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Possible Effects of Chestnut (*Castanea sativa*, Mill.) Fruit Powder and Extracts on Biological,Biochemical and Histological Change of Induced Obese Rats

Thourya M. Hassan -Seham A. Khader - BasmaA. Mohamed
Nutrition & Food Science Dept., Faculty of Home Economics, Menoufia Univ., Egypt

Abstract:

The effect of different concentrations (2.5 and 5%) as powder and (250 and 500mg/kg/BW) as extract of chestnut fruits (*Castanea sativa,* M.) on obese rats were evaluated. Thirty six male albino rats weighting 140 ±10 g were used in this study and divided into 6 groups, 6 rats per each. Rats were fed on high fat diet (20% animal fat) to induce obese. Results showed that the highest body weight gain, feed intake and feed efficiency ratio recorded for 250mg/kgchestnut fruits extract, while the lowest recorded for 2.5 % chestnut fruits as powder with significant difference.The lowest ALT, AST and ALP liver enzyme of treated grouprecorded for group fed on 500mg/kgchestnut fruits extract with significant difference ($P \leq 0.05$).The highest cholesterol and triglycerides levels recorded for group fed on 2.5 % chestnut fruit powder while, the lowest value recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference($P \leq 0.05$).The highest (HDL-c) levels recorded for group fed on 500 mg/kg chestnut fruit extract.The lowest LDL-c and VLDL-c values recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference($P \leq 0.05$). While, the lowest uric acid, urea and creatinine values recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference. As conclusion, obese rats treated with 500 mg/kg chestnut fruit extract had improvement lipid profile, liver and kidney functions compared withchestnut fruit powder.

Key words : Chestnut fruits,Anti-obesity, liver functions, kidney functions, serum lipid profile.

Introduction

Obesity is the most prevalent health problem. It is also known to be a risk factor for the development of metabolic disorders such as type 2 diabetes, systemic hypertension, cardiovascular disease, dyslipidemia, and atherosclerosis. Obesity is a pathological condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems **(Cheng*et al.*, 2010)**.

Obesity according to The World Health Organization (WHO) defines as an over fat accumulation which influence to human health. Obesity has also been defined as an increased of adipose tissue mass **(Roh *et al.*, 2012)**. Also **Ling *et al.*, (2012)** mentioned that dyslipidemia is generally characterized by elevated levels of total cholesterol, triglycerides, low density lipoprotein cholesterol, and decreased levels of high density lipoprotein cholesterol. Dyslipidemia as an independent preventable risk factor of coronary heart disease has been shown to increase the risk of cardiovascular mortality. Furthermore **Hassan and El-Gharib, (2015)** concluded that obesity is becoming one of the most prevalent health concerns among all populations and age groups worldwide, resulting in a significant increase in mortality and morbidity related to coronary heart diseases, diabetes type 2, metabolic syndrome, stroke, and cancers. Disappointing results after cessation the lifestyle modification or pharmacotherapy compelled the researchers and physicians to rethink to find a new, safe, and striking therapeutic alternative for this global health concern. Many natural products act as anti-obesity through various mechanisms to reduce body weight and its complications.

The chestnut group is a genus (*Castanea*) of eight or nine species of deciduoustrees and shrubs in the beech family, *Fagaceae*, native to temperate regions of the Northern Hemisphere. Chestnut fruits stood out for many centuries as one of the most important food resources of the European rural areas, but the emergence of severe chestnut tree diseases and the rural depopulation caused a progressive decline in their production **(Adua, 1999)**.

The growing demand for traditional foods has convertedchestnut to an added value resource. Nowadays, chestnut worldwide production is estimated in 1.1 million tons, distributed by a surface with near 340 thousand hectares. From a nutritional point of view, chestnuts have

interesting characteristics, as it has been supported by other studies on the chemical composition of its kernels, focused on starch, fiber, fat and fatty acids (FA), protein and amino acids, ash, minerals **(De Vasconcelos*et al.*, 2007)**.

