

The Effect of Some Herbal Beverages on the Level of Adiponectin Hormone, Glucose and Lipid Profile of Obese Rats

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Abstract:

Obesity is a growing health problem which is accompanied with increasing the rate of morbidity and mortality. The fact that obesity is the state of adiponectin deficiency makes this hormone a very tempting target for possible therapeutic interventions focusing. Most slim reduction weight cause potentially serious side effects. Herbal medical is a growing area of alternative medicines nowadays. Accordingly, the present study was aimed to identify the effect of different doses of fennel, marjoram, sage and ginger on body weight, adiponectin, leptin, glucose and lipid profile for rats suffering obesity. Aqueous extract of four herbs (Fennel, marjoram, sage and ginger) were prepared. 60 male albino suffering from obesity were treated with different doses of Aqueous extract of the previous four herbs. The results indicated that, best results in body weight gain % recorded for the group which treated with 1½ ml of fennel. Groups treated with high dose of four tested herbs tended to have lower in total cholesterol, triglyceride, LDL-c, VLDL-c and serum glucose. On contrast with increasing the herbal dose the HDL-c has been also increase. Group treated with high dose of ginger tended to have the best results for all tested factor (lipid profile, serum glucose). All tested herbs decrease the level of leptin hormone and increase the level of serum adiponectin hormone. Accordingly, all tested herbs specially ginger can use for reduction of body weight.

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Moreover, the drinking of a those herbs beverage might prevent or decrease the risk of cardiovascular disease and anti-diabetic.

INTRODUCTION:

Obesity is a growing health problem which is accompanied with increasing the rate of morbidity and mortality (Takahashi et al ., 2008) . During the recent decades, the prevalence of obesity in childhood and adolescent is doubled (Kelishadi et al ., 2008). The probability of being obese adults is higher in obese adolescents and this risk is much higher in girls (Gao et al., 2011). Unfortunately, the incidence of obesity-based diseases is increasing sharply in recent years and its' control need to urgent programming among adolescents (Badman et al., 2007) .

Adiponectin has now been added on the list as a new and a very exciting player in the field of obesity related insulin resistance and atherosclerosis. The fact that obesity is the state of adiponectin deficiency makes this hormone a very tempting target for possible therapeutic interventions focusing on the possibility that adiponectin treatment may improve obesity-related insulin resistance and atherosclerosis (Tsao et al., 2002).

Leptin is produced mainly by adipose tissue. Serum leptin levels are elevated in obese children; besides, leptin levels decrease during the weight loss period (Wang and

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Beydoun., 2007). A recent study conducted in overweight children and adolescents showed that being female and having greater BMI were significantly and independently associated with increased serum leptin levels (Havel 2002).

A wide variety of therapeutic agents in modern medicine are available for the treatment of obesity. However, most antiobesity drugs cause potentially serious side effects, and include digestive disturbances, nausea and vomiting. Regular usage of many herbs has been recommended in the management of hyperlipidemia (Ginsberg, 1994).

Herbal medical is a growing area of alternative medicines nowadays. Many active ingredients in manufactured drugs are derived from plant compounds and have a wide range of use. Plants and plant extracts more safe than chemical products whereas natural products is becoming more popular, since drugs of synthetic origin may have a negative impact on the environment and parasite resistance to poisonous chemicals can develop after repeated applications (Magi and Sahk, 2003).

More than 2000 plants have been listed in the traditional (Herbal/Alternative) systems of medicine and some of these are providing comprehensive relief to the people suffering from cardio-vascular diseases, specially "hyperlipidemia" and "ischemic heart disease". WHO reports indicate that around eighty percent of the global

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population still relies on botanical drugs and several herbal medicines have advanced to clinical use in modern times. Accordingly, the present study was aimed to identify the effect of different doses of fennel, marjoram, sage and ginger on adiponectin , leptin ,glucose and lipid profile for rats suffering obesity

Material and Methods:

3.1. Materials:

3.1.1. Source of samples:

- 1- Fennel, marjoram, sage and ginger were purchased from the International Herbals Company, El-Fayoum, Egypt.
- 2- Casein, cholesterol vitamins and minerals, Alczan were obtained from Elgomhoriya Company , Cairo , Egypt.
- 3- Kits for biochemical analysis of serum leptin, adiponectin, cholesterol, triglyceride, HDL-c and blood glucose were obtained from the Gamma Trade Company for Pharmaceutical and Chemicals, Dokki, Egypt.
- 4- Adult males with rats (130) of Sprague Dawley Strain were obtained from International Research Center, Dokky, Cairo, Egypt.

