Effect of Some Levels from Ginseng, Barley and Carob on Lipid Profile and Kidney Functions of Rats Fed on High Fructose Diets.

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Abstract: The main target of the present investigation is to study the effect of three levels from ginseng, barley and carob (2.5%, 5% and 7.5%) and their combinations on biological value, lipid profile and kidney functions and histopathological examination in kidney of rats fed on high fructose diet. Seventy male Sprague albino rats divided into two main groups. The first group fed on basal diet as a (-ve control group), while the second main group fed on high fructose diet for two weeks. The second main group divided into thirteen subgroups. Subgroups (1, 2&3) fed on high fructose diet (HFD) containing 2.5%, 5% and 7.5% ginseng, respectively. Subgroups (4, 5&6) fed on HFD containing 2.5%, 5% and 7.5% barley, respectively. Subgroups (7, 8 & 9) fed on HFD containing 2.5%, 5% and 7.5% carob. Subgroups (10, 11&12) fed on HFD containing 2.5%, 5% and 7.5% combination of (ginseng, barley and carob). Subgroups (13) fed on HFD only (control positive group). At the end of the experimental period (4 weeks) rats were fasted over night before sacrificing, blood was collected then centrifuged to separate the serum. Kidney was removed from each rat, cleaned and weighted to estimate of kidney weight / body weight percent. Kidney was examined hestopathologically. The obtained results revealed that, feeding rats on high fructose diet led to significant increase in (body weight gain %, kidney weight/body weight %, cholesterol, triglycerides, LDL-c, VLDL-c, uric acid, urea nitrogen, creatinine) and decreased (food intake and HDL-c). Feeding rats on high fructose diet with the different levels from ginseng, barley, carob and their combinations improved all parameters and kidney weight, especially when used the high level from (barley, ginseng and combination of ginseng, barley and carob). The histopathological examination in the kidney confirmed this improvement.
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1. Introduction

Fructose intake has increased steadily during the past two decades due to its introduction as sweetener in pharmaceuticals and in mainstream food applications such as carbonated beverages, canned fruits, jams, jellies and dairy products. This has led to an increased interest in the study of diets rich in this nutrient ***(Maria et al., 2002)***.

Glen et al., (2004) **reported that,** high-fructose feeding cause's diet-induced alterations of lipid metabolism and decreased insulin sensitivity with alterations of hepatic pyruvate dehydrogenase and hepatic very low-density lipoprotein secretion. Inflammatory cytokines also induce dramatic changes in lipid metabolism, particularly in serum triglycerides via increased hepatic secretion and/or delayed clearance of very low-density lipoprotein.

Laura et al., (2007) **reported that,** fructose administration either in diet (60%) or drinking water (10%) induced hypertension, hyperuricemia, and hypertriglyceridemia; however, there was a progressive increment in these parameters with higher fructose intake (C<F10<F60).

In China, ginseng root has been used for millennia as a tonic to increase vitality ***(Attele et al., 2002)***. Attention has been focused on the two most popular types of ginseng, namely Panax quinquefolius *L.* **(***Xiyangshen***,** American ginseng) and *Panax ginseng CA Meyer* **(***Renshen***,** Asian ginseng) (***Vuksan et al., 2000)*** [a &b]**.** According to Chinese medicine theory, the two ginseng types possess different properties and display different effects. *Panax ginseng* increases blood flow and decreases fatigue. Experimental studies indicate that *Panax ginseng* alleviates oxidative stress generated by diabetes through the inhibition of lipid peroxidation ***(Kang et al., 2005)*.**

Ohnishi et al., (1996) reported that both types of ginseng may influence carbohydrate metabolism and diabetes mellitus. Numerous animal studies indicate that *P ginseng* CA Meyer and *P quinquefolius* L have significant hypoglycemic action.

Fastnaught, (2001) demonstrated that the insoluble fiber found in barley may be beneficial in helping the body maintain regular bowl function and also may help lower the risk for certain cancers such as colon cancer; in addition, barley contains antioxidants, which are also important for maintaining good health. Specifically, antioxidants work to slow down the rate of oxidative damage by gathering up free radicals that form when body cells use oxygen.

Brennan and Cleary, (2005) demonstrated that soluble fiber such as β-glucan, has been shown to have effects on the glycaemic, insulin, and cholesterol responses to foods. Cereals (such as barley) are good sources for these functional ingredients. The (1→3, 1→4)-β-d-glucan content of barley ranges from 5–11%.

In humans, consumption of carob fiber was shown to have a high antioxidant capacity ***(Kumazawa et al., 2002)*** and to lower serum cholesterol and serum triglycerides ***(Zunft et al., 2003)***. Furthermore, other studies showed that polyphenols may increase fat oxidation and energy expenditure in humans ***(Dulloo et al., 1999)*** and in mice ***(Klaus et al., 2005)***. Therefore, carob fiber may exert beneficial effects on postprandial lipid metabolism and substrate utilization potentially related to the secretion of gut hormones.

The aim of this study was to investigate the effect of some levels from ginseng, barley and carob on lipid profile and kidney functions of rats fed on high fructose diets.

