Potential Anti-obesity Effects of Terminallia chebula Fruit Powder and Extract in Rats Fed High-Fat Diet

Emad M. El-Kholie[*], Abeer Abdel Rahman, Heba N.E. Abdallah and Safaa Arafa

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Abstract

The goal of this study is to find out how the fruit powder and extract of *Terminallia chebula* can efficiently treat overweight rats' obesity. Six groups, every with six rats, had been formed from the 36 male albino rats, every weighing 160±10g. Rats have been given a high-fat diet (20% sheep fat) to assist them increase weight. The study assessed lipid fractions which includes triglycerides (TG), total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL), very low-density lipoprotein (VLDL), and atherogenic index (AI), glucose levels, liver enzymes that is Alanine amino transferase (ALT), Aspartate amino transferase (AST), & alkaline phosphatase (ALP) as well as renal biomarkers (creatinine, uric acid, and urea). The result confirmed that, when rats fed *Terminallia chebula* fruit extract, the treated groups showed considerably reduced glucose levels, liver enzymes, and renal biomarkers. In addition, lowest lipid fractions, such as TC and TG, LDL, VLDL levels, and AI %, had been observed, and vice versa for HDL levels. As conclusion, overweight rats have been fed an extract of *Terminallia chebula* fruit at a level of 500 mg/kg, displayed improving lipid profiles, glucose, liver enzymes, and renal function ranges. As a result, the research advises using *Terminallia chebula* fruit in the recommended meal and drinks for decreasing body fat percentages.

Key words: *Terminallia chebula*, Obesity, Biochemical analysis.

Nutrition and Food Science Department, Faculty of Home Economics, Menoufia University, Egypt.
***Corresponding Author:** Emad M.A. El-Khouli

INTRODUCTION

One of the major problems with health that contributes to the emergence of various metabolic syndromes, such as diabetes and heart diseases, is obesity **(1)**. An overall life imbalance is used to excuse being overweight, which results in a poor quality of life **(2)**. Overweight is a major public health issue in nations that are both industrialized and developing. Obese individuals are those whose body mass index is 30 or higher. Changes in neuropeptides, hormones, and adipokines in the brain, stomach, and adipose tissue were part of the pathophysiology of overweight disorders. Two factors have been connected to overweight: A greater consumption of high-calorie foods and decreased physical activity because of changes in numerous types of job opportunities, accelerating urbanization, and growing options for transportation **(3)**. Overweight is usually linked with decreased glucose tolerance and cell disorder, which is the main factor contributing to the deterioration of glycemic guidelines **(4)**. Insulin resistance and reduced glucose tolerance are additionally made possible through irritation linked to adiposity in the liver and fats cells **(5)**. Over the previous few decades, the incidence of weight problems has risen dramatically, nearing epidemic levels. In accordance with the World Health Association, 39% of persons global had been obese or overweight in 2016. Moreover, the buildup of greater fats in the liver and fats tissue, which reasons non-alcoholic fatty liver disorder, is one of the danger variables related to being overweight **(6)**.

With the resource of the helpful biological characteristics held through the chemical compounds acquired from plants, novel strategies are now being developed for treating metabolic illnesses in overweight persons **(7)**. It has been confirmed that the *Combretaceae* plant family *Terminallia chebula* possesses a huge spectrum of biological functions. Among the key components in the natural treatment "TRIPHALA," which has been extensively utilized in Indian ayurvedic medicinal drug for diabetes and cardiovascular diseases, is the fruit of *T. chebula*. **(8)**. Chebulic acid, which is included in *T. chebula* fruit extract, protects hepatocytes toward oxidative injury. Additionally, it contains extra elements such as chebulinic acid, chebulagic acid, corilagin, and different galloyl derivatives **(9)**. In rats given an HFD, supplementation with ethanolic *T. chebula* fruit extract (EETC) lowered body weight gain, more advantageous glucose tolerance, and improved serum triglyceride and cholesterol levels. These advantages of EETC would possibly be linked to modifications in the expression of genes like FAS, PPAR, CPT-1, and adipo-cytokines like leptin and adiponectin **(10)**. Due to its great vary of medicinal properties and enormous utilization in typical healthcare, *T. chebula*, retz, additionally recognized as black- or chebulic myrobalan, ink tree, or chebulic myrobalan, is additionally referred to as the "King of Medicine"

(11). Rats getting *T. chebula* treatment in an atherogenic diet-induced hyperlipidemia confirmed considerable decreases in TC, and TG, as well as a make elevate in HDL-c. The outcomes additionally published that *T. chebula*, at dosages of 1.05 and 2.10 mg/kg b.wt. had a lipid-lowering impact **(12)**. After 15 days, Diazonidae rats exposed to various doses of *T. chebula* fruit extract (200, 400, and 800 mg/kg) had a lipid-lowering influence **(13)**. Furthermore, extract administered at a level of 600 mg/kg *T. chebula* proven great anti-hyperlipidemic action in a high-cholesterol diet-induced hyperlipidemic rat **(14)**.