METHODS:

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Preparation of Aqueous extract of herbs:

kilograms of fresh herbs collected and crushed, A total of 200 g of each powder of fennel, marjoram, sage and ginger were dissolved in 1 L of distilled water and boiled for 10 min, cooled and filtered using double layers of gauze to obtain 20% aqueous extracts (Shalaby and Hamowieh, 2010). which have been stored in the refrigerator at 2-8 ° C in a dark glass container closed well.

3.2.3. Experimental animals:

The present study was approved by the local Animal Ethics Committee. The investigation conformed to the National Institutes of Health (NIH) Guide for the Care and Use of Laboratory Animals [DHHS Publication No. (NIH) 85-23, Revised 1985, Office of Science and Health Reports, Bethesda, MD 20892]. All animals were maintained on a 12 h lights and 12 h dark cycle and a temperature of $23 \pm 1^{\circ}\text{C}$. All animals received modified basal diets (Reeves, 2004) and water ad libitum. Male Sprague-Dawley rats with average weights of about 150 g (8 wk old) were purchased from International Research Center, Dokky, Egypt. They were housed 5 rats/cage.

3.2.4. Design of the experiment:

The study will be conducted on 60 rats from male albino rats of the strain (Wister) be aged 8 weeks and ranged weight (150 ± 2 g). The rats were divided into three main groups. The first main group (n=6 rats) was fed on the basal

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diet only, as a control negative group (C-). The second main group was suffering from obese and divided into 9 subgroups ((n=6 rats for each group). The first subgroup was control positive group (suffering from obesity and not treated with herbs). Other four subgroups were suffering from obesity and treated with 1½ ml of aqueous extract of fennel, marjoram, Sage and ginger/100 g body weight. The last four subgroups were suffering from obesity and treated with 3 ml of aqueous extract of fennel, marjoram, sage and ginger/100 g body weight.

Blood sampling:

At the end of each experiment, rats were fasted overnight and anesthetized. Blood samples were collected from the retro-orbital plexus from all animals of each group into clean, dry and labeled tube .The tubes contained heparin (10.01U/ml) as anticoagulant. Blood was centrifuged to separated plasma which was tightly kept in sealed aliquot tubes at -20C until biochemical assays According to (Foster and Dumns, 1973).

Estimation of serum lipid profile:

Total serum cholesterol (Cohn et al., 1988), triglycerides (Foster and Dumns, 1973), HDL-c (young, 2001), LDL-c and VLDL-c calculated by the methods described by Foster and Dumns, 1973.

Estimation of Adiponectin and Leptin

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Serum adiponectin and leptin concentrations were measured by a commercially available ELISA assay (BBridge International, Inc, Sunnyvale CA, USA and R&D Systems, Minneapolis MN, USA, respectively). The determination of those hormones was done in the main laboratory of El-Demerdash hospitable, Ain Shams University.

Determination of serum glucose:-

Serum glucose level was analyzed by colorimetric procedures kits developed by Diamond Diagnostics kits Cairo, Egypt using 550 n/m, according to (Foster and Dumns, 1973).

Statistical analysis:

The statistical analysis was performed by M statat programs. The results are expressed as means \pm sem. The groups were compared by one-way ANOVA followed by Dunnett's test. The correlations between the values were estimated by Pearson correlation test.

RESULTS AND DISCUSSION:

Healthy rats and rat which were suffering from Obesity were supplemented with different doses of fennel, marjoram, sage and ginger for 6 weeks, by the end of the experiments results could be presented as follows:-

Feed intake:

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The effect of feeding healthy rats and rats, which were suffering from Obesity and supplemented with different doses of fennel, marjoram, sage and ginger for 6 weeks on feed intake, is present in Table (1) the till end of experimental period.

The results revealed that feed intake showed significant differences among many studied groups at ($P < 0.01$). By the end of experimental period, the data regarding feed intake was (15.4g/rat) for group (1); control group fed on basil.

The feed intake has been decreased significantly at ($P < 0.01$) for control positive groups of experimental rats, (fed on hyperlipidemic die) recording (14.5 g/rat) and all groups Treatment with different doses of fennel, marjoram, sage and ginger as compared to control negative groups.

