sterol- enriched products are offering a new avenue in the dietary management of elevated serum cholesterol concentrations.

The results of the present study indicated that; there were highly significant differences in liver total lipids, TG and TC between the experimental dietary groups (P<0.01). In groups fed dried plants, the lowest mean values were found in group of rats fed dried moringa (30.60±0.127mg/g tissue, 12.90±0.084mg/g tissue and 8.24±0.084mg/g tissue) for liver TL, TG and TC , respectively as compared with positive control group (46.09±0.225, 21.19±0.106 and 14.45±0.202mg/g tissue) [table (5) and figures(7,8 and 9)] Ara, et al.,(2008), they revealed that the leaves extracts of moringa oleifera with atenolol has got profound hyperlipidemic activity in adrenaline induced rats and lowering of blood glucose ,heart and body weight .

The results in **(Table 6)** illustrated that there were highly significant differences in serum ALT, AST and ALP between the experimental dietary groups (P<0.01). The highest increase in serum ALT, AST and ALP was found in positive control group (24.54± 0.223 U/L, 42.62± 0.522 u/l and 158.41±0.768 U/L, respectively) as compared with the other groups of rats. The lowest mean values were found in group of rats fed (HFC) diet and dried sonchus (17.67±0.240 U/L, 31.34±0.295 U/L and 137.77±0.341 U/L)for serum ALT,AST and ALP, respectively in groups fed dried plants as compared with positive control group [table 6 and figures (10, 11 and 12)

The present study indicated that there were highly significant differences in serum MDA level between experimental dietary groups and positive control group (P<0.01). Positive control group had the highest mean value for serum MDA level (3.93±0.015 U mol/L) as compared with the other groups. The highest decrease (by 57.2%) of mean value for serum MDA level among groups fed dried plants was found in group of rats fed (HFC) diet and dried sonchus (1.68 ±0.013 U mol/L) as compared with positive control group (table 7 and figure 13). Also, these results illustrated that there were highly significant differences in erythrocyte-SOD activity between experimental dietary groups and positive control group (P<0.01). The lowest mean value for erythrocyte-SOD was found in positive control group (281.12± 4.118 Units/ml blood) as

compared with the other groups. The highest increase (by 114.8%) of mean value for E-SOD among groups fed dried plants was found in group of rats fed (HFC) diet and dried sonchus (604.04 ± 3.638 Units/ml blood) as compared with positive control group (table 7and figure 14).

CONCLUSION:

The test plants are rich of protein ash, fiber and photochemical that has been associated with protection from chronic diseases such as cancer, cardiovascular diseaseand diabetes.Moringa leaves contain the higest percentage of protein (33.8g.%) and ash (14.20g.%).But chicory contains the highest percentages of crude fiber (19.86g %)

Chicory is a bushy perennial herb with blue or lavender flowers. The roots are baked, ground, and used as a coffee substitute.

Moringa Leaves are full of essential disease-preventing nutrients:

- Vitamin A, which acts as a shield against eye disease, skin disease, heart ailments, diarrhea, and many other diseases.
- Vitamin C, fighting a host of illnesses including colds and flu.
- Calcium, which builds strong bones and teeth, and helps prevent osteoporosis.
- Proteins, the basic building blocks of all our body cells.
- Potassium, essential for the functioning of the brain and nerves

TABLES AND FIGURES:

Table (2) : Proximate analysis of the experimental dried plants (g/100g)

Types of plants	Moisture	Protein	Fat	Fiber	Ash	arbohydrates
Chicory	12.20	18.80	3.05	19.86	12.62	33.47
Sonchus	13.45	18.90	2.36	18.10	11.79	35.40
Moringa leaves	9.50	33.80	2.90	13.66	14.20	25.94

Table (3) : Effect of the experimental dietary plants on serum total lipids, triacylglycerols and total cholesterol (mean ±S.E)

Parameters	Groups					
	(1) Standard diet Negative control	(2) HFC diet Positive control	(3) HFC diet + Chicory	(4) HFC diet + Sonchus	(5) HFC diet + Moringa leaves	P
Serum TL (mg/dl)		a	b	b	b	
Range	383.00-395.00	525.00-532.00	435.00-441.00	428.00-432.00	426.00-430.00	**
Mean ±S.E	388.12±1.394	528.25±0.881	437.75±0.796	429.62±0.497	428.50±0.654	
Serum TG (mg/dl)		a	b	b	b	
Range	119.45-122.01	158.11-161.59	141.94-143.61	131.05-134.11	129.98-133.12	**
Mean ±S.E	120.49±0.301	160.13±0.507	143.43±0.443	132.45±0.412	131.36±0.396	
Serum TC (mg/dl)		a	b	b	b	
Range	86.18-89.14	122.50-126.04	106.60-110.96	96.54-98.96	93.99-97.81	**
Mean ±S.E	87.68±0.327	124.53±0.527	108.50±0.591	97.66±0.364	96.00±0.501	