Materials and Methods:

Material:

1. Barley (*Hordeum vulgare* L.) was obtained from the field crops institute, Agriculture Research Center. Giza, Egypt.
2. Ginseng (*Panax Ginseng*) and carob *(Ceratonia siliqua*) were obtained from the local market.
3. Fructose, casein, all vitamins, all minerals, cellulose and sucrose were obtained from Elgomhor'ya Company, Cairo, Egypt.
4. Normal males albino rats Sprague Dawely Strain (70 rats) were purchased from the Helwan farm, Cairo, Egypt.

Methods:

Preparation of the basal diet:

The basal diet was prepared according to *Reeves et al., (1993).*The salt mixture used according to *Hegested et al., (1941).*The Vitamin mixture used according to *Campbell (1963).*

Grouping of experimental animals:

The experiment was done at National Research Center. It was carried out on 70 male albino rats weighing (150 ± 5 g). Rats were kept in individual polyethylene cages for one week before starting the experiment for acclimatization. After this week, the rats were divided into two main groups as follows:

The first group (5 rats):

Fed on Basal diet as a control negative group.

The second main group (65 rats): fed on fructose-enriched diet (diet containing 60% fructose) for 15 days according to the method described by *(Ramu et al., 2005)*.

After this period, the second main group divided into thirteen subgroup (5 rats each). These groups treated with some levels from ginseng, barley and carob for 30 day as follow: *Subgroups (1, 2&3)* fed on high fructose diet (HFD) containing 2.5%, 5% and 7.5% ginseng, respectively. *Subgroups (4, 5&6)* fed on HFD containing 2.5%, 5% and 7.5% barley respectively. *Subgroups (7, 8 & 9)* fed on HFD containing 2.5%, 5% and 7.5% carob *Subgroups (10, 11&12)* fed on HFD containing 2.5%, 5% and 7.5% combination of (ginseng, barley and carob). *Subgroups (13)* fed on HFD only (control positive group). During the experimental period (28 days), the diet consumed was recorded daily and body weight of rats was recorded twice weekly. Biological evaluation of the different tested groups was carried by determination of food intake (FI), body weight gain% (BWG %) and kidney weight / body weight% according to *Chapman et al., (1959)*.

At the end of the experimental period (4 weeks) rats were fasted over night before sacrificing, blood was collected then centrifuged. Serum was separated and stored at - 20° C until analysis. Kidney was removed from each rat, cleaned and weighted to estimate of Kidney weight / body weight percent. Kidneys were prepared for histopathological examination. Body weight gain percent and food intake estimated.

Serum samples were used for determination of total cholesterol (TC) *Allain et al., (1974)*, triglycerides (TG) *Fossati and Principel., (1982)*, high-density lipoprotein cholesterol (HDL-C) *(Burstein. , 1970)*. While serum low-density lipoprotein cholesterol (LDL-C) and very low- density lipoprotein cholesterol (VLDL-C) were calculated according to the equation of *Friedewald et al., (1972).* Serum uric acid was determined according to the method described by *(Fossati et al., 1980).* Serum urea was determined according to the method described by *(Patton and Crouch, 1977)*. Creatinine content in serum was determined kinetically using the method of *Bartels and Bohmer., (1971)*. The kidney in each group was examined histopathologicaly, according to *(Sheehan and Hrapchak, 1980)*.

Statistical analysis:

The statistical analyses were carried out by using SPSS, PC statistical software (verion 8.0 spss Inc., chieago, USA). The results were expressed as mean ± SD. Data was analyzed by one way analysis of variance (ANONA). The differences between means were tested for significance using least significant difference (LSD) test at ($P < 0.05$) *(Steel and Torri, 1980)*.

3. Results and Discussion:

Effect of Some Levels from Ginseng, Barley and Carob on Food Intake and Body Weight Gain % of Rats Fed on High Fructose Diets.

Food intake (g/day / rat)

The mean value of food intake summarized in table (1). The control positive group (control +ve) decreased slightly than the mean value of food intake in healthy rats (control –ve group). Treating HFD groups with diets containing (2.5%, 5% and 7.5%) ginseng, barley, carob and their combination increased the mean value of food intake, as compared to the control negative and positive groups.

Body Weight Gain % (BWG %):

The mean value ± SD of BWG% shown in table (1). The negative control group was (52.615 ± 5.177 %) while it was (64.852 ± 2.340%) for the positive control group fed on HFD. All treated groups showed significant decrease $p<0.05$ in BWG%, except group of rats fed on HFD containing 7.5% carob and the groups fed on HFD containing (2.5% & 5% combination of ginseng, barley and carob, as compared to the positive control groups. Treating rats with 5% and 7.5% ginseng also 2.5% carob led to significant decrease in BWG%, as compared control groups and other treated groups.

In this respect *Sharon* ***et al.,*** *(2002)* reported that fructose consumption might be a contributing factor to the development of obesity and the accompanying metabolic abnormalities observed in the insulin resistance syndrome. Also ***Suzen*** *et al., (2009)* observed that **high fructose corn syrup** (HFCS) consumption increases the risk for obesity and other adverse health outcomes compared to other caloric sweeteners.