Therefore, the aim of this research was investigate the influence of *T. chebula* fruit powder and extract at various doses on the biological and biochemical parameters in over weight rats.

MATERIAL AND METHODS

Materials:

Terminallia chebula fruit were purchased from Haraz herbalist store, Cairo, Egypt.

Experimental rats:

A total of Thirty-six mature male white Sprague Dawley rats, weighing 160±10g each, were purchased from Medical Insects Research Institute, Cairo, Egypt.

DL-Methionine, casein, cellulose, and choline chloride were purchased diet supplement which is casein, cellulose, powdered choline chloride, and powdered DL-methionine through the Morgan Company, in Cairo, Egypt.

Chemical kits:

Al-Gomhoria Company for Trading in Chemical, Drug, and Medical Equipment, Cairo, Egypt, supplied the chemical kits that were used to determine the lipid fractions, renal biomarkers, liver activity, and glucose.

Methods:

Preparations of psyllium and quinoa seeds:

To make the dried powdered psyllium husk as well as quinoa seeds, they were bought from an herbalist. The husk and seeds were then weighed, ground with an air-powered mill by a high-speed blender (Broun, made in Germany), and served in powder form before being packaged in dark glass bottles and kept at -18 °C in a deep freezer until further treatments.

Induction of overweight rats:

In earlier times, a standard diet enriched with high-fat meal contain 20% animal fat was used to induce obesity in regular healthful male albino rats **(15)**.

Experimental design:

The research was once conducted in Animal House at the University of Menoufia in Egypt, which has been authorized, Department of Nutrition and Food Science, Faculty of Home Economics according to Ethical approval of the Science Research Ethics Committee of Faculty of Home Economics cleared the study protocol **#14-SREC-04-2021.**

In this study, 48 grown-up male white rats, ten weeks old, and averring weighed 135gm, were utilized. For seven days straight, all experimental rats given a standard diet in this test in accordance with **(16)**. Rats are then placed into 8 groups of 5 rats each after the time of adaptation, as follows: Group (1): Rats fed on standard diet and served as negative control group. Group (2) Overweight rats were fed on standard diet and served as a positive control group. Group (3): Overweight rats were fed on standard diet and *Terminallia chebula* fruit powder by 2.5% of the weight of the diet. Group (4): Overweight rats were fed on standard diet and *T. chebula* fruit powder by 5% of the weight of the diet. Group (5): Overweight rats were fed on standard diet and *T. chebula* fruit extract by 250 mg/kg of the weight of the diet. Group (6): Overweight rats were fed on standard diet and *Terminallia chebula* fruit extract by 500 mg/kg of the weight of the diet.

The research study lasted for twenty-eight days throughout the duration of the study. All rat was weighed independently at the finish of the experiment before being slaughtered and having blood samples collected.

Collection of blood:

After a 12-hour fast, blood samples of each rat were obtained from the hepatic portal vein at the finish line of each trial. The serum was taken away from the blood samples by centrifuging them for 10 min. at 4000 rpm after they had been drawn into dry, clean centrifuge tubes and allowed to clot for 30 minutes in a water bath (37°C). After gently collecting the serum into clean cuvette tubes, it was then frozen until analysis according to **(17)**.

Biochemical analysis:

Determination of serum lipids fractions:

Using **(18)** colorimetric procedure, the cholesterol was measured. As stated by **(19 and 20)**, serum triglycerides were measured using enzymatic techniques. The method described by **(21 and 22)** was used to calculate HDL-c. According to **(23)**, very low density-lipoprotein was estimated in mg/dl applying the formula below: Triglycerides (mg/dl) = very low density-lipoprotein cholesterol / 5. According to **(23)**, low density-lipoprotein cholesterol was estimated in mg/dl as below: Low density-lipoprotein cholesterol = Total cholesterol - High density-lipoprotein cholesterol - Low density-lipoprotein cholesterol. The concentration of atherogenic index (AI) was estimated according to **(24)** by calculation the follows: AI = VLDL-c + LDL-c/ HDL-c. Enzymatic determination of serum glucose was carried out calorimetrically according to the method of **(25)**. Determination of serum glutamic oxaloacetic transaminase (GOT) was carried out according to the method of **(26)**. While serum

glutamic pyruvic transaminase (GPT) was carried out according to the method of **(27)**. Urea was determined by enzymatic method according to **(28)**. Serum uric acid was determined calorimetrically according to the method of **(29)**. Serum creatinine was determined according to the method described by **(30)**.