Many natural compoundshave a wide range of biological activities including antioxidant, chemo-preventive, anti-inflammatory, neuro-protective, and cardio-protective effects. Sweet chestnut (*Castanea sativa,* Mill.) is a known source of phenolic bioactive compounds, in particular of tannins **(Sanz*et al.*, 2010)**. Therefore, in recent years, the consumers have been showing an increased interest in chestnut fruits because of their nutritional qualities and potential beneficial health effects. In fact, chestnuts are also rich in carbohydrates and are a good source of essential fatty acids and minerals **(Carvalho et al., 2010)**.

Chestnuts are quite different from other nuts nutritionally and inaculinary sense. They have a sweet, nutty taste but a texturesimilar to a farm baked potato rather than the crunchy texture ofother nuts. Nutritionally chestnuts are more like a wholegrainthan a nut as they are low in fat, contain protein and are a goodsource of low glycemic index (GI) carbohydrate and dietary fiber. Whilethey are a source of the similar vitamins and minerals found in other nuts, their high water content means the concentration of these nutrientsis less **(Vázquez *et al.*, 2012)**. Also, sweet chestnut extract administration reduced oxidative stress induced by high n-3 polyunsaturated fatty acid (n-3 PUFA) intake in young pigs and the formation of toxic products of PUFA oxidation; in addition, it prevented DNA damage in blood lymphocytes **(Li *et al.*, 2012)**.

This work was conducted to study theeffect of chestnut fruit powder and extracts on biochemical analysis of obese rats.

Materials and Methods

Materials:

Chestnut (*Castanea sati*va, Mill.)fruits were obtained from Alexandria City, Alexandria Governorate, Egypt.

Experimental animals

A total of 36 adult normal male albino rats Sprague Dawley strain weighing 140±10 g were obtained from Vaccine and Immunity Organization, Ministry of Health, Helwan Farm, Cairo, Egypt.

Methods

The induction of experimental obesity

Obesity was induces in normal healthy male albino rats by fed on high fat diet (20% animal lipid) supplemented in the basal diet and used as a positive control group.

Table (a): The ingredients of the basal diet (g/100 g diet).

Ingredients	g/100 g
*Casein	12
Sunflower oil	10.0
Mineral mixture	4
Vitamins mixture	1
Fibers (cellulose)	4
Sugar (sucrose)	10
DL- methionin	0.3
Choline chloride	0.2
Corn starch	56.55
Total	**100 (g)**

* 12 g casein yielded 10.32 g protein.

The chemical kits

Chemical kits used for determination the (TC, TG, HDL-c, ALT, AST, ALP, urea, uric acid and creatinine) were obtained from Al-Gomhoria Company for Chemical, Medical and Instruments, Cairo, Egypt.

Preparations chestnut fruit

To prepare the chestnutfruit powder fruitswere washed thoroughly under running tap water, shade dried, and ground to a fine powder using an air mill.

Experimental design

Thirty six adult male white albino rats, Sprague Dawley Strain, 10 weeks age, weighing (140±10g) were used in this experiment. All rats were fed on basal diet (casein diet) prepared according to **AIN, (1993)** for 7 consecutive days. After this adaptation period, rats are divided into 6 groups, per each six rats as follows: Group (1): rats fed on basal diet as negative control. Group (2): Obese rats induced by fed on high fat diet (20% animal lipid) supplemented in the basal diet and used as a positive control group.Group (3): A group obese rats fed on chestnutfruitas powder by 2.5% of the weight of basal diet. Group (4): A group infected obese rats fed on chestnutfruit as powder by 5% of basal diet. Group (5): A group infected obese rats fed on chestnutfruitextract by 250 mg/kgof

the weight of the rat.Group (6): A group infected obese rats fed on chestnutfruitextract by 500 mg/kgof the weight of the rat. During the experimental period, the body weight and feed intake were estimated weekly and the general behavior of rats was observed. The experiment periodwas take 28 days, at the end of the experimental period each rat weight separately then, rats are slaughtered and collect blood samples. Blood samples were centrifuged at 4000 rpm for ten minute to separate blood serum, and then kept in deep freezer till using.