All treated groups showed significant decrease $p<0.05$ in BWG%, except group of rats fed on HFD containing 7.5% carob and the groups fed on HFD containing (2.5% & 5% combination of ginseng, barley and carob , as compared to the positive control groups. The anti-obesity effects of chikusetsusaponins isolated from P. japonicus rhizomes in mice fed a high-fat diet may be partly mediated through delaying the intestinal absorption of dietary fat by inhibiting pancreatic lipase activity. The present study clearly indicated that the saponin fractions of P. japonicus rhizomes had a significant anti-obesity action and supports the traditional usage as a substitute drug for ginseng roots *(**Li-Kun** et al., 2005)*.

Table (1): Effect of some levels from ginseng, barley carob and their combination on food intake and body weight gain % of rats fed on high fructose diet.

Parameter / Groups	Mean of Food intake g/day	Body weight gain %
Control (-)	17.857	52.615 ± 5.177 [c d]
Control (+)	17.142	64.852 ± 2.340 [a]
HFD containing 2.5% ginseng.	19.857	56.769 ± 6.445 [b c]
HFD containing 5% ginseng.	19.143	31.499 ± 4.057 [f]
HFD containing 7.5% ginseng.	19.714	34.666 ± 3.039 [e f]
HFD containing 2.5% barley.	19.275	54.666 ± 2.906 [c]
HFD containing 5% barley.	19.275	52.533 ± 0.557 [c d]
HFD containing 7.5% barley.	19.857	51.666 ± 5.368 [c d]
HFD containing 2.5% carob.	19.285	38.000 ± 4.327 [e]
HFD containing 5% carob.	18.571	47.142 ± 5.933 [d]
HFD containing 7.5% carob.	19.500	65.999 ± 3.837 [a]
HFD containing 2.5% combinations.	19.142	63.333 ± 9.718 [a]
HFD containing 5% combinations.	19.714	61.333 ± 2.799 [a b]
HFD containing 7.5% combinations.	19.500	53.592 ± 4.601a [c d]

HFD: High Fructose Diet

Effect of Some Levels from Ginseng, Barley and Carob on Kidney Weight / Body Weight % of Rats Fed on High Fructose Diets.

The effect of ginseng, barley, carob and their combination with different levels (2.5%, 5% and 7.5%) on kidney weight / body weight % of rats fed on high fructose diet is presented in (Table 2). All treated groups with ginseng , barley, carob and their combination showed significant decrease $p<0.05$ in kidney weight / body weight%, as compared to the positive control group, except groups of rats which treated with 2.5% ginseng and 2.5% carob. Feeding rats on HFD containing high level from combination of (ginseng, barley and carob) recorded the best results in kidney weight / body weight %, followed by the groups which fed on HFDs containing 7.5% barley and 7.5% ginseng, respectively. These groups recorded nonsignificant differences in the weight of this organ, as compared to the negative control group.

Table (2): Effect of some levels from ginseng, barley carob and their combination on kidney weight/body weight % of rats fed on high fructose diet.

Parameter / Groups	Kidney weight / body weight %
Control (-)	0.678 ± 0.014 [e f]
Control (+)	0.864 ± 0.022 [a]
HFD containing 2.5% ginseng.	0.826 ± 0.028 [a b]
HFD containing 5% ginseng.	0.769 ± 0.012 [c d]
HFD containing 7.5% ginseng.	0.680 ± 0.017 [e f]
HFD containing 2.5% barley.	0.792 ± 0.046 [b c] a
HFD containing 5% barley.	0.765 ± 0.048 [c d]
HFD containing 7.5% barley.	0.679 ± 0.025 [e f]
HFD containing 2.5% carob .	0.857 ± 0.028 [a]
HFD containing 5% carob .	0.782 ± 0014 [c d]
HFD containing 7.5% carob .	0.700 ± 0.014 [e]
HFD containing 2.5% combinations.	0.772 ± 0.046 [c d]
HFD containing 5% combinations.	0.739 ± 0.046 [d] a
HFD containing 7.5% combinations.	0.650 ± 0.026 [f]

HFD: High Fructose Diet

Effect of Some Levels from Ginseng, Barley and Carob on Lipid Profile of Rats Fed on High Fructose Diets.

The effect of some levels from ginseng, barley, carob and their combination on total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-c), low and very low density lipoprotein cholesterol (LDL-c &VLDL-c) of rats fed on high fructose diet is presented in (tables 3 and 4).

Cholesterol and Triglycerides (mg/dl):

Feeding rats on high fructose diet led to significant increase $p < 0.05$ in serum cholesterol and triglyceride, as compared to the rats fed on basal diet. Treating rats with different levels from ginseng, barley, carob and their combination resulted in significant decrease in serum cholesterol and triglyceride, as compared to the positive control group. The more effect in reducing total serum cholesterol and triglyceride recorded for the treated groups with the high levels from ginseng, barley, carob alone or combination of them.

