Effect of Cocoa Seeds and their Extract on Weight Loss in Obese Rats

Thourya M. Hassan, Emad M. El-Kholie and Fatma M. M. Azzam

Nutrition & Food Science Dept., Faculty of Home Economics, Menoufia Univ., Egypt

Abstract

The effect of different concentrations (5&10%) as powder and 250 & 500mg/kg) as extract of cocoa seeds (*Theobroma cacao*, L) on obese rats were evaluated. Thirty six male albino rats weighting 140 ±10 g were used in this study and divided into 6 groups, each group contain 6 rats. Rats were treated by high fat diet (20% animal fat) to induce obese. Results showed that the highest glucose level recorded for 5 % cocoa seeds powder, while the lowest recorded for 500 mg/kg cocoa seeds extract with significant difference. The lower ALT, AST and ALP liver enzyme of treated group recorded for group fed on 500mg/kg cocoa seeds extract with significant difference. The highest cholesterol and triglycerides levels recorded for group fed on 5 %cocoa seeds powder while; the lowest value recorded for group fed on 500 mg/kg cocoa seeds extract with significant difference. The highest (HDL-c) levels recorded for group fed on 500 mg/kg cocoa seeds extract. The lowest LDL-c and VLDL-c values recorded for group fed on 500 mg/kg cocoa seeds extract with significant difference. While, the lowest uric acid, urea and creatinine values recorded for group fed on 500 mg/kg cocoa seeds extract with significant difference. As conclusion, obese rats treated with 500 mg/kg cocoa seeds extract had improvement lipid profile, liver and kidney functions compared with cocoa seeds powder.

Key words: Cocoa seeds, Rats, and Anti-obesity effect and Biochemical analysis.

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)**.

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.

Also, obesity is generally defined as the abnormal or excessive accumulation of fat in adipose tissue to the extent that health may be impaired **(Aronne and Segal, 2002)**.

Cocoa has various effects that promote good health, including the improvement of mental relaxation and concentration and the prevention of dental caries in the case of cacao bean husk. In particular, cacao liquor polyphenols exert potent effects in terms of antioxidant activity, inhibition of arteriosclerosis, modulation of immune function, suppression of gastric mucosal lesions, and anti-mutagenicity **(Watanabe, 2002)**.

Seeds from The obroma cacao L. (*Sterculiaceae*) are the base for the production of the most important and widespread functional food in human history. The origin of cocoa dates back to more than 3000 years ago, and it was used for nutritional and medicinal purposes by the Mayan and Aztec civilizations (**Dillinger *et al.*, 2000)**.

Besides flavonoids, cocoa is rich in other component of remarkable nutritional interest such as dietary fiber (DF). According to the updated definition of DF put forward by the American Association of Cereal Chemists Expert Committee on dietary fiber this consists of plant cell wall polysaccharides, lignin and associated substances resistant to hydrolysis by the digestive enzymes of humans. DF has well-

documented beneficial effects on human health and body function; thus, a high consumption of DF is associated with a reduced incidence of disorders and diseases common in developed societies such as chronic bowel disorders, obesity, diabetes, cardiovascular disease and cancer **(Cooper *et al.*, 2007).**

Relatively few studies have investigated the preventive or therapeutic effects of cocoa and cocoa constituents against obesity and metabolic syndrome. For example, treatment of high fat (HF)-fed rats with 12.5 % cocoa powder for 3 weeks significantly decreased final body weights, mesenteric WAT weights, and modulated the expression of genes related to fatty acid metabolism **(Yamashita *et al.*, 2011).**

Matsui *et al.*, (2005) reported that cocoa can prevent high-fat diet–induced obesity by modulating lipid metabolism, especially by decreasing fatty acid synthesis and transport systems, and enhancement of part of the thermogenesis mechanism in liver and white adipose tissue. A mechanism for the anti-obesity effects of cocoa, that ingestion effectively prevents TG accumulation by suppression of FA synthesis in the liver and by suppression of FA synthesis and transport systems with concurrent activation of thermogenesis.