Blood sampling:

After fasting for 12 hours, blood samples in initial times were obtained from retro orbital vein, while it obtained from hepatic portal vein at the end of each experiment. Blood samples were collected into a dry clean centrifuge glass tubes and left to clot in water bath (37°C) for 30 minutes, then centrifuged for 10 minutes at 4000 rpm to separate the serum, which were carefully aspirated and transferred into clean cuvette tube and stored frozen indeep freezer till analysis according to method described by **Schermer (1967)**.

Body weight gain (BWG), food intake (FI), and feed efficiency ratio(FER):

During the experimental period (28 days) the net FI was daily recorded, while BWG was weekly recorded. The net feed intake and gained body weight were used for the calculation of (FER) according to **Chapman *et al.*, (1959)**as follow:

$$\text{FER \%} = \frac{\text{Body weight gain (g)}}{\text{Food intake (g)}} \times 100$$

Biochemical analysis:

Lipids profile:

Determination of total cholesterol:

Serum total cholesterol was determined according to the colorimetric method described by **Thomas (1992)**.

Determination of serum triglycerides:

Serum triglyceride was determined by enzymatic method using kits according to the **Young, (1975) and Fossati, (1982)**.

Determination of high density lipoprotein (HDL-c):

HDL-c was determined according to the method described by**Friedewaid (1972) and Grodon and Amer (1977)**.

Very low density lipoproteincholesterol (VLDL-c):

VLDL-c was calculated in mg/dl according to **Lee and Nieman (1996)** using the following formula:

VLDL-c (mg/dl) = Triglycerides / 5

Low density lipoprotein cholesterol (LDL-c):

LDL-c was calculated in mg/dl according to **Lee and Nieman (1996)** as follows:

LDL-c (mg/dl) = Total cholesterol – HDL-c – VLDL-c

Liver functions

Determination of serum alanine aminotransferase (ALT), serum asparatate aminotransferase (AST) and serum alkaline phosphatase (ALP) were carried out according to the method of **Hafkenscheid(1979), ClinicaChimicaActa(1980)**, **and Moss (1982**),respectively.

Kidney functions

Serum urea and serum creatininewere determined by enzymatic method according to**Henry (1974) and Patton and Crouch (1977)**.

Statistical analysis

The data were analyzed using a completely randomized factorial design **(SAS, 1988)** when a significant main effect was detected; the means were separated with the Student-Newman-Keuls Test. Differences between treatments of ($P \leq 0.05$) were considered significant using Costat Program. Biological results were analyzed by One Way ANOVA.

Results and Discussion

Effect of chestnut fruit powder and extracts on BWG, FIand FER of obese rats

Data presented in Table (1) show theeffect of chestnut fruit on (BWG), (FI) and (FER) of obese rats.The obtained results showed that the body weight gain (BWG) % of negative control recorded the highest value when compared with positive control with significant difference. The mean values were 41.77 and 31.73 %, respectively. From obese rat groups, it is clear to notice that the highest BWG(%) recorded for 250 mg/kgchestnut fruit extract, while the lowest BWG (%) recorded for 2.5 % chestnut fruit powder with significant difference ($P \leq 0.05$). The mean values were 58.49 and 15.03 %, respectively.In case of (FI), it could be notice that the feed intake of positive control recorded the highest value when compared with negative control with significant difference.