The highest decrease in serum cholesterol and triglyceride recorded for the treated group with the combination of ginseng, barley and carob. Feeding rats on HFD containing (2.5%, 5% and 7.5% barley) led to significant decrease in serum cholesterol, as compared to the positive control group. Increasing the level of barley led to significant decrease in the mean value of serum cholesterol. The lowest concentration of serum cholesterol recorded for the treated group with 7.5% barley. In this respect two randomized controlled studies have examined the effect of barley consumption after subjects were stabilized on a baseline low-fat diet *(**Behall** et al., 2004)***.**

Table (3): Effect of some levels from ginseng, barley carob and their combination on serum cholesterol and triglycerides of rats fed on high fructose diet.

Parameter / Groups	mg/dl	
	Cholesterol	Triglycerides
Control (-)	80.051 ± 4.918 [i]	40.557 ± 3022 [g]
Control (+)	123.554 ± 2.172 [a]	70.153 ± 3.396 [a]
HFD containing 2.5% ginseng.	115.780 ± 1.745 [b c]	66.334 ± 3.531 [a b]
HFD containing 5% ginseng.	106.824 ± 1.812 [e]	59.634 ± 3.988 [c d e]
HFD containing 7.5% ginseng.	100.260 ± 1.873 [g]	55.359 ± 3.482 [e f]
HFD containing 2.5% barley.	112.994 ± 1.774 [c d]	63.050 ± 3.661 [b c]
HFD containing 5% barley.	104.383 ± 1.993 [e f]	57.988 ± 3.310 [e]
HFD containing 7.5% barley.	94.375 ± 1.872 [h]	51.347 ± 3.618 [f]
HFD containing 2.5% carob .	117.349 ± 1.976 [b]	68.167 ± 3.328 [a]
HFD containing 5% carob .	112.3474 ± 2.535 [c d]	62.868 ± 3.672 [b c d]
HFD containing 7.5% carob .	111.543 ± 2.705 [d]	58.187 ± 2.460 [d e]
HFD containing 2.5% combinations.	111.428 ± 2.929 [d]	65.689 ± 3.419 [a b]
HFD containing 5% combinations.	101.622 ± 2.557 [f g]	58.508 ± 2.474 [de]
HFD containing 7.5% combinations.	95.478 ± 4.711 [h]	52.883 ± 2.670 [f]

HFD: High Fructose Diet

High fructose diets containing low, medium and high levels from carob decreased serum cholesterol and triglycerides concentration, as compared to the positive control group. Groups of rats which treated with (5% and 7.5% carob) showed significant decrease in serum cholesterol, as compared to the group which treated with (2.5%). In this respect in a study on Guar gum, obtained from the seeds of *Cyamopsis tetragonolobus* (L.) Taub. (Leguminosae), and carob gum, obtained from the seeds of Ceratonia siliqua L. (Leguminosae), were investigated for their effect on body weight, blood glucose and insulin levels in rats fed on a diet containing 15% of guar or carob gums for 2 to 6 consecutive weeks. At the same time, cholesterol plasma levels were assayed. A decrease in both plasma glucose and hematic cholesterol level were observed *(Forestieri et al., 2006).*

John et al., *(2000)* reported that dietary fructose was associated with increased fasting and postprandial plasma triacylglycerol concentrations in men. Also *Jeon* ***et al., (2000)*** suggested that hypolipidemic effect of *Panax ginseng* extract is associated with a decrease in total cholesterol, triglyceride, LDL, malondialdehyde levels and an increase in HDL. These findings support scientific claims that ginseng has the hypolipidemic potential. Administration of *Panax ginseng* extract increased superoxide dismutase and catalase activities while decreased malondialdehyde level indicating that antioxidant potential of *Panax ginseng* extract might induce hypolipidemic effect as one of action mechanism. Also ***Ripple*** *et al., (2009)* demonstrated that barley-derived β-glucan appears to beneficially affect total cholesterol, LDL-cholesterol, and triglycerides, but not HDL-cholesterol.

Zunft *et al., (2001)* demonstrated that the carob pulp preparation may have value in the dietary treatment of hypercholesterolemia.

Lipoprotein Fractions:

Feeding rats on high fructose diet led to significant increase *p*< 0.05 in serum LDL-c and VLDL-c while HDL-c decreased, as compared to the healthy rats fed on basal diet. High density lipoprotein-cholesterol HDL-c in all treated groups increased, especially the groups fed on HFD containing high levels from (ginseng, barley, carob and their combination), as compared to the positive control group. On the other hand, the highest increase in the mean value of HDL-c was found in the group which treated with the medium and high levels from barley, followed by the treated groups with 7.5% ginseng or combination of (ginseng, barley, carob and their combination), respectively.

Low density lipoprotein decreased in all treated groups with medium and high levels from ginseng, barley, carob and their combination. Feeding rats on diets containing 7.5% barley or 7.5% combination of (ginseng, barley and carob) achieved the best results in LDL-c.