** :P<0.01

a= Highly significant increase when compared to negative control group

b= Highly significant decrease when compared to positive control group

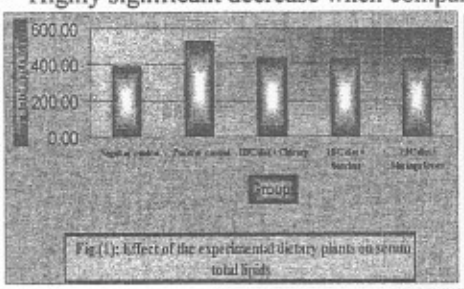

Fig.(1): Effect of the experimental dietary plants on serum total lipids

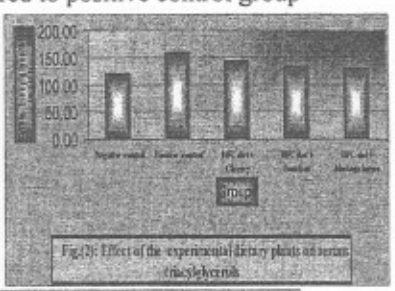

Fig.(2): Effect of the experimental dietary plants on serum triacylglycerols

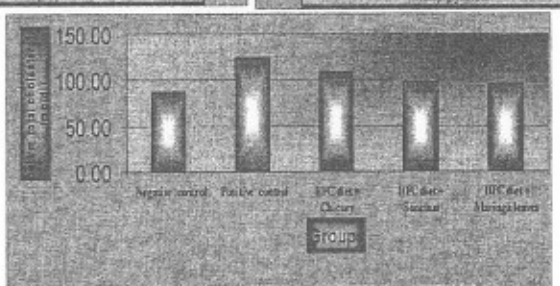

Fig.(3): Effect of the experimental dietary plants on Serum total cholesterol

Table (4) : Effect of the experimental dietary plants on serum VLDL-,LDL- and HDL- cholesterol (mean ±S.E)

Parameters	Groups					
	(1) Standard diet Negative control	(2) HFC diet Positive control	(3) HFC diet + Chicory	(4) HFC diet + Sonchus	(5) HFC diet + Moringa leaves	P
S- VLDL - C (mg/dl) Mean ±S.E	24.098±0.060	a 32.03±0.102	b 28.68±0.088	b 26.49±0.082	26.27±0.079	
LDL-C (mg/dl) Range	10.44-14.34	60.24-64.15	38.12-42.22	23.14-26.32	30.36-32.86	**
Mean ±S.E	12.06±0.517	62.22±0.513	39.78±0.514	24.37±0.398	31.29±0.336	
S- HDL -C (mg/dl)		c	d	d		
Range	50.40-53.01	29.57-30.96	38.91-41.12	45.05-48.16	37.64-39.11	**
Mean ±S.E	51.52±0.315	30.29±0.230	40.03±0.238	46.80±0.395	38.45±0.198	
LDL/HDL Ratio	0.234	2.050	0.994	0.521	0.814	