STATISTICAL ANALYSIS:

A completely randomized factorial design was used to analyze the data when a significant main effect was discovered **(31)**. The means of the Student-Newman-Keuls test were distributed. Differences between treatments at P0.05 were found to be significant using the Costat Program. To be able to evaluate the biological effects, one way ANOVA was performed.

RESULTS AND DISCUSSION

Influence of *Terminallia chebula* fruit powder and its extract on total cholesterol and triglycerides of overweight rats;

Table (1) shows the mean value of serum total cholesterol (TC) and serum triglycerides (TG) of overweight rats fed on various diets. The average value of serum TC of control (+) group was higher than control (-) group, being 244.5 and 97.2, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in the average values as compared to control (+) group. The values were 162.70, 128.70, 143.70 and 111.0 mg/dl for 2.5 and5% *Terminallia chebula* fruit powder, and 250 & 500 mg/kg date desert fruit extract, respectively. The best serum TC was recorded for groups (6) overweight rats fed on 500 mg/kg of *Terminallia chebula* fruit extract when compared to control (-) group.

Concerning serum triglycerides, it was noticed that the average value of serum (TG) of control (+) group was higher than control (-) group, being 174.70 and 80.50, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in mean values as compared to control (+) group. The values were 145.7, 137.30, 143.80 and 123.70, mg/dl for 2.5 and 5% *Terminallia chebula* fruit powder, and 250 and 500 mg/kg, *T. chebula* fruit extract respectively.

These results agree with these of **(32)** who mentioned that treating groups with *Terminallia chebula* alcoholic extract (600 mg/kg) for 4 weeks precipitated an enhancement in lipid fraction values and a significant reduce in blood cholesterol and triglyceride levels. In diabetic rats, the extract could block the mechanism for cholesterol formation.

Triglyceride and total cholesterol concentrations in rats with atherogenic diet-induced hyperlipidemia going through Haritaki (*T. chebula*) fruit remedies have been much lower **(33)**.

Comparing the lipid fractions of overweight rats administered kiwi fruit extract at a dose of 200 mg/kg to these of the fruit powdered. It could be noticed that kiwi fruit extract had greater improved the lipid fraction than fruit powder **(34)**.

Table (1): Impact of *Terminallia chebula* fruit and its extract on total cholesterol and triglycerides of overweight rats

Parameter / Groups	Total cholesterol (mg /dL)	Triglycerides (mg /dL)
Control negative	97.20^{f}±0.80	80.50^{f}±0.50
Control positive	244.50^{a}±0.50	174.70^{a}±0.30
Obese rats +2.5 % *Terminallia chebula* powder	162.70^{b}±0.30	145.70^{b}±0.50
Obese rats +5 % *Terminallia chebula* powder	128.70^{d}±0.50	137.30^{d}±0.20
Obese rats +250 mg/kg *Terminallia chebula* extract	143.70±^{c}0.20	143.80^{c}±0.20
Obese rats +500 mg/kg *Terminalia chebula* extract	111.00^{c}±10	123.70^{c}±0.10
LSD (P ≤ 0.05)	**1.094**	**0.599**

TC =Total cholesterol; TG=Triglycerides. Each value represents the mean ± SD of three replicates. Means in the same column with different letters are significantly different (P≤0.05).

Influence of *Terminallia chebula* fruit powder and its extract on lipid fractions of overweight rats

Table (2) displays the mean value of serum lipid fractions that is low-density lipoprotein (LDL-c), very low-density lipoprotein (VLDL-c), high-density lipoprotein (HDL-C) and atherogenic index

(AI) with overweight albino rats fed on various diets. According to results, the findings revealed that, the mean value of serum HDL-c of control (+) group was lower than control (-) group, being 34.60 and 51.30, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in average values as compared to control (+) group except group 4,5 The values were 44.13, 47.05, 47.30 and 48.40 mg/dl for 2.5% and 5%*Terminall chebula a*f ruit powder and 250 & 500 mg/kg *T. chebula* fruit extract, respectively. The best serum HDL-c was recorded for groups (6) obese rats fed 500 mg/kg of *T. chebula* fruit extract compared to control (-) group.