Table (1): Effect of chestnut fruits powder and its extracts on BWG, FI and FER of obese rats

Treatment / Parameters	BWG (g)	FI (g/day)	FER (%)
Control group (-)	41.77±0.20[b]	18.45±1.24[c]	0.080[a] ± 0.002
Control group (+)	31.73±0.32[c]	25.15±1.23[a]	0.045[b] ± 0.004
Obese rats with chestnut fruits powder (2.5%)	15.03±0.11[e]	18.88±1.10[c]	0.028[b] ± 0.001
Obese rats with chestnut fruits powder (5%)	18.68±0.50[d]	17.67±1.25[c]	0.037[b] ±0.002
Obese rats with chestnut fruits extract (250 mg/kg)	58.49±0.61[a]	23.10±1.12[b]	0.090[a] ±0.003
Obese rats with chestnut fruits extract (500 mg/kg)	56.11±0.12[a]	22.52±1.31[b]	0.088[a] ±0.005
LSD	**3.561**	**1.578**	**0.021**

Each value is represented as mean ± standard deviation (n = 3).

Mean under the same column bearing different superscript letters are different significantly ($p \leq 0.05$).

The mean values were 25.15 and 18.45 g/day, respectively. From obese rat groups, it is obvious that the highest FI recorded for 250 mg/kgchestnut fruit extract, while the lowest FI recorded for 5 % chestnut fruit powder with significantdifference ($P \leq 0.05$). The mean values were 23.10 and 17.67 g/day, respectively. The obtained results indicated that the highest feed efficiency ratio recorded for negative control group, while the lowest value recorded for positive control group with significant differences. The mean values were 0.080 and 0.045 %, respectively. On the other hand, the highest FER of treated group recorded for 250 mg/kgchestnut extract, while the lowest FER recorded for 2.5% chestnut powder with significant differences ($P \leq 0.05$). The mean values were 0.090 and 0.028g, respectively. These results are in agreement with**Yin*et al.*,(2011),**they reported thatthe 300 mg/kg dosage caused a significant body weight loss in both normal and diabetic rats.

Effect of chestnut fruit on liver functions level of obese rats

Data given in Table (2) show the effect of chestnut fruit on liver functions (ALT, AST and ALP) of obese rats.The obtained results indicated that the ALT liver enzyme of positive control rats group recorded the highest value when compared with negative control group with significant difference ($P \leq 0.05$). The mean values were 95.08 and 32.11 U/L, respectively.While, the highest ALT liver enzyme of treated

group recorded for group fed on 2.5 % chestnut fruit powder but, the lowest value recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference (P≤0.05). The mean values were 79.45 and 43.50 U/L, respectively.On the other hand, AST liver enzyme of positive control rats group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 86.54 and 29.65 U/L, respectively.

Table (2): Effect of chestnut fruits powder and its extracts on liver functions ofObese rats

Treatment/Parameter	ALT (U/L)	AST (U/L)	ALP (U/L)
Control group (-)	32.11 ± 1.90^{f}	29.65 ± 1.20^{f}	29.40± 1.60^{f}
Control group (+)	95.08 ± 2.13^{a}	86.54 ± 1.12^{a}	71.03± 1.11^{a}
Obese rats with chestnut fruits powder (2.5%)	79.45 ± 1.63^{b}	53.40 ± 1.10^{b}	56.20±1.30^{b}
Obese rats with chestnut fruits powder (5%)	66.17 ± 1.21^{c}	47.20 ± 1.25^{c}	41.05±1.16^{d}
Obese rats with chestnut fruits extract (250 mg/kg)	60.65 ± 2.10^{d}	43.34 ± 2.31^{d}	48.23± 2.23^{c}
Obese rats with chestnut fruits extract (500 mg/kg)	43.50 ± 3.23^{e}	28.16 ± 1.20^{e}	37.02± 2.10^{e}
LSD	**2.75**	**4.19**	**3.02**

Each value is represented as mean ± standard deviation (n = 3).

Mean under the same line bearing different superscript letters are different significantly (p ≤0.05).