** :P<0.01

a= Highly significant increase when compared to negative control group

b= Highly significant decrease when compared to positive control group

Highly significant decrease when compared to negative control

c= group

d= Highly significant increase when compared to positive control group

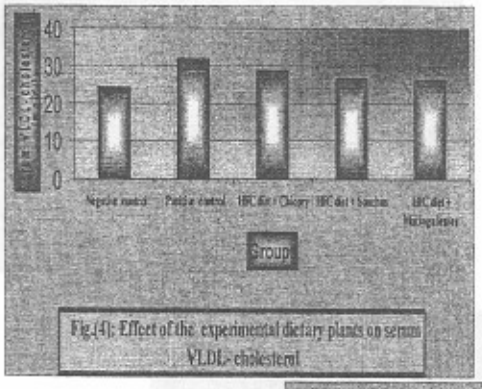

Fig.(4): Effect of the experimental dietary plants on serum VLDL- cholesterol

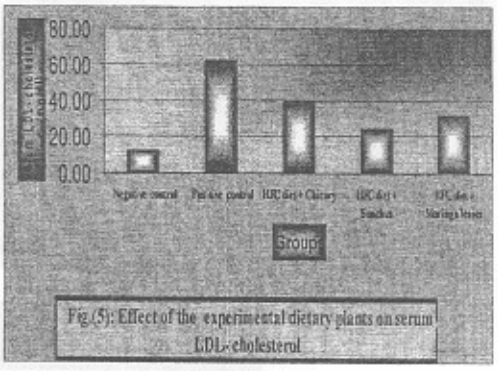

Fig.(5): Effect of the experimental dietary plants on serum LDL- cholesterol

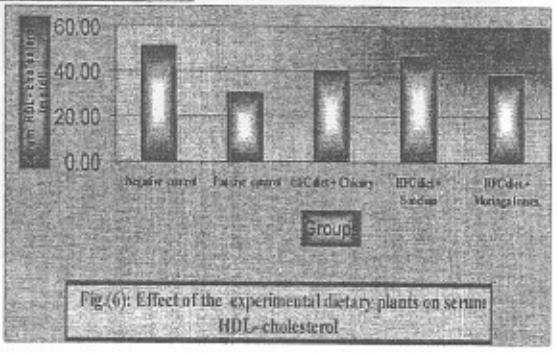

Fig.(6): Effect of the experimental dietary plants on serum HDL- cholesterol

Table (5) : Effect of the experimental dietary plants on liver total lipids, triacylglycerols and total cholesterol (mean ±S.E)

Parameters	Groups					
	(1) Standard diet Negative control	(2) HFC diet Positive control	(3) HFC diet + Chicory	(4) HFC diet + Sonchus	(5) HFC diet + Moringa leaves	P
Liver TL (mg/g tissue)		a	b	b	b	
Range	23.20-24.80	45.40-47.20	35.80-37.80	31.60-33.40	29.80-31.20	**
Mean ±S.E	23.97±0.198	46.17±0.225	63.67±0.256	32.47±0.290	30.60±0.217	
Liver TG (mg/g tissue)		a	b	b	b	
Range	9.90-10.50	20.80-21.60	15.40-16.46	12.80-13.50	12.60-13.20	**
Mean ±S.E	10.20±0.081	21.19±0.106	15.86±0.122	13.30±0.103	12.90±0.084	
Liver TC (mg/g tissue)		a	b	b	b	
Range	4.70-5.60	13.80-15.20	9.70-10.40	8.60-9.20	7.9-8.50	**
Mean ±S.E	5.12±0.113	14.45±0.202	10.06±0.103	8.87±0.070	8.24±0.084	