As for LDL-c, it was noticed that the mean value of serum LDL of control (+) group was higher than control (-) group, being 175.04 and 29.60, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in mean values as compared to control (+) group. The values were 89.36, 54.19, 67.73 and 37.85 mg/dl for 2.5% and 5%*T. chebula* fruit powder and 250 and 500 mg/kg *T. chebula* fruit extract, respectively. The best serum LDL was recorded for groups (6) overweight rats fed on 500 mg/kg of *T. chebula* fruit extract when compared to control (-) group.

In the case of VLDL-c, it is clear to notice that the mean value of serum VLDL of control (+) group was higher than control (-) group, being 34.94 and 16.10, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in mean values as compared to control (+) group. The values were 29.14, 27.46, 28.76 and 24.74mg/dl for 2.5% and 5%*T. chebula* fruit powder and 250 & 500 mg/kg *T. chebula* fruit extract, respectively. The best serum VLDL-c was recorded for groups (6) overweight rats fed on 500 mg/kg of *T. chebula* fruit extract when compared to control (-) group.

Regarding the AI value, it was observed that the average value of AI (%) of control (+) group was higher than control (-) group, being 6.07 and 0.89, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in mean values as compared to control (+) group. The values were 2.69, 1.74, 2.03 and 1.29mg/dL for 2.5% and 5%*T.chebula* fruit powder and 250 and 500 mg/kg *Terminallia chebula* fruit extract, respectively. The best AI was recorded for groups (6) rats fed on 500 mg/kg of *Terminallia chebula* fruit extract when compared to control (-) group. These results agree with who reported that *T. chebula* has a hypochlosterolemic effect in animals fed with an atherogenic diet **(35)**.

The present results was in parallel to **(36)** who indicated that administration of the ethanolic extracts of dried *Terminallia chebula* fruits (1.25 g/kg body weight), which is double our effective dose, to improve lipidemic status male rats.A 5% blend of plant powder fed to overweight rats resulted in extra effectively lipid fractions. Therefore, the find out about advises eating plant combinations in the recommended ratios to lower the body's ranges of overweight **(37)**.

Table (2): Impact of *Terminallia chebula* fruit and its extract on lipid fractions of overweight rats

Groups	Parameters			
	HDL (mg/dl)	**LDL (mg/dl)**	**VLDL (mg/dl)**	**AI %**
G_1 C (-)	51.30^{a}±0.30	29.60^{f}±0.20	16.10^{f}±0.10	0.89^{e}±0.01
G_2 C (+)	34.60^{c}±0.40	175.04^{a}±0.97	34.94^{a}±0.20	6.07^{a}±0.35
G_3 Obese rats + 2.5 % *Terminalial chebula* Powder)	44.13^{d}±0.50	89.36^{b}±1.00	29.14^{b}±0.03	2.69^{b}±0.27
G_4 Obese rats +5% *Terminallia chebula* Powder	47.05^{c}±0.04	54.19^{d}±0.06	27.46^{d}±0.10	1.74^{d}±0.15
G_5 Obese rats +250 mg/kg *Terminallia chebula* extract	47.30^{c}±0.60	67.73^{c}±0.20	28.76^{c}±0.02	2.03^{c}±0.24
G_6 Obese rats +500 mg/kg *Terminalia chebula* extract	48.4^{b}±0.40	37.85^{c}±0.18	24.74^{c}±0.10	1.29^{d}±0.12
LSD (P≤0.05)	**0.735**	**1.042**	**0.194**	**0.233**

LDL-c =Low-density lipoprotein. VLDL-c=Very low-density lipoprotein HDL-c = High-density lipoprotein. AI= Atherogenic index. Each value represents the mean ± SD of three replicates. Means in the same column with different letters are significantly different (P≤0.05).

Influence of *Terminallia chebula* fruit powder and its extract on glucose of overweight rats

Data displayed in Table (3) show the average value of serum glucose (mg/dl) of overweight rats fed on various diets. It could be indicated that the mean value of serum glucose of control (+) group was higher than control (-) group, being 174.70 and 99.47, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in mean values as compared to control (+) group. The values were 160.10, 150.57, 144.30 and 133.37mg/dl for 2.5% and 5%*T.chebula* fruit powder and 250 and 500 mg/kg *Terminallia chebula* fruit extract, respectively. The best serum glucose was recorded for groups (6) overweight rats fed on 500 mg/kg of *T. chebula* fruit extract when compared to control (-) group. These findings are in line with those of **(38)**, who mentioned that giving Type two diabetes male rats an ethanolic extract of dried ripe *T. chebula* fruits at a dose of 1.25 g/kg body weight accelerated their glycemic status which is made using 80% ethanolic solvent.