**Table (1): The effect of different doses of fennel,
marjoram, sage and ginger on feed intake for rats
suffering from Obesity**

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Parameters Groups		End of 1st week	End of 2ndweek	End of 3rd week	End of 4thweek	End of 5th week	End of 6th week
Control (-) fed on BD		12.1 ^a	12.2 ^{bcd}	13.2 ^a	13.2 ^b	10.4 ^{ab}	10.4 ^{ab}
Control (+) Obese Rats		10.2 ^{bc}	10.7 ^{cd}	12.4 ^{ab}	12.2 ^{bc}	13.0 ^{cd}	14.0 ^{abc} _c
1/2 ml Aqueous extract of the herb	fennel	10.5 ^{abc}	10.8 ^{cd}	11.8 ^{abc}	12.2 ^{bc}	13.7 ^{cd}	14.8 ^b
	Marjoram	10.7 ^{abc}	12.2 ^{bcd}	11.9 ^{abc}	12.3 ^{bc}	13.1 ^d	13.7 ^{bc} _d
	Sage	12.8 ^a	10.1 ^a	13.5 ^a	13.3 ^b	11.6 ^{ef}	12.0 ^{cd}
	Ginger	12.7 ^a	13.1 ^{abc}	13.3 ^a	16 ^a	16.2 ^a	16.0 ^a
3 ml Aqueous extract of the herb	fennel	11.7 ^{abc}	10.1 ^a	12.6 ^{abc}	12.1 ^{bc}	12.7 ^{de}	12.7 ^{cd}
	Marjoram	11.7 ^{ab}	12.2 ^{bcd}	11 ^{bc}	13.4 ^b	12.8 ^{de}	14.0 ^b
	sage	11.1 ^{abc}	10.2 ^d	12.8 ^{abc}	14 ^{ab}	13.0 ^{cd}	14.7 ^{cd}
	Ginger	11.0 ^{abc} _c	13.8 ^{ab}	12.6 ^{abc}	15.8 ^a	14.8 ^{bc}	10.8 ^{ab}

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Means with the same letter were not significantly different ($P > 0.01$)

Except highly significant increase of feed intake at ($p < 0.01$) has been observed for Ginger with the low or high dose recording (16.5g/rat) (15.8 g/rat), as compared to control negative or positive groups

Body weight gain:

By the end of experimental period. The data given in Table (2) showed that, body weight gain recorded (69.58%) for control negative group. Moreover, the body weight gain has been increased significantly at ($P < 0.01$) for control positive groups of experimental rats, (fed on hyperlipidemic die) as compared to control negative groups and recording (91.48%).

In this respect, Amin and Nagy., (2009) showed that feeding HFD diet significantly increased final body weight.

However groups treated with low dose of tested herbs (fed on hyperlipidemic diet plus 1½ ml of fennel, marjoram, sage and ginger) of experimental rats, as compared to control positive groups recording (72.99 %), (74.23 %), (73.88 %) and (75.32 %); respectively.

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Table (2): The effect of different doses of fennel, marjoram, sage and ginger on Body weight gain for rats suffering from Obesity.

Parameters		Initial weight	Final weight	BWG%
Groups				
Control (-) fed on BD		118.33 ^b	200.67 ^a	69.58 ^a
Control (+) Obese Rats		109.67 ^a	210.00 ^c	91.48 ^d
1½ ml Aqueous extract of the herb	fennel	118.50 ^b	205.00 ^{ab}	72.99 ^{ab}
	marjoram	118.33 ^b	206.17 ^{ab}	74.23 ^{ab}
	Sage	118.67 ^b	206.33 ^{ab}	73.88 ^{ab}
	ginger	118.83 ^b	208.33 ^{bc}	75.32 ^{bc}
3 ml Aqueous extract of the herb	fennel	118.83 ^b	205.00 ^{ab}	72.51 ^a
	Marjoram	118.33 ^b	206.17 ^{ab}	73.30 ^{ab}
	sage	118.83 ^b	205.00 ^{ab}	72.51 ^a
	Ginger	118.83 ^b	205.00 ^{ab}	72.51 ^a

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Means with the same letter were not significantly different ($P < 0.01$)

The best results in body weight gain % recorded for the group which treated with 1½ ml of fennel. This result agreed with Bae et al ., (2015) who reported that the effects of drinking fennel tea (FT), fenugreek tea (FGT) were significantly effective aid to suppress subjective appetite among overweight women in South Korea

It should be noted that, with the increasing the dose of fennel, marjoram, sage and ginger the body weight gain % has been decreased, as compared to control positive groups recording (72.51 %), (73.30 %), (72.51%) and (72.51 %); respectively. The best results in body weight % recorded for the groups treated with high dose of herbs (fed on hyperglycemia diet plus 3 ml of fennel, , sage and ginger).

In this respect, Ninomiya et al., (2004) Stated that the extract of *S. officinalis* leaves inhibitory effect against the pancreatic lipase activity and eventually was effective in reducing body weight and obesity. On the other hand a recent article suggest that consumption of ginger could aid in the treatment of obesity and other diseases (Ahmida and Abuzogaya, 2009).