** :P<0.01

a= Highly significant increase when compared to negative control group

b= Highly significant decrease when compared to positive control group

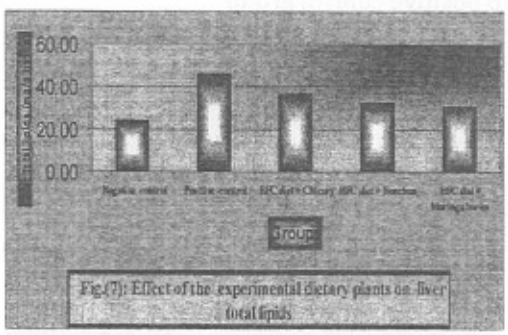

Fig.(7): Effect of the experimental dietary plants on liver total lipids

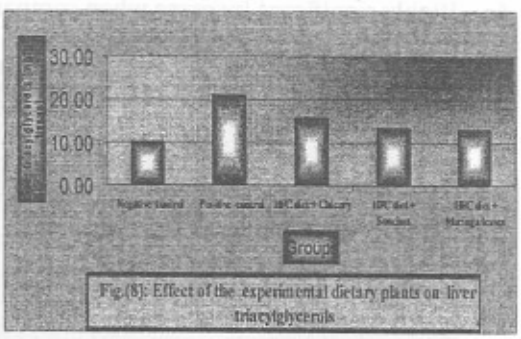

Fig.(8): Effect of the experimental dietary plants on liver triacylglycerols

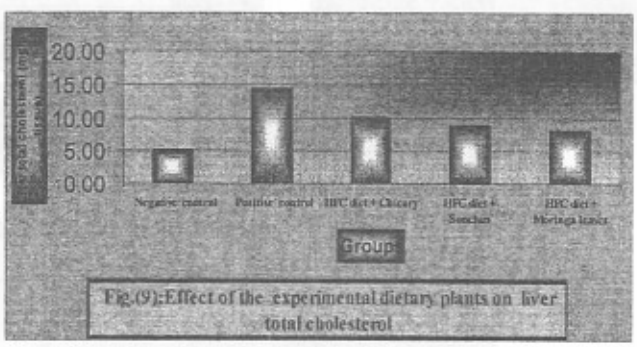

Fig.(9):Effect of the experimental dietary plants on liver total cholesterol

Table (6) : Effect of the experimental dietary plants on serum - ALT,ASTand ALP (mean ±S.E)

Parameters	Groups					
	(1) Standard diet Negative control	(2) HFC diet Positive control	(3) HFC diet + Chicory	(4) HFC diet + Sonchus	(5) HFC diet + Moringa leaves	P
Serum ALT (U /L)		a	b	b	b	
Range	16.50-18.10	23.60-25.40	18.80-21.20	16.60-18.60	17.40-18.90	*
Mean ±S.E	17.37±0.204	24.54±0.223	19.75±0.268	17.67±0.240	18.06±0.274	*
Serum AST (U /L)		a	b	b	b	
Range	31.60-35.10	40.60-44.40	33.40-37.20	29.90-32.40	32.30-34.90	*
Mean ±S.E	33.51±0.455	42.62±0.522	35.50±0.498	31.34±0.295	33.50±0.345	*
Serum ALP (U /L)		a	b	b	b	
Range	59.90-62.40	155.8-162.60	145.40-148.10	136.50-139.20	140.50-144.30	*
Mean ±S.E	60.60±0.696	158.41±0.768	146.95±0.359	137.77±0.341	142.65±0.550	*

** :P<0.01

a= Highly significant increase when compared to negative control group

b= Highly significant decrease when compared to positive control group

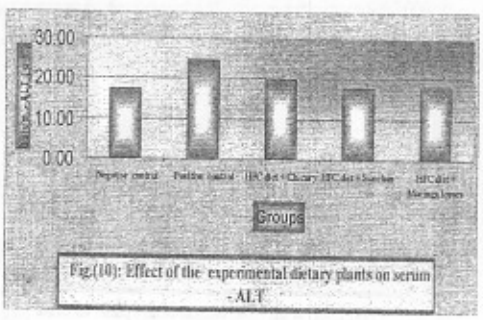

Fig.(10): Effect of the experimental dietary plants on serum - ALT

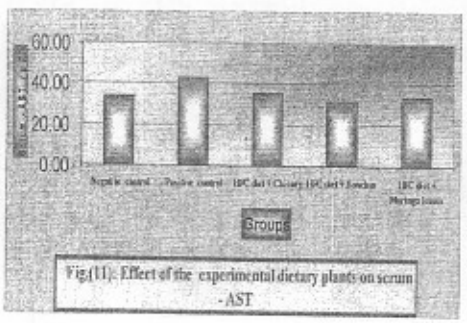

Fig.(11): Effect of the experimental dietary plants on serum - AST

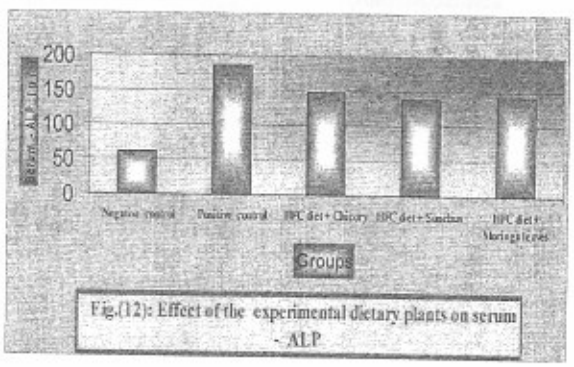

Fig.(12): Effect of the experimental dietary plants on serum - ALP

Table (7) : Effect of the experimental dietary plants on serum malondialdehyde (MDA) and erythrocyte-superoxide dismutase(SOD) (mean ±S.E)