Treating rats with different levels from ginseng, barley, carob and their combination resulted in significant decrease in serum VLDL-c, as compared to the positive control group. The more effect in reducing VLD-c recorded for the treated groups with the high levels from ginseng, barley, carob alone or combination of them. The highest decrease in serum VLDL-c recorded for the treated group with the combination of ginseng, barley and carob.

Table (4): Effect of some levels from ginseng, barley carob and their combination on serum lipoproteins of rats fed on high fructose diet.

Parameter / Groups	mg/dl		
	HDL-c	LDL-c	VLDL-c
Control (-)	44.072 ± 2.975 [a]	27.868 ± 1.909 [h]	8.111 ± 0.605 [g]
Control (+)	30.201 ± 3.524 [f]	79.323 ± 4.811 [a]	14.030 ± 0.679 [a]
HFD containing 2.5% ginseng.	34.014 ± 3.529 [d e f]	68.499 ± 4.593 [b c]	13.267 ± 0.706 [a b]
HFD containing 5% ginseng.	36.868 ± 3.225 [c d e]	58.029 ± 4.382 [d]	11.927 ± 0.737 [c d e]
HFD containing 7.5% ginseng.	38.620 ± 3.042 [c]	50.568 ± 4.207 [e f]	11.072 ± 0.696 [e f]
HFD containing 2.5% barley.	36.228 ± 3.183 [c d e]	64.155 ± 4.241 [c]	12.610 ± 0.732 [b c]
HFD containing 5% barley.	40.259 ± 3.086 [b c]	52.530 ± 4.497 [e]	11.593 ± 0.662 [e]
HFD containing 7.5% barley.	42.454 ± 3.146 [ab]	41.651 ± 4.471 [g]	10.269 ± 0.724 [f]
HFD containing 2.5% carob .	30.657 ± 3.074 [f]	73.059 ± 4.456 [b]	13.633 ± 0.666 [a]
HFD containing 5% carob .	34.075 ± 2.171 [d e f]	65.699 ± 3.638 [c]	12.574 ± 0.734 [b c d]
HFD containing 7.5% carob .	36.261 ± 1.776 [c d e]	63.669 ± 1.668 [c]	11.638 ± 0.492 [d e]
HFD containing 2.5% combinations.	32.912 ± 1.904 [e f]	65.379± 3.638 [c]	13.138 ± 0.684 [a b]
HFD containing 5% combinations.	37.817 ± 1.921 [c d]	52.104 ± 4.119 [e]	11.702 ± 0.495 [d e]
HFD containing 7.5% combinations.	38.559 ± 2.106 [c]	46.342 ± 3.264 [f g]	10.577 ± 0.534 [f]

HFD: High Fructose Diet

Zunft et al., (2003) demonstrated that daily consumption of food products enriched with carob fibre shows beneficial effects on human blood lipid profile and may be effective in prevention and treatment of hypercholesterolemia.

Serum LDL-c in all treated groups decreased significantly p<0.05, as compared to the positive control group. On the other hand, the mean value of serum LDL-c decreased gradually with increasing the level of ginseng, barley and combination of (ginseng, barley and carob). In this respect ***Behal et al., (2004)*** **reported that,** the addition of barley to a healthy diet may be effective in lowering total and LDL cholesterol in both men and women. Also ***Nancy and Camille*** ***(2008)*** demonstrated that the consumption of barley products is effective for lowering total and LDL cholesterol.

The consumption of insoluble polyphenols found in carob reduced the total cholesterol by 17.8 ± 6.1% ($p < 0.05$), LDL cholesterol by 22.5 ± 8.9% ($p < 0.001$), LDL: HDL cholesterol ratio by 26.2 ± 14.3% ($p < 0.001$) and triglycerides by 16.3 ± 23.4% ($p < 0.05$) at the end of the study compared with baseline *(Baltasar et al., 2010)*.

Effect of Some Levels from Ginseng, Barley, Carob and Their Combination on Kidney Functions of Rats Fed on High Fructose Diet.

The effect of different levels from ginseng, barley, carob and their combination on serum uric acid, urea nitrogen and creatinine (mg/dl) is presented in Table (5). Feeding rats on high fructose diet resulted in significant increase $p < 0.05$ in serum uric acid, urea nitrogen and creatinine, as compared to the rats fed on basal diet.

The mean value of serum uric acid and urea nitrogen in all tested groups decreased significantly $p<0.05$, as compared to the positive control group. The medium and high levels from ginseng, barley, carob and their combination showed the highest decrease in serum uric acid and urea nitrogen. The best results in serum uric acid and urea nitrogen in all treated groups recorded for the groups fed on HFD containing 5 % &7.5% barley, 7.5% & 5% combination of (ginseng, barley and carob) and 7.5% ginseng.

Serum creatinine decreased significantly in all treated groups, as compared to the positive control group. The highest and medium levels from barley (5% and 7.5%), the highest level from ginseng (7.5%) and the highest level from combination of (ginseng, barley and carob) recorded the best results in serum creatinine.

The highest decrease in serum creatinine was observed in the treated group fed on HFD containing 7.5% barley, followed by treated groups with 5% barley, 7.5% ginseng and 7.5% combination of (ginseng, barley and carob), respectively.