From the statistical data presented in Table (2) it may be noted that, body weight gain of all treated group with the different levels of fennel, marjoram, sage and ginger decreased significantly, as compared to control negative and

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positive groups. Moreover, the experimental groups which supplemented with high doses of fennel, marjoram, sage and ginger tended to have percent of body weight lower than its counterparts fed on supplemented with low doses of fennel, marjoram, sage and ginger .

Adiponectin:-

The effect of feeding healthy rats and rats which were suffering from Obesity and supplemented with different doses offennel, marjoram, sage and ginger for 6 weeks on the level of Adiponectin and Leptin hormones were presented in table (3)

The results revealed that adiponectin was (25 µg/ml) for control negative group of experimental rats (control group fed on basal diet). Likewise, the adiponectin levels has been decreased significantly at ($p < 0.01$) for positive group (untreated group fed on hyperlipidemic diet) of experiment rats recording (15 µg/ml).

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Table (3): The effect of different doses of fennel, marjoram, sage and ginger on adiponectin and leptin for rats suffering from Obesity

Parameters		Adiponectin	Leptin
Groups			
Control (-) fed on BD		25 ^d	19 ^a
Control (+) Obese Rats		15 ^a	32 ^d
1½ ml Aqueous extract of the herb	fennel	19 ^b	30 ^{cd}
	Marjoram	22 ^{bcd}	26 ^b
	Sage	20 ^{bc}	26 ^b
	Ginger	25 ^d	18 ^a
3 ml Aqueous extract of the herb	fennel	20 ^{bc}	28 ^{b^c}
	Marjoram	25 ^d	21 ^a
	sage	23 ^{cd}	20 ^a
	Ginger	23 ^{cd}	21 ^a
r^+		-0.94 ^{**}	

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Means with the same letter were not significantly different ($P < 0.01$)

r^+ , Simple Correlation

From the above-mentioned data presented in Table (9), it could be observed that, Serum adiponectin levels are negatively correlated with body weight gain. The present data all the same agreed with that of (Kadowaki and Yamauchi, 2005) observed that inverse association between obesity phenotypes and adiponectin levels in the blood.

In this respect, Results chemerin concentrations were associated with and adiponectin levels in obese girl adolescents, negatively (Maghsoud et al ., 2015)

Likewise, the adiponectin increased significantly at ($p < 0.01$) for groups groups that treated with low dose of tested herbs (fed on hyperlipidemic diet plus 1½ ml of fennel, marjoram, sage and ginger) of experimental rats recording (19 µg/ml), (22µ g/ml), (20µ g/ml) and (22 µg/ml); respectively. as compared to positive group (untreated group fed on hyperlipidemic diet). This result was agreed with the results published by Imatoh et al ., (2011) found that the means of adiponectin levels were positively associated with coffee consumption

From the above-mentioned data presented in Table (3), it could be observed that, with the increasing the dose of fennel, marjoram, sage and ginger the level of adiponectin has been also increased recoding(20 µg/ml), (25 µg/ml),

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(23 µg/ml) and (23 µg/ml); respectively Moreover, the experimental groups which supplemented with high doses of fennel, marjoram, sage and ginger tended to have percent of body weight lower than its counterparts fed on supplemented with low doses of fennel, marjoram, sage and ginger .

From the above-mentioned data presented in Table (3), it could be observed that, increase dose of tested herbs (fennel, marjoram, sage and ginger) level of adiponectin has been also increased while body weight gain decreased compared to positive group (untreated group fed on hyperlipidemic diet).

Leptin:-

The effect of feeding healthy rats or rats, which were suffering from Obesity and supplemented with different doses of fennel, marjoram, sage and ginger on leptin , were presented in Table (3). The data regarding leptin were (19 µg/ml) for control negative group. It should be noted that, the leptin level increased significantly at ($p < 0.01$) for control positive group (untreated group fed on hyperlipidemic diet) of experiment rats recording (32 µg/ml).

Likewise, the leptin levels decreased significantly at ($p < 0.01$) for all treated groups (fed on hyperlipidemic diet plus of different doses of fennel, marjoram, sage and ginger)

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of experimental rats as compared to control positive group (untreated group fed on hyperlipidemic diet).

From the above-mentioned data presented in Table (8), it could be observed that, with the increasing the dose of fennel, marjoram, sage and ginger the level of leptin has been also decreased recoding(28µg/ml), (21 µg/ml), (20 µg/ml) and (20 µg/ml); respectively Moreover, the tended to have percent of body weight lower than its counterparts fed on supplemented with low doses of fennel, marjoram, sage and ginger ..

