Effect of White Bean (Phaseolus Vulgaris) on Lipid Profile and Oxidative Stress in Hyperlipidemia Male Rats

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Abstract
The plant white bean is used to treat hyperlipidemia , so the study was designed to know their ability to reduce lipid in the blood and effect on oxidative stress, 30 adult male rats were used and randomly divided into two equal groups The first group (C): it included (15) animals were fed regular diet., The second group: it included (15) animals also in which hyperlipidemia was introduced by adding 2%, powdered cholesterol in dite for one months The second group was divided into two subgroups as follows, Positive control group (T1) : included (6) animals, fed a high fat foods The second treatment,(T2), included (6) animals, fed a high- fat diet and administered white bean at a dose of 10% mg / kg The third treatment,(T3), included (6) animals ,fed regular diet and dosed with aqueous white bean extract at a dose of 10% mg / kg for a month The aqueous extract of white bean contributed positively to reducing improving some biochemical parameters.
Keywords: white bean, hyperlipidemia, rats, lipid profile

1. Introduction

At present, the prevalence of hyperlipidemia has increased all over the world as a result of the frequent intake of foods rich in saturated and unsaturated fatty acids. Therefore, hyperlipidemia has become one of the most prevalent conditions in some societies and It is characterized by increased levels of lipoproteins or lipids in serum or plasma, which result from acquired disorders or genetic factors. . Several studies have proven that high levels of fat are the main cause of many diseases such as cardiovascular disease, obesity, kidney and liver disease [1, 2]. Legumes are one of the most important foods that have functional and nutritional properties, the intake of legumes at least 4 times a week can reduce the risk factors associated with cardiovascular disease and congestive heart failure and improve the lipid profile, on the other hand, the daily consumption of legumes showed a significant improvement in the level of sugar in Blood, Blood Pressure, and Inflammatory Conditions [3]. White bean (Phaseolus vulgaris) is the second most important legume crop and is one of the most common legumes consumed worldwide. It is a tremendous source of dietary fiber, carbohydrates, proteins, vitamins, minerals, and phytochemicals [4, 5]. Based on the above, the current study aimed to examine the hypolipidemic properties of white beans in male rats fed high-fat diets.

2. Materials and Methods

Preparation of the aqueous extract of white bean
The aqueous extract of white bean was prepared according to the method [6] as follows:
[7] g of dry white bean powder was weighed, then the white bean was ground and placed in a 500 ml glass beaker containing 200 ml of distilled water and mixed with a magnetic stirrer for 10 minutes. The solution was left after that (30) minutes to precipitate the plant parts and filtered the solution with tulle, neglecting the sediment and separating the filtrate in a centrifuge at a speed of (300) revolutions per minute for (10) minutes To obtain a clear solution, it was concentrated in a rotary evaporator at a temperature of (45) C, then dried the extract after concentration in a rotary evaporator by placing it in glass dishes (weights known) with a capacity of 75 ml and placed in an electric oven at a temperature of (40) C to obtain the dry aqueous extract.
In this study, 30 adult white males were used, weighing between (150-200) kg were used and The animals were divided into two groups:
• The first group (C): it included (15) animals and was fed on normal diet.
• The second group: it included (15) animals where obesity was introduced by addition of 2% per cent animal fat for one month's [8] After the end of the period, the lipid profile (3) of an animal was measured to ensure that it had a higher fat content compared to the random sample taken from the control group.

The second group was divided into three subgroups as follows:

Negative control group (C): included (6) animals were fed with normal diet and dosed with distilled water for one month.
2- Positive control group (T1) : included (6) animals were fed with high fat diet and dosed with distilled water for one month.
3- The second treatment,(T2), included (6) animals were

doi.org/10.31838/hiv22.02.238 Received: 09.05.22, Revised: 10.06.22, Accepted: 22.08.22

fed a high-fat diet, and aqueous white bean extract at a dose of 10% mg / kg per month [9].

4- The third treatment,(T3), included (6) animals were fed with normal diet and dosed with aqueous white bean extract at a dose of 10% mg / kg per month .

After the experiment, which lasted, the animals were anesthetized using chloroform and blood was withdrawal directly from the heart using a 5 ml syringe,1 ml of blood drawn should be placed in the EDTA anticoagulant blood collection tubes for analysis of the doll standards Whereas, 3 ml of the remaining blood was placed in the clean anticoagulant test tubes ,the Samples were placed inside the centrifuge for 15 minutes in order to separate the serum and performing biochemical tests.

3. Statistical analysis:

The data are presented as mean ± SD. Multiple comparisons were performed using one-way ANOVA followed by LSD as a post hoc test. The 0.05 level of probability was used as the criterion for significance. All statistical analyses were performed using SPSS program version27 [7].

4. Results

Table (1) shows a significant increase (P <0.05) in the concentration of MDA, concentrations and a decrease in the level of CAT levels in the T1 treatment compared to the negative control group (C), while a significant decrease (P <0.05) in the MDA and increase in level of CAT of the treatment. T2 compared to treatment T1, while the results of treatment T3 a showed no significant decrease (P <0.05) in antioxidant level compared to C.