Table (5): Effect of some levels from ginseng, barley carob and their combination on kidney functions of rats fed on high fructose diet.

Parameter / Groups	mg/dl		
	Uric acid	Urea nitrogen	Creatinine
Control (-)	1.535 ± 0.046 h	27.553 ± 1.263 i	0.515 ± 0.040 g
Control (+)	2.088 ± 0.097 a	43.212 ± 2.494 a	0.803 ± 0.037 a
HFD containing 2.5% ginseng.	1.896 ± 0.102 b c	38.972 ± 1.502 b	0.701 ± 0.087 b
HFD containing 5% ginseng.	1.791± 0.027 c d e f	33.752 ± 0.712 e f	0.623 ± 0.013 c d
HFD containing 7.5% ginseng.	1.723± 0.128 e f g	31.252 ± 1.518 g h	0.577 ± 0.015 e f
HFD containing 2.5% barley.	1.822± 0.105 b c d e	37.659 ± 1.083 b c	0.643 ± 0.017 c
HFD containing 5% barley.	1.715 ± 0.065 e f g	32.172 ± 0.704 f g	0.595± 0.029 d e f
HFD containing 7.5% barley.	1.653 ± 0.061 g	30.172 ± 1.554 h	0.565 ± 0.018 f
HFD containing 2.5% carob .	1.934 ± 0.124 b	39.300 ± 0.967 b	0.719 ± 0.068 b
HFD containing 5% carob .	1.865 ± 0.039 b c d	34.954 ± 1.463 d e	0.650 ± 0.016 c
HFD containing 7.5% carob .	1.803 ± 0.066 c d e f	32.246 ± 1.621 f g	0.625 ± 0.024 c d
HFD containing 2.5% combinations.	1.823 ± 0.109 b c d e	36.200 ± 1.695 c d	0.655 ± 0.049 c
HFD containing 5% combinations.	1.758 ± 0.053 d e f g	32.268 ± 1.598 f g	0.621± 0.022 c d e
HFD containing 7.5% combinations.	1.696 ± 0.034 f g	29.578 ± 1.558 h	0.595 ± 0.034 d e f

HFD: High Fructose Diet

Takako et al., (1995) found oral ginseng suppressed uremic toxins, decreased urinary excretion of protein and inhibited mesangial proliferation, demonstrating the arrest of progressive renal disorder from subtotal nephrectomy. In experiments using cultured mesangial cells, there was considerable suppression of mesangial cell proliferation. This suggests ginseng has a role as a free radicalscavenger. Another study shows Ginseng saponin protecting the kidney from oxidative stress. Ginseng's action as a free radical scavenger is important since free radical production is implicated in progressive kidney disorders.

Mahgoub (2010) reported that the concentrations of serum creatinine and urea in the carob pods (200 mg/kg body weight) treated group were reduced to 57.5% and 51.5%, respectively, with respect to the control group.

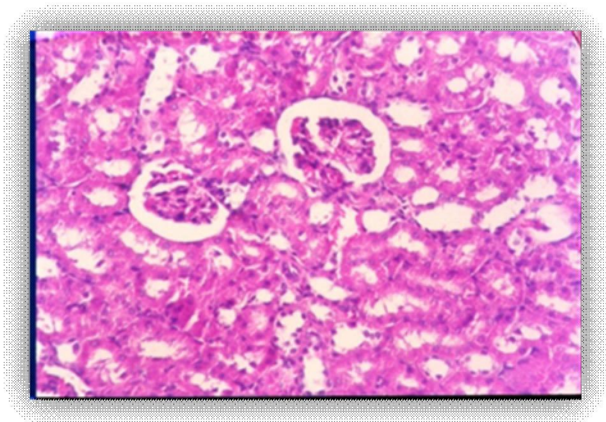
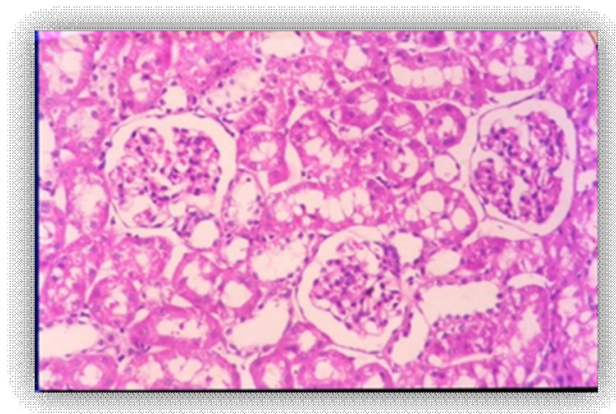
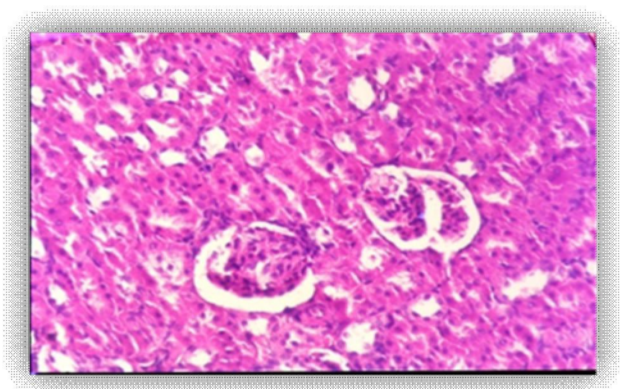
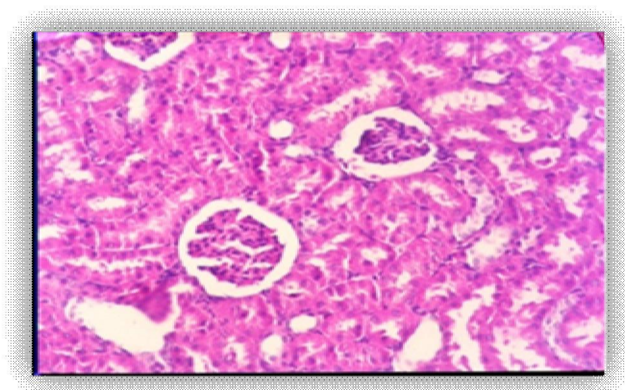
Histopathological Results