Table (4): Simple Correlation between adiponectin, Leptin levels and Body weight gain for rats suffering from Obesity

Parameters		BWG%	Adiponectin	Leptin
Groups				
Control (-) fed on BD		69.58 ^a	25 ^d	19 ^a
Control (+) Obese Rats		91.48 ^d	15 ^a	32 ^d
1½ ml Aqueous extract of the herb	fennel	72.99 ^{ab}	19 ^b	30 ^{cd}
	Marjora	74.23 ^{ab}	22 ^{bcd}	26 ^b
	Sage	73.88 ^{ab}	20 ^{bc}	26 ^b
	Ginger	75.32 ^{bc}	25 ^d	18 ^a

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3 ml Aqueous extract of the herb	fennel	72.51 ^a	20 ^{bc}	28 ^{bc}
	Marjora	73.30 ^{ab}	25 ^d	21 ^a
	sage	72.51 ^a	23 ^{cd}	20 ^a
	Ginger	72.51 ^a	23 ^{cd}	21 ^a
r^+			-0.091	0.161

Means with the same letter were not significantly different ($P < 0.01$)

r^+ , Simple Correlation

From the above-mentioned data presented in Table (4), it could be observed that, increase dose of tested herbs (fennel, marjoram, sage and ginger) level leptin of has been also decreased while body weight gain decreased compared to positive group (untreated group fed on hyperlipidemic diet). There are a positive relation between adiponectin and BWG. And negative relation between leptin and BWG. The previous data agreed with the results of studies have shown that leptin remains highly correlated to body fat mass and that it usually is coupled to be the antilog of adiponectin, increasing in level while the other is decreasing. (Rea and Donnelly., 2004)

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Serum total cholesterol:

The effect of feeding healthy rats and rats which were suffering from Obesity and treated with different doses of fennel, marjoram, sage and ginger for 6 weeks on serum total cholesterol and triglycerides were presented in table (5)

Table (5): The effect of different doses of fennel, marjoram, sage and ginger on the serum total cholesterol and triglycerides for rats suffering from obesity.

Parameters	Total cholesterol	Triglycerides
Control (-) fed on BD	106.50 ^a	84.33 ^a
Control (+) Obese Rats	292.00 ^g	216.17 ^f
1½ ml Aqueous extract of the herb	fennel	166.83 ^{ef}
	Marjoram	142.83 ^d
	Sage	181.17 ^f
	Ginger	127.83 ^c

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3 ml Aqueous extract of the herb	fennel	161.33 ^e	145.83 ^e
	Marjoram	134.17 ^{cd}	98.17 ^b
	sage	174.33 ^f	125.50 ^{cd}
	Ginger	117.5 ^b	81.67 ^a

Means with the same letter were not significantly different ($P < 0.01$)

The results given in table (5) revealed that, serum total cholesterol showed significant differences among all studied groups at ($p < 0.01$). However the data in table (5) regarding serum total cholesterol were 106.50 mg/dl for control negative group of experimental rats (control group fed on basal diet). As expected, serum total cholesterol increased at ($p < 0.01$) for control positive group of experimental rat (untreated group fed on hyperlipidemic diet, and recording 292.00 g (mg/dl).

Meanwhile, the serum cholesterol in low dose groups experimental rat (fed on hyperlipidemic diet plus 1½ ml of fennel, marjoram, sage and ginger) decreased significantly at ($p < 0.01$) and recording (166.83 mg/dl, 142.83 mg/dl, 181.17 mg/dl and 127.83 mg/dl); respectively as compared to control positive group (untreated group fed on hyperlipidemic diet).

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From this data it could be concluded that, the effect of different doses of fennel, marjoram, sage and ginger led to decrease total serum cholesterol significantly at ($p < 0.01$) in rats as compared to control positive group (untreated group fed on hyperlipidemic diet).

Moreover, the total serum cholesterol has been decreased significantly with the increasing doses of fennel, marjoram, sage and ginger for healthy or hyperlipidemic rats. recording (161.33 mg/dl, 134.17 mg/dl, 174.33mg/dl and 117.5mg/dl);

The best result for total cholesterol was record for treated group fed on hyperlipidemic plus Ginger followed by Marjoram. In this respect, Vági et al., (2005) and Amarowicz et al., (2008) found that marjoram ethanolic extract contain considerable amounts of total phenolics compounds and have antioxidant activity and free radical-scavenging capacity. The hypocholesterolemic effect of marjoram could be attributed to presence of is flavones which prevent intestinal absorption of cholesterol by competition for its absorption sites. These results also in accordance (Dina And Naglaa., 2012) recommended that use of marjoram and ginger in cholesterol patients food

These results are in the same line with Saeid et al., (2010) who explore the usage of different levels of aqueous extract of ginger at concentration of 0.4 and 0.6% respectively on the Lipid Profile of the Broiler Chickens. He

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found that serum cholesterol level was a significantly lower in the 0.4 and 0.6% aqueous extract of ginger ($p < 0.05$) than control.