Parameters	Groups					
	(1) Standard diet Negative control	(2) HFC diet Positive control	(3) HFC diet + Chicory	(4) HFC diet + Sonchus	(5) HFC diet + Moringa leaves	P
Serum MDA (U mol/L)		a	b	b	b	
Range	2.26-2.30	3.87-3.98	2.08-2.12	1.61-1.72	1.76-1.84	**
Mean ±S.E	2.27 ±.008	3.93 ±0.015	2.099 ±0.005	1.68 ±0.013	1.80 ±0.010	
SOD (units /ml blood)		c	d	d	d	
Range	385.00-415.00	260.00-291.00	480.00-511.00	590.00-620.00	548.00-585.00	**
Mean ±S.E	403.37 ±3.754	281.12 ±4.118	495.75 ±3.695	604.00 ±3.638	565.12 ±4.934	

** :P<0.01

a= Highly significant increase when compared to negative control group

b= Highly significant decrease when compared to positive control group

c= Highly significant decrease when compared to negative control group

d= Highly significant increase when compared to positive control group

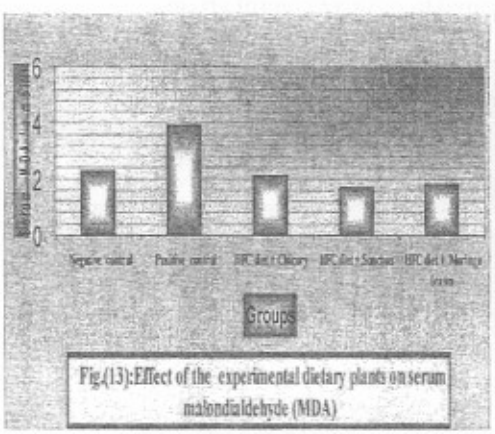

Fig.(13):Effect of the experimental dietary plants on serum malondialdehyde (MDA)

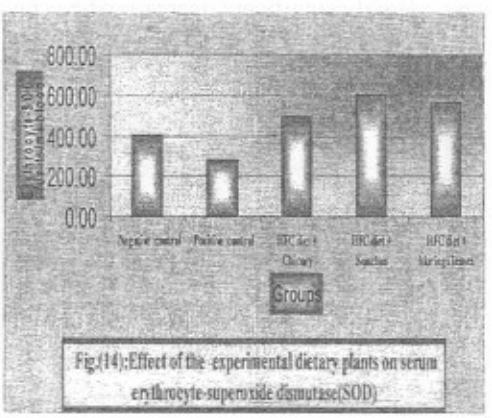

Fig.(14):Effect of the experimental dietary plants on serum erythrocyte-superoxide dismutase(SOD)

REFERENCES

AIN, (1977): American Institute of Nutrition Ad Hoc; Committee on Standards for nutritional studies. J.Nutr., 107:134

Anderson, J.W.; Jones, A.E. and Riddell-Mason, S. (1994): Ten different dietary fibers have significantly different effects on serum and liver lipids of cholesterol fed rats. J. Nutr., 124:78.

Anwar, F. and Bhanger, M.I. (2003): Analytical characterization of Moringa oleifera seed oil grown in temperate regions of Pakistan. J. Agric. Food Chem., 51:6558.

A.O.A.C. (1980): Official methods of analysis, 13th., ed., publ. Association of Official Analytical Chemists. Washington, D.C.U.S.A.

Ara, N, Rashid,M, and Shah Amran, M.D.(2008):Comparison of Moringa oleifera leaves extract with atenolol on serum triglyceride, serum cholesterol,blood glucose, heart weight ,body weight in adrenaline induced rats .Saudi.J.Biol.Sci.,15 (2)-253-258.

Bakry, A.A. (2002): Influence of carrots, cabbage and cauliflower on serum lipids of rats fed high cholesterols diet. Egypt. J. Nutr., xv11:1.

Bligh, W.G. and Dyer, W.J. (1959): A-rapid method of total lipid extraction and purification. Cand. J. Biochem. Physiol., 37:911.

Cambie, R.C. and Ferguson, L.R. (2003): Potential functional foods in the traditional Maori diet. Mutat. Res., 523-524:109-117

Chevallier, A. (1996): The Encyclopedia of Medicinal plants, 1st edition, published by DK publishing Inc. New York:153

Chu, F.; Sun, J.; Wu, X. and Liu, R.H. (2002): Antioxidant and ant proliferative activities of common vegetables. J. Agric . Food Chem , 50:6910.

Draper, H.H. and Hadley, M. (1990): Malondialdehyde determination as index of lipid peroxidation. Method in Enzymology, 186:421.