Table(1): Effect of white bean extract on antioxidant level with white male rats

Groups	MDA	Catalase
C	19.06±1.23AC	16.21±0.78A
G1	29.22±0.83B	9.58±0.65B
G2	17.8±0.83A	14.84±0.85C
G3	19.6±1.19C	16.04±1.08A
LSD(P<0.05)	1.39	1.14

*Values represent mean ± SD for 5 batches .
*Means with different letters in the same column are significantly different (P<0.05)

Table (2) shows a significant increase (P <0.05) in the concentration of TC, TG, LDL, concentrations and VLDL and a decrease in the level of HDL levels in the T1 treatment compared to the negative control group (C), while a significant decrease (P <0.05) in the lipid level of the treatment. T2 compared to treatment T1, while the results of treatment T3 a showed no significant decrease (P <0.05) in lipid level compared to C.

Table (2):Effect of white bean extract on of white male rat lipids

Groups	Cholesterol	TG	HDL	VLDL	LDL
C	55.8±1.48A	76±4AB	32.79±0.74A	15.2±0.78A	8±0.35A
G1	77.4±1.67B	78.8±4.38A	25.32±0.81B	35.54±0.47B	26.6±1.67B
G2	52.6±1.67C	75.2±2.77B	30±2.44C	13.2±2.28C	7.4±1.08A
G3	56.6±3.01A	78±1.64AB	42.2±1.44D	14.18±0.28AC	8.28±1.5A
LSD(P<0.05)	3.08	3.22	2.04	1.60	1.82

*Values represent mean ± SD for 5 batches.
*Means with different letters in the same column are significantly different (P<0.05)

5. Discussion

The results of the current study were consistent with [10] and with the results of Saleh and [11]. Also, [9] showed that a high-fat diet led to an increase in cholesterol, LDL, VLDL, and TG levels and a decrease in HDL levels. . The increase in lipids in rats fed a high-fat diet may be due to the activity of the enzyme lipoprotein lipase that converts VLDL-c to LDL-c, which leads to an increase the concentration of LDL-c in the blood [11].

As well as, the change in the lipid profile may be due to the activation of gastric lipases, intestinal fat absorption, and lipolysis [12], or it may be due to the increase in the resulting cholesterol esters, and this confirms the ability of cholesterol to increase triglyceride levels, or it may be the result of a decrease in the level of bile salts. Or because of changes in the process of absorption and secretion of sterols, high cholesterol in the blood may be attributed to a disease that affects the liver and thus loses its ability to benefit from cholesterol to convert it to HDL and LDL [13]. As cholesterol is a risk factor for many diseases such as cardiovascular disease and cholelithiasis, it has been shown that a low plasma concentration of harmful cholesterol reduces the risk of cardiovascular disease and associated mortality [14].

The results also showed low levels of cholesterol, LDL, TG, and VLDL, and high levels of HDL in G2. This may be because eating beans increases the rate of cholesterol secretion in bile, which reduces the availability of hepatic cholesterol for the manufacture of lipoproteins. Phaseolus vulgaris also promotes the removal of VLDL may be due to some components In Phaseolus vulgaris such as saponins and phytosterols inhibit lipid absorption in the gut by forming a complex with bile acids and interfere with the formation of cholesterol micelles essential for lipid absorption and downregulation of lipogenic proteins via certain receptors in the liver [2]. The cholesterol-lowering effect of beans may be due to the potential effects of soluble fibers, proteins, saponins, and tannins. Clinical studies and studies conducted on animals have shown that the fiber content in beans prolongs the presence of lipoproteins derived from the intestines and increases cholecystokinin response to the meal, which leads to a hypocholesterolemic effect. [15-17] revealed that white bean extract significantly reduced the concentrations of TG, TC, and LDL-c and increased the concentration of HDL-c. The cholesterol-lowering effect may be due to the high amount of phytochemicals in the beans and may be attributed to the vast pharmacological properties. the decrease in TC and TG concentrations after treatment with bean extract may be due to the effect of the availability of saponins, which reduces

cholesterol through the formation of insoluble compounds with cholesterol and bile, making them unavailable for absorption [18].

The results of the current study revealed that the increased level of MDA and decreased level of Catalase in G1. the decreased activity of antioxidant enzymes in the serum of rats fed a high-fat diet could lead to the excessive availability of superoxide and peroxyl radicals, which in turn generate hydroxyl radicals, leading to the initiation and proliferation of more lipid peroxidation products. In addition, foods rich in fats lead to the secretion of free fatty acids through the action of lipoprotein lipase, with an increase in triglycerides in the blood and causing lipotoxicity, which leads to an imbalance in the insulin receptors. Excessive release of free fatty acids induces lipotoxicity, and fats and their metabolites generate oxidative stress [19]. In obese human and animal models, hyperlipidemia leads to oxidative stress and increased lipid peroxidation.

The results of the current study also revealed a decrease in the level of MDA and an increase in the level of Catalase in G2. Phytochemical studies of white beans showed the presence of tannins, flavonoids, alkaloids, saponins, glycosides, and phenolic compounds, phenolic compounds are effective scavengers of free radicals as well being chelating agents for transition metal ions. Flavonoids have a chemical structure with a special hydroxyl site in the molecule that is involved in the mechanism of proton donation and radical scavenging [17, 20]. Phenolic acids, flavonoids, and tannins can finish the oxidative chain reaction by eliminating free radical mediators and inhibiting other oxidative reactions [21].

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