Treatment of alloxan-induced diabetic rats with an aqueous extract of *T. chebula* 500 mg/kg body weight led to a considerably decrease serum glucose ranges, in accordance with **(39)**.

Table (3): Impact of *Terminallia chebula* fruit and its extract on glucose of overweight rats

Parameter / Groups	Glucose mg/dL
Control negative	99.47^{f}±2.50
Control positive	174.70^{a}±4.30
Obese rats +2.5 % *Terminallia chebula* powder	160.10^{b}±3.02
Obese rats +5 % *Terminallia chebula* powder	150.57^{c}±3.40
Obese rats +250 mg/kg *Terminallia chebula* extract	144.30^{d}±3.62
Obese rats +500 mg/kg *Terminallia chebula* extract	133.37^{e}±3.57
LSD (P ≤ 0.05)	**4.089**

Each value represents the mean ± SD of three replicates. Means in the same column with different letters are significantly different (P≤0.05).

Influence of *Terminallia chebula* fruit powder and its extract on liver activity of overweight rats:

Data tabulated in Table (4) shows the influence of *T.* chebula fruit powder and its extract on liver enzymes of overweight rats. The obtained results showed that the average value of serum ALT enzyme (U/L) of control (+) group was higher than control (-) group, being 94.53 and 30.03, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in mean values as compared to control (+) group. The values were 72.87, 60.77, 54.23 and 40.53 (U/L) for 2.5% and 5%*T.chebula* fruit powder and 250 & 500 mg/kg *T. chebula* fruit extract, respectively. The best serum ALT enzyme was recorded for groups (6) overweight rats fed on 500 mg/kg of *T. chebula* fruit extract as compared to control (-) group.

In the case of AST enzyme, it could be noticed that the average value of serum AST (U/L) of control (+) group was higher than control (-) group, being 77.80 and 21.47, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in mean values as compared to control (+) group. The values were 55.11, 45.59, 44.50 and 38.10 U/L for 2.5% and 5%*T. chebula* fruit powder and 250 & 500 mg/kg *T. chebula* fruit extract, respectively. The best serum (AST) was recorded for groups (6) obese rats fed on 500 mg/kg of *T. chebula* fruit extract when compared to control (-) group.

The obtained results showed that the average value of serum ALP of overweight rats fed on various diets. It could be noticed that the mean

value of serum ALP (U/L) of control (+) group was higher than control (-) group, being 73.47 and 30.23, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in average values as compared to control (+) group. The values were 53.27, 46.49, 47.38and 33.53 U/L for 2.5% and 5%*Terminallia chebula* fruit powder and 250 and 500 mg/kg *Terminallia chebula* fruit extract, respectively. The best serum ALP enzyme was recorded for groups (6) overweight rats fed on 500 mg/kg of *Terminallia chebula* fruit extract when compared to control (-) group. These findings assist the findings of **(40)**, who claimed that a fruit extract from *Terminallia chebula* protects instant and serious liver damage and explains the corresponding mechanisms concerned in the suppression of oxidative damage and cytokines that cause inflammation.

The liver-protective function of *T. chebula* fruit extract (TCE) can be attributed to its antioxidant possible system, indicating that the extraction may additionally be useful to avoid ethanol-induced toxicity to the liver The ethanolic fruit TCE, it is determined, protects against ethanol-induced oxidative liver harm in rats **(41)**.

Additionally, eating various fruit improved the functioning of the liver through lowering liver enzyme, bilirubin, albumin, and globulin. This is indicative of the amazing nutraceutical therapeutic impact of consuming a variety of fruit components to treat CCl_4-induced hepatic intoxication in male albino rats **(42)**.