While, the highest AST liver enzyme of treated group recorded for group fed on 2.5 % chestnut fruitpowder but, the lowest value recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference (P≤0.05). The mean values were 53.40 and 28.16 U/L, respectively. In case of ALP liver enzyme of positive control rats group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 71.03 and 29.40 U/L, respectively. While, the highest ALP liver enzyme of treated group recorded for group fed on 2.5 % chestnut fruit powder but, the lowest value recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference (P≤0.05). The mean values were 56.20 and 37.02 U/L, respectively. The best treatment observed the highest reduction in liver enzymes recorded for 500 mg/kg chestnut fruit extract.These results are in agreement with**Frankicand Salobir, (2011)**,they reported that sweet chestnut woodextract administration

reduced oxidative stress induced byhigh n-3 polyunsaturated fatty acid (n-3 PUFA) intake inyoung pigs and the formation of toxic products of PUFAoxidation; inaddition, it prevented DNA damage in bloodlymphocytes.

Effect of chestnut fruit on total cholesterol and triglycerides level of obese rats:

Theeffect of chestnut fruit on the serum total cholesterol and triglycerides of obese rats are shown in Table (3). The obtained results indicated that the cholesterol levels of positive control group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 156.03 and 68.22 mg/dl, respectively. While, the highest cholesterol levels recorded for group fed on 2.5 % chestnut fruit powder but, the lowest value recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference (P≤0.05).

Table (3): Effect of chestnut fruits powder and its extracts on serum total cholesterol and triglycerides of obese rats

Treatment/Parameter	Total cholesterol (mg /dl)	Triglycerides (mg /dl)
Control group (-)	68.22±4.74^{e}	65.20±3.24^{d}
Control group (+)	156.03±5.18^{a}	127.03± 2.61^{a}
Obese rats with chestnut fruits powder (2.5%)	97.40±4.23^{b}	85.00±4.38^{b}
Obese rats with chestnut fruits powder (5%)	92.00±5.66^{c}	81.11±4.61^{c}
Obese rats with chestnut fruits extract (250 mg/kg)	74.40± 4.26^{d}	67.10± 2.51^{d}
Obese rats with chestnut fruits extract (500 mg/kg)	70.05± 2.77^{e}	63.45± 3.72^{e}
LSD	**2.26**	**2.17**

Each value is represented as mean ± standard deviation (n = 6).
Mean under the same column bearing different superscript letters are different significantly ($p \leq 0.05$).

The mean values were 97.40 and 70.05 mg/dl, respectively. In the other hand, the triglyceride of positive control group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 127.03 and 65.20 mg/dl, respectively. While, the highest triglyceride recorded for group fed on 2.5 % chestnut fruit powder but, the lowest value recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference (P≤0.05).The mean values were 85.00 and 63.45 mg/dl, respectively.These results are in agreement with**Yin*et al.*,(2011)**, they reported thatoral administration of chestnut fruit extract at a different

dose of 150-300 mg/kg caused significant decreases in serum triglyceride, total cholesterol, LDL-cholesterol levels.

Effect of chestnut fruit on serum lipid profile level of obese rats:

Theeffect of chestnut fruits on serum lipid profile (HDL-c, LDL-c and VLDL-c) level of obese rats was shown in Table (4).The obtained results indicated that HDL-c levels of positive control group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 46.65 and 36.16 mg/dl, respectively.While, the highest (HDL-c) levels recorded for group fed on 500 mg/kg chestnut fruit extract but, the lowest value recorded for group fed on 5 % chestnut fruit powder with significant difference (P≤0.05). The mean values were 47.50 and 41.12 mg/dl, respectively.Data also showed that theLDL-c levels of positive control group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 83.97 and 19.02 mg/dl, respectively. While, the highest LDL-c levels recorded for group fed on 2.5 % chestnut fruit powder but, the lowest value recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference (P≤0.05).