Fossati, P. and Prencipe, L. (1982): serum triglycerides determined colorimetery with an enzyme that produces hydrogen peroxide. Clin. Chem.., 28:2077.

Friedewald, W.T.; Levy, R.I. and Fredrickson, D.S. (1972): Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultra centrifuge.Clin Chem., 18:499.

Frings, C.S. and Dunn, R.T. (1970): A colorimetric method for determination of total Serum lipids based on the sulfo-phospho-vanillin reaction. Am. J. Clin. Path., 53:89.

Ghasi, S.; Nwobodo, E. and Ofili, J.O. (2000): Hypocholesterolemic effects of crude extract of leaf of Moringa oleifera in high-fat diet fed Wistar rats. J. Ethnopharmacology, 69:21.

Heibatollah,S.,Reza,N.M.,Izadpanah,G. and,Sohailla,S.(2008): Hepatoprotective effect of Cichorium intybus on a carbon tetra choinduced liver injury in rat .J.Ethnopharmacology.,Vol,111,Issue 2,4 May ,430-434.

Kim, M. and Shin, H.K. (1998): The water-soluble extract of chicory influences serum and liver lipid concentration, cecal short chain fatty acid concentrations and fecal lipid excretion in rats. J. Nutr., 128:1731.

Kirby, R.W.; Anderson, J.W. and Sieling, B. (1981): Oat-bran intake selectively lowers serum low-density lipoprotein cholesterol concentration of hypercholesterolemic man. Am. J. Clin. Nutr., 34:824.

Kisiel,W. and Michalska, K. (2002): A new coumarin glucoside ester from cichorium intybus . Fitoterpia, 73: 544

Lopes-Virella, M.F.; Stone, P.; Eills, S. and Colwell, J.A.(1977): Cholesterol determination in high - density lipoproteins separated by three different methods. Clin. Chem.., 23:882

Norbaek, R.; Nielsen, K. and Kondo, T. (2002): Anthocyanins from flowers of Cichorium intybus. Phytochemistery, 60:357.

Pearson. (1991): Composition and analysis of foods. Edited by Kirk, R.S. and Sawyer, R. Ninth edition, Publ., Longman Scientific and technical. Singapora.

Rec. GSCC, (DGKC) (1972): Kientic determination of alkaline phosphatase activity. J. Clin. Chem. and Clin. Biochem., 10:182.

Reeves,P.G.,Nielson,F.and Fahey, G.C. (1993): Purified diets for laboratory rodents:Reformulation of the AIN-76 ARodent diet .J.Nutr.,123:1939-1951.

Reitman, S. and Frankel, S. (1957): Kinetic determination of amino transferase activity. Am. J. Clin. Path., 28:56.

Richmond, W. (1973): Preparation and properties of a cholesterol oxidase from nocardia Sp. and its application to the enzymatic assay of total cholesterol in serum. Clin. Chem., 19:1350.

Saluja, M.P.; Kapil, R.S. and Popli, S.P. (1978): Studies in medicinal plants: Part (V)-chemical constituents of Moringa oleifera. (Hybrid variety) and isolation of 4-hydroxymellein. Indian. J. Chem., 16B:1044.

Siddhuraju, P. and Becker, K. (2003): Antioxidant properties of various solvent extracts of total phenolic constituents from three different agroclimatic origins of drumstick tree (Moringa oleifera.) Leaves, J. Agric. Food Chem., 51:2144.

Snedecor, G.W. and Cochran, W.G. (1980): Statistical methods, 7 th. ed. Iowa State University Press, Ames, Iowa, U.S.A.225.

Su, Q.; Rowley, K.G.; Itsiopoulos, C. and O'Dea, K. (2002): Identification and quantitation of major carotenoids in selected components of the Mediterranean diet: green leafy vegetables, figs and olive oil. Eur. J. Clin. Nutr., 56:1149.

Tapola, N.S.; Lyyra, M.L.; Karvonen, H.M.; Uusitupa, M.I. and Sarkinen, E.S. (2004): The effect of meat products enriched with plant sterols and minerals on serum lipids and blood pressure. International J. Food Sciences and Nutr., 55:389

Vlahov, G.; Chepkwony, P.K. and Ndalut, P. K.(2002):[13] CNMR characterization of triacylglycerols of Moringa oleifera seed oil: An "oleic-vaccenic acid" oil. J. Agric. Food Chem., 50:970.