It should be noted that, the diet should be containing a high or moderate level of doses of fennel, marjoram, sage and ginger.

Serum triglycerides:

The effect of feeding healthy rats or rats which suffering from obesity on serum triglycerides were illustrated in table (5).

The data indicated that serum triglycerides were (84.33) for control negative group of experimental rats (group fed on basal diet). Likewise, The serum triglycerides for control positive group of experimental rats (untreated group fed on hyperlipidemic diet) had total triglyceride much higher than control negative group. Even significant differences has been observed between them. The serum triglycerides decreased significantly at ($p < 0.01$) for treated groups with low doses of three tested herbs, to recoding (149.33 mg/dl, 121.67 mg/dl, 131.83 mg/dl and 88.50 mg/dl); respectively.

Moreover, hyperlipidemic groups treated with different doses of fennel, marjoram, sage and ginger tended to have triglyceride lower than control positive groups diet.

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The serum triglycerides decreased significantly at ($p < 0.01$) for all treated groups which fed on hyperlipidemic diet plus 3 ml Aqueous extract of the tested herbs , to recording 145.83 mg/dl, 98.17 mg/dl, 125.50 mg/dl and 81.67 mg/dl); respectively. It should not be forgotten that TG is used to give energy to the cells to function. Meanwhile undesirable effects of high triglycerides are associated with a high risk of heart disease.

From this data, it could be concluded that, the effect of doses of fennel, marjoram, sage and ginger led to decrease total serum triglyceride. Even, significant differences were observed at ($P < 0.01$), as compared to control hyperlipidemic rats. Moreover, the total serum triglycerides has been decreased significantly with the increasing doses of fennel, marjoram, sage and ginger for hyperlipidemic rats.

Ginger with the low or high dose tended to have the best effect for lowering the total triglyceride. Even no statistical significant differences were observed between this group and control negative group (healthy group). The previous data agreed with the results of (Beattie et al.,2011) Found that dietary ginger phytochemicals target cholesterol metabolism and fatty acid oxidation in mice, with anti-obesogenic but also hypercholesterolemia consequences

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Serum HDL cholesterol :

High density lipoprotein (HDL-c) of serum healthy or Obese rats, which treated, or not treated with different doses of fennel, marjoram, sage and ginger were presented in table (6).

However, the data revealed that HDL cholesterol was 38.00 mg/dl for control negative group of experimental rats Likewise, The serum (HDL-c) for control positive group of experimental rats (untreated group fed on hyperlipidemic diet) had higher than control negative group.

The results revealed that serum HDL-c showed significant differences among almost studies groups at ($p < 0.01$) as shown in table (13). From this data it could be concluded that, the effect of different doses of fennel, marjoram, sage and ginger led to increase (HDL-c) significantly at ($p < 0.01$) in rats as compared to control positive group (untreated group fed on hyperlipidemic diet).

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Table (6): The effect of different doses of fennel ,marjoram, sage and ginger on HDL- cholesterol, LDL cholesterol, VLDL cholesterol and HDL/LDL ratio for rats suffering from obesity

Groups	Parameters	HDL-cholesterol	LDL-cholesterol	VLDL-cholesterol	HDL\LDLratio
Control (-) fed on BD		38.00 ^e	56.47 ^a	16.87 ^a	0.67 ^d
Control (+) Obese Rats		23.67 ^a	210.77 ^e	43.23 ^d	0.11 ^a
1½ ml Aqueous extract of the herb	fennel	31.33 ^c	102.47 ^{cd}	29.87 ^c	0.26 ^{ab}
	Marjora	33.83 ^{cd}	84.67 ^{bc}	24.33 ^b	0.40 ^c
	Sage	27.00 ^b	119.63 ^d	26.37 ^{bc}	0.22 ^{ab}
	Ginger	34.50 ^{cd}	83.13 ^{dc}	17.70 ^a	0.41 ^{bc}
3 ml Aqueous extract of the herb	fennel	33.17 ^{cd}	98.17 ^{bcd}	29.17 ^c	0.38 ^c
	Marjora	34.00 ^{cd}	83.20 ^{bc}	19.63 ^a	0.41 ^{bc}
	sage	31.33 ^c	117.90 ^d	25.10 ^b	0.28 ^{ab}
	Ginger	35.17 ^{de}	77.50 ^b	16.33 ^a	0.45 ^{bc}

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Means with the same letter were not significantly different ($P < 0.01$)

Meanwhile, the serum HDL cholesterol in treated groups with high dose increased significantly at ($p < 0.01$), as compared to control positive group, and recording (33.17, 34.00, 31.33 and 30.17 mg/dl); respectively.