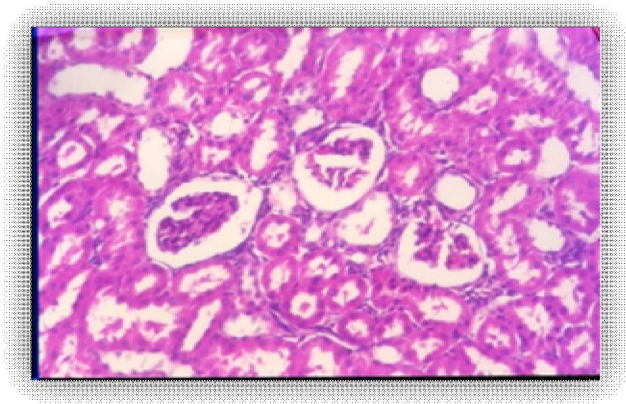
Microscopically, kidneys of control (-) rat revealed the normal histological structure of renal parenchyma (Photo 1). Meanwhile, kidneys of control (+) rat showed vacuolaion of endothelial lining glomerular tufts and epithelial lining renal tubules (Photo2). However, kidneys of rats from 2.5% carob, 5% carob group revealed no histopathological changes (Photomicrograph 3 and 4).

Some examined sections from 7.5% carob group showed atrophy of glomerular tufts (Photo5), whereas, other sections from the same group revealed no histopathological changed (Photo 6).

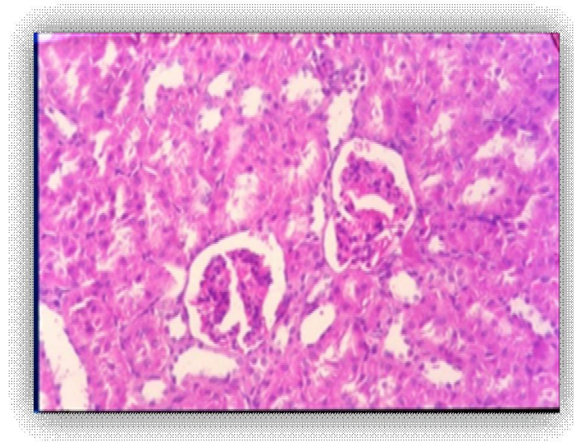
However, kidneys of rat from 2.5% barely group revealed presence of eosinophilic protein cast in the lumen of some renal tubules (Photo7) and vacuolations of endothelial lining glomerular tufts was noticed in kidneys of rat from group 5% barley (Photo9). Meanwhile, kidneys of rat from 7.5%barley, 2.5% ginseng group revealed apparent normal renal parenchyma (Photos 10 and 11).

Moreover, sections from 5% ginseng, 7.5% ginseng, 2.5% combinations group showed no histopathological changes (Photos 12, 13 and 14). However, kidneys of rat from 5% combinations group revealed cystic dilatation of some renal tubules (Photo15). Eosinophilic protein cast in the lumen of some renal tubules was noticed in liver of rat from7.5% combinations group (Photo 16).

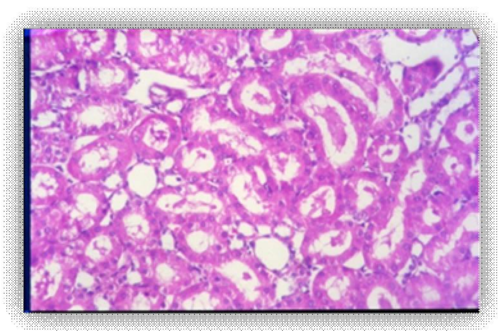
 Microphotograph (1): kidney of control (-) rat showing the normal histological structure of renal parenchyma. (hand e x200).	 Microphotograph (2): kidney of control (+) rat showing vacuolation of endothelial lining glomerular tufts and epithelial lining renal tubules. (hand e x200).
 Microphotograph (3): kidney of rat from 2.5% carob group showing no histopathological changes . (hand e x200).	 Microphotograph (4): kidney of rat from 5% carob group showing no histopathological changes. (hand e x200).