Table (4): Effect of chestnut fruits powder and its extracts on lipid profile of obese rats

Treatment/Parameter	(HDL-C) (g/dl)	(LDL-C) (g/dl)	(VLDL-C) (g/dl)
Control group (-)	36.16±2.60^{e}	19.02± 1.74^{d}	13.04±0.21^{c}
Control group (+)	46.65±4.50^{a}	83.97±1.77^{a}	25.41±0.13^{a}
Obese rats with chestnut fruits powder (2.5%)	43.00±4.28^{c}	37.40±1.75^{b}	17.00±0.20^{b}
Obese rats with chestnut fruits powder (5%)	41.12±5.26^{d}	34.66±1.87^{c}	16.22±0.42^{b}
Obese rats with chestnut fruits extract (250 mg/kg)	46.30±5.11^{b}	14.68±1.75^{e}	13.42±0.10^{c}
Obese rats with chestnut fruits extract (500 mg/kg)	47.50±4.47^{a}	9.89±1.87^{f}	12.69±0.70^{c}
LSD	**0.95**	**1.15**	**0.82**

HDL-C=High density lipoprotein cholesterol.LDL=Low density lipoprotein cholesterol
VLDL = Very low density lipoprotein cholesterol
Each value is represented as mean ± standard deviation (*n* = 3)
Mean under the same column bearing different superscript letters are different significantly ($p \leq 0.05$)

The mean values were 37.40 and 9.89 mg/dl, respectively. In case ofVLDL-c levels, the positive control group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 25.41 and 13.04 mg/dl, respectively.While, the highest (VLDL-c) levels recorded for group fed on 2.5 % chestnut fruit powder but, the lowest value recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference (P≤0.05). The mean values were 17.00 and 12.69 mg/dl, respectively.These results are in agreement with**Krentz, (2003)**, they reported that could reverse the hyperlipidemia in experimental diabetic rats, and thus may lead to a decrease in the risk of micro- and macrovascular disease and related complications.Also,**Brown *et al.*,(2011)**mentioned thatin diabetic rats, chestnut fruit treatment at dose of 150 and 300 mg/kg for 21 days could significantly decrease the serum triglyceride, total cholesterol and LDL cholesterol levels compared to diabetic control groups. A dosage of 150 mg/kg also caused significant elevation of HDL-cholesterol levels in diabetic rats compared to diabetic controls. Chestnut fruit treatment was able to improve serum lipid metabolites of diabetic rats, including decreasing the levels of triglyceride, total cholesterol, LDL cholesterol and increasing the level of HDL cholesterol.

Effect of chestnut fruit on kidney functions level of obese rats:

Data presented in Table (5) show theeffect of chestnut fruit on the kidney functions (uric acid, urea and creatinine) level of obese rats.It is clear to notice that the uric acid levels of positive control group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 8.79 and 6.17 mg/dl, respectively. While, the highest uric acid levels recorded for group fed on 2.5 % chestnut fruit powder but, the lowest value recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference (P≤0.05).

Table (5): Effect of chestnut fruits powder and its extracts uric acid, urea and creatinine of obese rats

Treatment/Parameter	Uric acid (mg/dl)	Urea (mg/dl)	Creatinine (mg/dl)
Control group (-)	6.17±0.10^{b}	21.83±0.20^{b}	0.85±0.01^{b}
Control group (+)	8.79±0.12^{a}	33.32±0.21^{a}	1.32±0.03^{a}
Obese rats with chestnut fruits powder (2.5%)	6.47±0.20^{b}	19.51±0.30^{c}	0.76±0.05^{c}
Obese rats with chestnut fruits powder (5%)	6.10±0.21^{b}	19.12±0.15^{c}	0.69±0.02^{d}
Obese rats with chestnut fruits extract (250 mg/kg)	5.53±0.30^{bc}	18.29±0.33^{d}	0.74±0.03^{c}
Obese rats with chestnut fruits extract (500 mg/kg)	5.28±0.25^{c}	16.98±0.10^{e}	0.61±0.04^{e}
LSD	**0.75**	**1.01**	**0.02**

Each value is represented as mean ± standard deviation (n = 3).

Mean under the same line bearing different superscript letters are different significantly ($p \leq 0.05$).