Volpe, R.; Niittynen, L.; Korpela, R.; Sirtori, C.; Bucci, A.; Fraone, N. and Pazzucconi, F. (2001): Effects of yoghurt enriched with plant sterols on serum lipids in patients with moderate hypercholesterolaemia. Br. J. Nutr., 86:233.

Winterbourne, C.C.; Howkins, R.E.; Brain, M. and Carell, R.W. (1975): The estimation of red cell superoxide dismutase activity. J. Lab. Clin. Med., 85:337.

التأثير الغذائى لبعض النباتات على وظائف ومكونات الدهون فى حيوانات التجارب

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كلية البنات - جامعة عين شمس - قسم الكمياء الحيوية و التغذية.

فى هذه الدراسه تم اجراء التجربه على 40 ذكرا من الفئران البيضاء من النوع الألبينو ذات سلالة (Sprague Dawley) ويتراوح متوسط اوزنها ما بين (156 - 158 جم) وقد تم تقسيم الفئران الى خمس مجموعات و كل مجموعة تتكون من ثمانية فئران وقد تم تغذية جميع الفئران لمدة أربعة اسابيع على وجبات التجربة:

المجموعه الأولى(الضابطة السلبية) : تغذت على غذاء قياس يحتوى على14% بروتين الكارين

المجموعه الثانيه(الضابطة الإيجابية): تغذت على وجبة عالية المستوى من الدهون والكوليستيرول.

المجموعة الثالثة والرابعة والخامسة تغذت على وجبة عالية المستوى من الدهون والكوليسترول بالاضافة إلى 10%من كل النباتات المختبرة الجافة الشيكوريا و جعضيض و أوراق المورينجا .

وفى نهاية التجربة تم تشريح الفئران تحت التخدير بالإثير وتم سحب عينات الدم من الوريد الكبدى البابى وتم إزالة كبد الفئران وذلك لتقدير الدهون الكلية والجليسريدات الثلاثية والكوليستيرول الكتى كما تم تقدير الكوليستيرول المرتبط بالبروتينات الدهنية المنخفضة جدا والمنخفضة والعالية فى الكثافة واسبرتيت امينو ترانسفيريز والانين امينو ترانسفيريز والفوسفاتيز القلوى وسوبرأوكسيد ديسميوتيز السيرم أيضا وقد دلت النتائج على الاتى MDA ومالونيل داى الدهيد SOD :

* وجود نقص معنوى فى مستوى الدهون الكلية والجليسريدات الثلاثيه والكوليستيرول الكلى والكوليستيرول المرتبط بالبروتنينات الدهنية المنخفضة جدا فى الكثافة والكوليستيرول المرتبط بالبروتينات الدهنية المنخفضة فى الكثافة بمصل الدم والكبد غير أنه وجدت زيادة معنوية فى الكوليستيرول المرتبط بالبروتينات الدهنيه العالية فى الكثافة بالمصل بين مجموعات التجربة التى تغذت على الشيكوريا والجعضيض واوراق المورينجا بالمقارنة بالمجموعة الضابطة الإيجابية

وتميرت مجموعة اوراق المورنجابالحصول على نتائج أقل قيمة من المتوسطات بالمقارنة بالمجموعة الضابطة الايجابية.

* وجد أن المجموعه التى تغذ ت على الجعضيض بها أقل قيمة من المتوسطات بالنسبة لمستوى الكوليستيرول المرتبط بالبروتينات الدهنية المنخفضة فى الكثافة بالمصل و بها اعلى قيمة من المتوسطات بالنسبة لمستوى الكوليستيرول المرتبط بالبروتينات الدهنية العالية فى الكثافة بالمصل بالمقارنة بالمجموعة الضابطة الإيجابية.

*وجود نقص معنوى فى اسبرتيت امينو ترانسفيريز والانين امينو ترانسفيريز والفوسفاتيز القلوىوفى مستوى المالونيل داى الدهيد(MDA) بين مجموعات التجربة التى تغذت على الشيكوريا والجعضيض واوراق المورينجا وكان أفضل النتائج فى مجموعةالجعضيض بالمقارنة بالمجموعة الضابطة الإيجابية .

* وجود زيادة معنوية فى السوبر أوكسيد ديسميوتيز بكرات الدم الحمراء(SOD) بين مجموعات التجربة التى تغذت على الشيكوريا والجعضيض واوراق المورينجا بالمقارنة بالمجموعة الضابطة الإيجابية.