Microphotograph (5): kidney of rat from 7.5% carob group showing atrophy of glomerular tufts. (hand e x200).



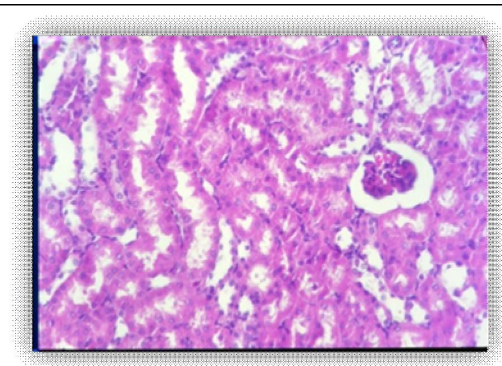
Microphotograph (6): kidney of rat from 7.5% carob group showing no histopathological changes. (hand e x200).



Microphotograph (7): kidney of rat from 2.5% barley group eosinphilic protein cast in the lumen of some renal tubules. (hand e x200).

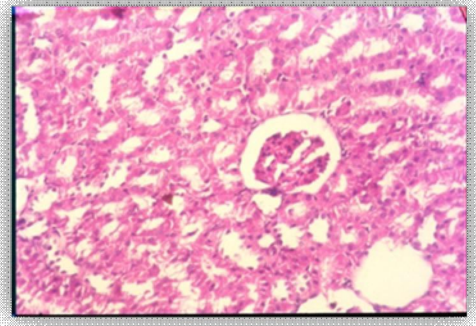
Microphotograph (8): kidney of rat from 5% barley group showing vacolations of endothelial lining glomerular tufts. (hand e x200).

Microphotograph (9): kidney of rat from 5% barley group showing slight atrophy of some glomerular tufts. (hand e x200).

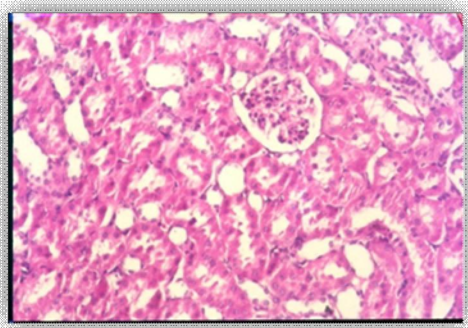


Microphotograph (10): kidney of rat from 7.5% barley group showing apparent normal renal parenchyma . (hand e x200).

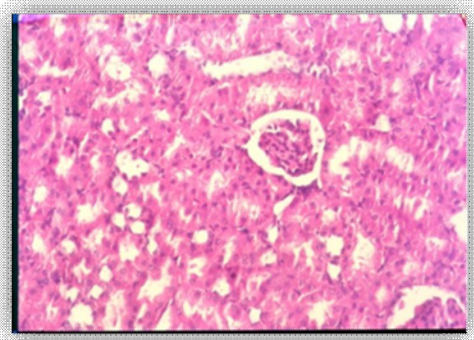
Microphotograph (11): kidney of rat from 2.5% ginseng group showing apparent normal renal parenchyma. (hand e x200).



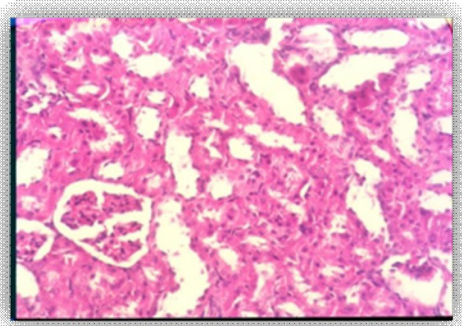
Microphotograph (12): kidney of rat from 5% ginseng group showing no histopathological changes. (hand e x200).



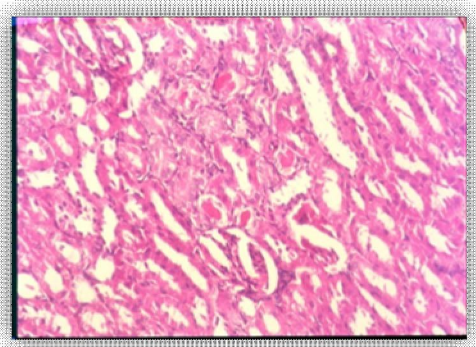
Microphotograph (13): kidney of rat from 7.5% ginseng group showing no histopathological changes . (hand e x200).



Microphotograph (14): kidney of rat from 2.5% combinations group showing no histopathological changes . (hand e x200).



Microphotograph (15): kidney of rat from 5% combinations group showing cystic dilatation of some renal tubules. (hand e x200).



Microphotograph (16): kidney of rat from 7.5% combinations group showing eosinophilic protein cast in the lumen of some renal tubules. (hand e x200).

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