Table (4): Impact of *Terminallia chebula* fruit and its extract on liver enzyme of overweight rats

Groups	Parameters		
	ALT (U /L)	AST (U /L)	ALP (U/L)
Control negative	30.03^{f}±1.00	21.47^{f}±0.50	30.23^{e}±0.25
Control positive	94.53^{a}±0.50	77.80^{a}±0.20	73.47^{a}±0.50
Obese rats +2.5 % *Terminallia chebula* powder	72.87^{b}±1.10	55.11^{b}±0.42	53.27^{b}±0.25
Obese rats +5 % *Terminallia chebula* powder	60.77^{c}±0.25	45.56^{c}±0.61	46.49^{c}±0.64
Obese rats +250 mg/kg *Terminallia chebula* extract	54.23^{d}±0.71	44.5^{d}±0.46	47.39^{c}±0.74
Obese rats +500 mg/kg *Terminallia chebula* extract	40.53^{e}±0.50	38.10^{e}±0.40	33.53^{d}±0.50
LSD (P≤0.05)	**1.317**	**0.799**	**0.916**

ALT=Alanine aminotransferase. AST= Aspartate aminotransferase. ALP Alkaline phosphatase. Each value represents the mean ± SD of three replicates. Means in the same column with different letters are significantly different (P≤0.05).

Influence of *Terminallia chebula* fruit powder and its extract on renal biomarkers of overweight rats

Data illustrated in Table (5) show the mean value of serum urea (mg/dl) of overweight rats fed on various diets. It could be noticed that the mean value of serum urea of control (+) group was higher than control (-) group, being 38.10 and 21.05, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in mean values as compared to control (+) group. The values were 27.09, 25.60, 25.14 and 24.30 mg/dl for 2.5% and 5%*T. chebula* fruit powder and 250 & 500 mg/kg *Terminallia chebula* fruit extract, respectively. The best serum urea was recorded for groups (6) overweight rats fed on 500 mg/kg of *T. chebula* fruit extract when compared to control (-) group.

The mean value of UA of control (+) group was higher than control (-) group, being 10.08 and 5.90, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in mean values as compared to control (+) group. The values were 7.20, 6.80, 7.30 and 6.40 mg/dl for

2.5% and 5%*Terminallia chebula* fruit powder and 250 & 500 mg/kg *Terminallia chebula* fruit extract, respectively. The best serum U.A was recorded for groups (6) overweight rats fed on 500 mg/kg of *Terminallia chebula* fruit extract when compared to control (-) group.

The mean value of creatinine (mg/dl) of control (+) group was higher than control (-) group, being 1.60 and 0.80, respectively, showing significant difference as compared to control (+) group. All overweight rats fed on various diets showed significant differences in mean values as compared to control (+) group. The values were 0.91, 0.86, 1.01 and 0.77 mg/dl for 2.5% and 5%*T.chebula* fruit powder and 250 & 500 mg/kg *Terminallia chebula* fruit extract, respectively. The best serum creatinine was recorded for groups (6) overweight rats fed on 500 mg/kg of *Terminallia chebula* fruit extract when compared to control (-) group. These results are steady with **(43)**, who encouraged giving 200 mg/kg *T. Chebula* ethanolic extract considerably decreased serum urea and creatinine concentrations in diabetic rats.

Nevertheless, **(44)** confirmed that the dose of 400 mg/kg of *T. chebula* extract, which assists in decreasing kidney damage induced via cadmium chloride, used to be reached with the very best enhancement in kidney functioning.

Table (4): Impact of *Terminallia chebula* fruit and its extract on liver enzyme of overweight rats

Groups	Parameters		
	ALT (U /L)	AST (U /L)	ALP (U/L)
Control negative	30.03^{f}±1.00	21.47^{f}±0.50	30.23^{e}±0.25
Control positive	94.53^{a}±0.50	77.80^{a}±0.20	73.47^{a}±0.50
Obese rats +2.5 % *Terminallia chebula* powder	72.87^{b}±1.10	55.11^{b}±0.42	53.27^{b}±0.25
Obese rats +5 % *Terminallia chebula* powder	60.77^{c}±0.25	45.56^{c}±0.61	46.49^{c}±0.64
Obese rats +250 mg/kg *Terminallia chebula* extract	54.23^{d}±0.71	44.5^{d}±0.46	47.39^{c}±0.74
Obese rats +500 mg/kg *Terminallia chebula* extract	40.53^{e}±0.50	38.10^{e}±0.40	33.53^{d}±0.50
LSD (P≤0.05)	**1.317**	**0.799**	**0.916**

Each value represents the mean ± SD of three replicates. Means in the same column with different letters are significantly different (P≤0.05).

Conclusion

It could be concluded that there is an effective new approach for treating overweight rats by *Terminallia chebula* fruit powder and extract. The most therapeutic dose appears to be 500 mg/kg of *Terminallia chebula* extract. Therefore, *Terminallia chebula* may be beneficial for patients suffering from overweight.

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