This work was conducted to study the effect of cocoa seeds powder and its extracts on biochemical analysis of obese rats.

Material and Methods

Materials

Commercially cocoa (*Theobroma cacao*, L) seeds were obtained from Sebin El-Kom City, Menoufia Governorate in 2017.

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.

Casein, cellulose, choline chloride, and DL- Methionine

Casein, cellulose, choline chloride powder, and DL- methionine powder, were obtained from Morgan Co. Cairo, 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.

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.

Methods

Preparations of cocoa seeds

Cocoa seeds were obtained from local market in February, 2017. Samples of cocoa seeds were grinded to powder form.

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 5 groups, each group which consists of six rats as follows: group (I): 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): Group infected obesity was fed on the cocoa seeds extract by 250 mg/kg of the weight of the rat.Group (4): A group infected obese rats fed onthe cocoa seeds extract by 500mg/kg of the weight of the rat. Group (5): A group infected obese rats fed on the cocoa seeds powder by 5%of the weight of the rat.Group (6): A group infected obese rats fed on cocoa seeds powder by 10% of 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)**.

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)**.

Calculation of 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

Calculation of 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), serum alkaline phosphatase (ALP) were carried out according to the method of **Hafkenscheid (1979), Clinica ChimicaActa (1980)**, **and Moss (1982**),respectively.

Kidney functions

Determination of serum urea

Serum urea and serum creatinine were determined by enzymatic method according to **(Henry (1974)** and **Patton &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 cocoa seeds powder and its extracts on glucose level of obese rats

Data presented in Table (1) show the effect of on cocoa seeds powder on glucose level of obese rats. The obtained results showed that the positive control recorded the highest value when compared with negative control with significant difference. The mean values were 228.20 and 95.32mg/dl, respectively. From obese rat groups, it is clear to notice that the highest recorded for 5% cocoa seeds powder, while the

lowest recorded for 500mg/kgcocoa seeds extract with significant difference (P≤0.05). The mean values were 155.75 and 105.63, respectively. These results are in agreement with **Bowser *et al.*, (2017)**, they reported that procyanidin-rich cocoa extract elicited an anti-diabetic effect by stimulating glycogen synthesis and glucose uptake, independent of insulin, being more pronounced this effect with larger procyanidins.

Effect of cocoa seeds powder and its extracts on liver functions of obese rats

Data given in Table (2) show the effect of cocoa seeds powderand its extracts 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≤0.05). The mean values were 93.36and 30.04U/L, respectively. While, the highest ALT liver enzyme of treated group recorded for group fed on 5 % cocoa seeds powder but, the lowest value recorded for group fed on 500 mg/kg cocoa seeds powder extract with significant difference (P≤0.05). The mean values were 77.21 and 41.7U/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 84.76 and 18.89U/L, respectively. While, the highest AST liver enzyme of treated group recorded for group fed on 5 % cocoa seeds powder but, the lowest value recorded for group fed on 500 mg/kg cocoa seeds extracts with significant difference (P≤0.05). The mean values were 51.66and 26.44U/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 72.02and 30.10U/L, respectively. While, the highest ALP liver enzyme of treated group recorded for group fed on 5 % cocoa seeds powder but, the lowest value recorded for group fed on 500 mg/kg cocoa seeds extract with significant difference (P≤0.05). The mean values were 56.20and 38.05 U/L, respectively. The best treatment observed the highest reduction in liver enzymes recorded for 5%cocoa seeds powder. These results are in agreement with **Arun, (2007)**, they found that cocoa seeds were rich in flavonoids it is having hepatoprotective effect studies suggest that the aqueous and ethanol extracts prepared from the whole plant of these species were evaluated for their anti-hepatoma activity. Also, **Arellanes**

***et al.,* (2016)**, reported that the presence of N-Caffeoyl dopamine in cacao tree , This natural compound showed a protective effect due to its antioxidant activity by increasing superoxide dismutase and glutathione levels in hepatic tissue and significantly lowering the liver-enzyme levels (AST, ALT and ALP).