Ginger and Marjoram with the low or high dose and tended to have the best effect for A significant increase serum HDL cholesterol These results are in the same line with (Dina And Naglaa., 2012) Showed that the effect of feeding on natural herbs marjoram and ginger or mixture of them on hypercholesterolemia male rats. been studied the effect of each of the herbs on the level of blood fats. The results revealed that , all treated rats with 5and10% marjoram and ginger or mixture of them at 10 % resulted in significant decrease ($P < 0.05$) of total cholesterol, triglyceride , LDL-c than positive control group, while HDL-c was increased

Serum LDL cholesterol:

The effect of feeding healthy or obese rats with two doses of fennel, marjoram, sage and ginger on serum LDL-c was presented in table (6). The result revealed that serum LDL cholesterol showed significant differences among almost studied groups at ($p < 0.01$).

The data regarding serum LDL cholesterol were (56.47) for control negative group of experimental rats

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However, the serum LDL cholesterol for control positive group (untreated group fed on hyperlipidemic diet) has been increase significantly at ($p < 0.01$), as compared to control negative group, and recorded (210.77mg/dl). Meanwhile, groups of rats fed on hyperlipidemic diet and treated with two tested doses of fennel, marjoram, sage and ginger had serum LDL-c much lower than untreated group fed on hyperlipidemic diet. Accordingly, it is easy to detect that those aqueous extract of the herb play active role in the metabolism of serum LDL-c These results are in the same line with(Amin and Nagy .,2009). showed that feeding HFD diet significantly increased final body weight, triglycerides (TG), total cholesterol, & LDL concentration compared with controls, while significantly decreasing HDL

From this data it could be concluded that, the effect of doses of fennel, marjoram, sage and ginger led to decreased serum LDL-c significantly at ($p < 0.01$), as compared to control hyperlipidemic rats (control positive). Moreover, the serum LDL-c has been decreased significantly with increasing the doses of aqueous extract of the three examined herb of for hyperlipidemic rats.

Ginger and Marjoram with the low or high dose and tended to have the best effect for A significant decrease serum IDL cholesterol These results are in the same line with (Dina And Naglaa., 2012)

Serum VLDL cholesterol:

The effect of treated healthy or obese rats with different doses of aqueous extract of fennel, marjoram, sage and ginger on the level of serum VLDL-c were presented in table (6). The results revealed that serum VLDL-c showed significant differences among all studied groups at ($p < 0.01$) as shown in table.

The data regarding serum cholesterol were 16.87 mg/dl for control negative group of experimental rats. As expected, control positive group (untreated group fed on hyperlipidemic diet) had VLDL-c approximately two times more than control negative group (untreated group fed on basal diet). Moreover, all treated groups of experimental rats fed on hyperlipidemic diet tended to have VLDL-c higher than its counterparts fed on basal diet (control negative group). It may be due to the effect of fats added in the diet. These results are in the same line with (Amin and Nagy .,2009).

Likewise, the serum VLDL cholesterol decreased significantly at ($p < 0.01$) for treated groups with two doses of aqueous extract of the three examined herb, as compared to hyperlipidemic diet group (control positive group).

Groups treated with two doses of aqueous extract of ginger tended to have the lowest VLDL-c among all experimental groups. Even there was no statistical

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significant differences were observed between those groups and control negative group.

HDL\LDL RATIO

The effect of feeding healthy or obese rats with two doses of fennel, marjoram, sage and ginger on HDL\LDL ratio was presented in table (6). The result revealed that HDL\LDL ratio showed significant differences among almost studied groups at ($p < 0.01$).

The data regarding HDL\LDL ratio were (0.67) for control negative group of experimental rats

However, the HDL\LDL ratio for control positive group (untreated group fed on hyperlipidemic diet) has been decrease significantly at ($p < 0.01$), as compared to control negative group, and recorded (0.11). Meanwhile, groups of rats fed on hyperlipidemic diet and treated with two tested doses of fennel, marjoram, sage and ginger had HDL\LDL ratio much higher than untreated group fed on hyperlipidemia

From this data it could be concluded that, the effect of doses of fennel, marjoram, sage and ginger led to increased HDL\LDL ratio significantly at ($p < 0.01$), as compared to control hyperlipidemic rats (control positive). Moreover, the HDL\LDL ratio has been increased significantly with increasing the doses of aqueous extract of the three examined herb of for hyperlipidemic rats.