The mean values were 6.47 and 5.28 mg/dl, respectively. Data also indicated that the urea levels of positive control group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 33.32 and 21.83 mg/dl, respectively.While, the highest urea levels recorded for group fed on 2.5 % chestnut fruit powder but, the lowest value recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference (P≤0.05). The mean values were 19.51 and 16.98 mg/dl, respectively. In case of creatinine levels, data showed that the positive control group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 1.32 and 0.85 mg/dl, respectively. While, the highest creatinine levels recorded for group fed on 2.5 % chestnut fruit powder but, the lowest value recorded for group fed on 500 mg/kg chestnut fruit extract with significant difference (P≤0.05). The mean values were 0.76 and 0.61 mg/dl, respectively.These results are in agreement with**Micucci *et al.*, (2013)**, they reported thatthe natural extract of chestnut increasing gallbladder contraction and inducing the relaxation of the sphincter of Oddi can be of benefit in pathological conditions associated with increased transit time at risk of gallstones.

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التأثيرات المحتمله لمسحوق ومستخلص ثمار أبوفروه على التغيرات البيولوجيـة والكيميائيه والهستولوجية للفئران المصابة بالسمنــة

ثريا مسلم حسن ، سهام عزيز خضر، بسمة عبد العاطى محمد
قسم التغذية وعلوم الأطعمة ـ كلية الأقتصاد المنزلى ـ جامعة المنوفية

الملخص العربى

تم تقييم تأثير تركيزات مختلفة من مسحوق فاكهة أبو فروة بتركيزات(2.5 ، 5%) و مستخلص فاكهة أبو فروة بتركيزات (250، 500 مجم/ كجم/ وزن الجسم) فى الفئران المصابة بالسمنة. وفى هذه الدراسة تم تقسيم 36 من ذكور الفئران والتى يتراوح وزنها (140± 10 جم) إلى 6 مجموعات ، كل مجموعة تحتوي على 6 فئران. وتم اصابة الفئران بالسمنة بالتغذية على وجبة عالية الدهون (20 % دهن حيوانى).وقد أظهرت النتائج أن أعلى قيم للزيادة فى وزن الجسم، وكمية الغذاء المتناول وكفاءة استخدام الغذاء بالمجموعة المعالجة بمستخلص فاكهة ابو فروة تركيز 250 مجم/ كجم/وزن الجسم ، في حين أن أقل قيمة معنوية سجلت للمجموعة التى تغذت على مسحوق ابو فروة تركيز 2,5٪.وبينما سجلت انخفاض معنوى لإنزيمات الكبد(ALT ، ALP , AST,) ،ومستوى الدهون الثلاثية ، والكوليسترول ،والكوليسترول منخفض الكثافة و الكوليسترول منخفض الكثافة جدا ، ومستوى اليوريا وحمض اليوريك و الكرياتينين فى مجموعة الفئران التي تغذت بمستخلص فاكهة أبوفروه بتركيز 500 مجم/ كجم.فى حين سجلت أعلى قيم معنوىةللكوليستيرول عالى الكثافة فى مجموعة الفئران التي تغذت على مستخلص فاكهة أبوفروه بتركيز 500 مجم/ كجممقارنة بالمجموعة الكنترول الموجبة (الغير معالجة) . الخلاصة ، وجد أن مجموعة الفئران المصابة بالسمنة والتى تغذت بمستخلص فاكهة أبو فروه بتركيز 500 مجم/ كجم اظهرت تحسين صورة دهون الدم ووظائف الكبد والكلى بالمقارنة بالفئران المصابة بالسمنة وكذلك المجموعات التى تغذت على تركيزات مختلفة من مسحوق و مستخلص فاكهة أبوفروه .

الكلمات المفتاحية:ثمار أبوفروه ، الفئران ، التأثير المضاد للسمنة ، وظائف الكبد ، وظائف الكلى ، صورة دهون الدم.