Effect of cocoa seeds on total cholesterol and triglycerides level of obese rats

The effect of cocoa seeds 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 ($P \leq 0.05$). The mean values were 159.11and 71.10 mg/dl, respectively. While, the highest cholesterol levels recorded for group fed on 5 % cocoa seeds powder but, the lowest value recorded for group fed on 500 mg/kg cocoa seeds extract with significant difference ($P \leq 0.05$). The mean values were 100.15and 71.87mg/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 ($P \leq 0.05$). The mean values were 128.65and 66.61mg/dl, respectively. While, the highest triglyceride recorded for group fed on 5 % cocoa seeds powder but, the lowest value recorded for group fed on 500 mg/kg cocoa seeds extract with significant difference ($P \leq 0.05$). The mean values were 86.63and 65.19mg/dl, respectively. These results are in agreement with **Jalil *et al.,* (2009)**, they reported previous studies have indicated that polyphenols could exert their lipid-lowering properties through various mechanisms, namely by slowing down triacyl glycerol absorption through inhibition of pancreatic lipase, increasing cholesterol excretion in feces, attenuating hepatic lipid accumulation through activation of adenosine mono phosphate (AMP)-activated protein kinase, suppressing hepatic secretion of apolipoprote in B100 and increasing expression of LDL receptors in the liver.

Effect of cocoa seeds powder and its extracts on lipid profile level of obese rats:

The effects of cocoa seeds on serum lipid profile (HDL-c, LDL-c and VLDL-c) level of obese rats were shown in Table (4). The obtained results indicated that the high density lipoprotein (HDL-c) levels of positive control group recorded the highest value when compared with negative control group with significant difference ($P \leq 0.05$). The mean values were 41.77 and 31.26 mg/dl, respectively. While, the highest

(HDL-c) levels recorded for group fed on 500 mg/kg cocoa seeds extract but, the lowest value recorded for group fed on 10 % cocoa seeds powder with significant difference (P≤0.05). The mean values were 42.32 and 36.64 mg/dl, respectively. Data also showed that the low density lipoprotein (LDL-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 89.48 and 25.62 mg/dl, respectively. While, the highest (LDL-c) levels recorded for group fed on 10 % cocoa seeds powder but, the lowest value recorded for group fed on 500 mg/kg cocoa seeds extractwith significant difference (P≤0.05). The mean values were 48.55 and 11.56 mg/dl, respectively. In case of very low density lipoprotein (VLDL-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 25.73 and 13.32 mg/dl, respectively. While, the highest (VLDL-c) levels recorded for group fed on 5 % cocoa seeds powder but, the lowest value recorded for group fed on 500 mg/kg cocoa seeds extract with significant difference (P≤0.05). The mean values were 17.33 and 13.04 mg/dl, respectively. These results are in agreement with **Hirano (2000),** they found that cocoa ingestion increased total cholesterol concentrations, especially high-density lipoprotein cholesterol, in serum, whereas gene expression for cholesterol biosynthesis was decreased in liver and MES-WAT.

Effect of cocoa seeds powder and its extracts on uric acid, urea and creatinine of obese rats