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Ginger and Marjoram with the low or high dose and tended to have the best effect for A significant increase HDL\LDL ratio

Table (7): Simple Correlation between adiponectin levels and

Parameters		glucose	Adiponectin	Leptin
Control (-) fed on BD		86.33 ^a	25 ^d	19 ^a
Control (+) Obese Rats		186.67 ^e	15 ^a	32 ^d
1½ ml Aqueous extract of the herb	fennel	136.67 ^d	19 ^b	30 ^{cd}
	Marjoram	114.17 ^{bcd}	22 ^{bcd}	26 ^b
	Sage	121.17 ^{bcd}	200 ^{bc}	26 ^b
	Ginger	106.17 ^{abc}	25 ^d	18 ^a
3 ml Aqueous extract of the herb	fennel	128.5 ^{cd}	20 ^{bc}	28 ^{bc}
	Marjoram	107.17 ^{abc}	25 ^d	21 ^a
	sage	117.67 ^{bcd}	23 ^{cd}	20 ^a
	Ginger	100.83 ^{ab}	23 ^{cd}	21 ^a
r^+			-0.929 ^{**}	0.838 ^{**}

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serum glucose for rats suffering from obesity.

Means with the same letter were not significantly different ($P > 0.01$) r^+ , Simple Correlation

Serum blood glucose:

The effect of treated healthy or obese rats which supplemented with different doses of fennel, marjoram, sage and ginger on the level of serum blood glucose were presented in Table (12). The results revealed that, serum blood glucose showed significant differences among all studied groups at ($p < 0.01$) Table (7).

Serum blood glucose were (86.33 mg/dl) for control negative group of experimental rats. This level of serum blood glucose increased significantly at ($p < 0.01$) for control positive groups, as compared to control negative group, and reaching (186.67 mg/dl). The present data for serum blood glucose were in general

In this respect, Elizabeth,(2005) and Canale et al ., (2013) detected that Obesity plays a pivotal role in the development of type 2 diabetes.

results also in accordance Bo Hu. (2011) recommended that Diabetes Mellitus (DM) is a chronic metabolic disorder. It is characterized by high blood glucose (sugar)

Likewise, the serum blood glucose decreased significantly at ($p < 0.01$) for groups treated with low dose of

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tested herbs, as compared to control positive group. This result was harmony with the observation that, high levels of fennel, marjoram, sage and ginger in the body may prevent diabetes. Moreover, there are a good relation between levels of fennel, marjoram, sage and ginger and insulin

As expected, control positive group of experiential rats (untreated group fed on hyperlipidemic diet) had blood glucose approximately one and have times more than control negative group. Moreover, all treated groups of experiential rats tended to have blood glucose higher than its counterparts fed on basal diet. It may be due to the fact that there are good correlations between the serum lipid profile and serum blood glucose. All obtained blood glucose in current study was in general agreement with a recent study published by (Barros et al .,2009) Fennel (*Foeniculum vulgare* Mill.) is a widespread perennial umbeliferous (Apiaceae) herb, traditionally used for medicinal purposes and human consumption. It is highly recommended for diabetes, (Christensen et al.,2010) Suggested that extract of *S. officinalis* has been found to exhibit insulin-like activities.

Whereas, treated groups with high doses of herbs which fed on hyperlipidemic diet plus 3 ml of fennel, marjoram, sage and ginger had the lowest level of serum blood glucose, as compared to other groups. From the above mentioned data it could be concluded that, groups treated with high and low doses of ginger had serum blood glucose

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lower than other treated groups. Even there was no significant differences has been observed between those groups and control negative group.

Ginger and Marjoram with the low or high dose and tended to have the best effect for A significant decrease serum blood glucose These results are in the same line with Oaman, and Abbas,2010) revealed that marjoram is a useful herbal remedy, oral administration of marjoram exerted noticeable amelioration of diabetes and its complications in male adult rats

From the above-mentioned data presented in Table (7), it could be observed that, Serum adiponectin levels are negatively correlated with serum blood glucose The present data all the same agreed with (Shakuntala.,2012) found that two of these hormones are adiponectin and leptin. Adiponectin has been causally linked to insulin sensitivity while leptin is involved in the regulation of food intake and energy balance

Conclusion

This trial clarified that the continuous ingestion of tested herbs, especially in high amounts, reduces serum cholesterol, triglyceride, LDL-c, VLDL-c levels, and blood glucose without the need for any lifestyle changes. Accordingly, the drinking of a those herbs water might prevent or decrease the risk of cardiovascular disease and anti-diabetic. Tested herbs, especially in high amounts

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tended to increase serum adiponectin and reduce serum leptin. Accordingly, the drinking of a those herbs water can play a positive role for weight reduction. All tested water extract of herbs have positive health effect and reduction of weigh, especially ginger at high dose.

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