The effect of cocoa seeds on uric acid, urea and creatinine of obese rats are shown in Table (5). The obtained results indicated that the highest uric acid level recorded for positive control group while the lowest value recorded for negative control group with significant differences .The mean values were 9.53and 6.97 mg/dl respectively .While, the highest uric acid of treated groups recorded for group fed on 5% cocoa seeds powder.While, the lowest uric acid level recorded for group fed on 500 mg /kg cocoa seeds extracts With significant differences. The mean values were 7.27 and 6.08mg/dl respectively. Data also showed that the highest urea level recorded for positive control group while the lowest value recorded for negative control group with significant differences. The mean values were 31.92and 20.43 mg/dl respectively. While, the highest urea of treated groups recorded for group fed on 5% cocoa seeds powder but, the lowest urea level recorded

for group fed on 500 mg /kg cocoa seeds extracts with significant differences. The mean values were 18.11 and 15.58mg/dl respectively. In case of creatinine level, the highest value recorded for positive control group while the lowest value recorded for negative control group with significant differences. The mean values were 1.27and 0.80 mg/dl, respectively. While, the highest creatinine level of treated groups recorded for group fed on 5% cocoa seeds powder but, the lowest creatinine level recorded for group fed on 500 mg /kg cocoa seeds extracts with significant differences. The mean values were 0.61 and 0.46mg/dl respectively. These results are in agreement with **Repta and Long, (1980)**, they reported that administration of cocoa powder decrease the effective renal plasma flow precedes the decrease in GFR. Also, **Tavafi *et al.*, (2012),** reported that many cocoa antioxidant containing substances have been tested and proposed to have ROS scavenging capacity. It was expected that the antioxidant capacity of cocoa polyphenols would mitigate the toxic effect of GM on the kidneys.

Table (1): Effect of cocoa seeds and its extracts on glucose level of obese rats

Parameters	Glucose level (mg /dl)
	Mean±SD
Control group (-)	95.32 ± 1.40^{f}
Control group (+)	288.20 ± 2.32^{a}
Obese rats with cocoa seeds powder (5%)	155.75 ± 1.60^{b}
Obese rats with cocoa seeds powder (10%)	117.66 ± 2.15^{d}
Obese rats with cocoa seeds extract (250 mg/kg)	137.65 ± 2.11^{c}
Obese rats withcocoa seeds extract (500 mg/kg)	105.63 ± 1.02^{e}
LSD	5.64

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

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

Table (2): Effect of cocoa seeds powder and its extracts on liver functions of obese rats

Treatment/Parameter	ALT (U/L)	AST (U/L)	ALP (U/L)
	Mean±SD	Mean±SD	Mean±SD
Control group (-)	30.04 ± 1.90^{f}	18.89 ± 1.28^{f}	30.10± 1.60^{f}
Control group (+)	93.36 ± 2.13^{a}	84.76 ± 1.13^{a}	72.02± 1.32^{a}
Obese rats withcocoa seeds powder (5%)	77.21 ± 1.63^{b}	51.66 ± 2.10^{b}	56.20±1.20^{b}
Obese rats withcocoa seeds powder (10%)	64.36 ± 1.21^{c}	45.13 ± 1.15^{c}	42.53±1.46^{d}
Obese rats with cocoa seeds extract (250 mg/kg)	58.72 ± 2.10^{d}	41.28 ± 2.58^{d}	49.07± 3.21^{c}
Obese rats withcocoa seeds extract (500 mg/kg)	41.72 ± 3.23^{e}	26.44 ± 1.50^{e}	38.05± 2.14^{e}
LSD	0.26	0.17	0.02

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

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

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

Treatment/Parameter	Total cholesterol (mg /dl)	Triglycerides (mg /dl)
	Mean±SD	Mean±SD
Control group (-)	71.10±2.41^{e}	66.61±2.24^{d}
Control group (+)	159.11±3.18^{a}	128.65± 3.32^{a}
Obese rats withcocoa seeds powder (5%)	100.15±1.23^{b}	86.63±1.40^{b}
Obese rats with cocoa seeds powder (10%)	95.93±5.02^{c}	82.60±1.11^{c}
Obese rats withcocoa seeds extract (250 mg/kg)	77.40± 4.14^{d}	68.84± 2.31^{d}
Obese rats with cocoa seeds extract (500 mg/kg)	72.87± 1.53^{e}	65.19± 3.42^{d}
LSD	4.26	3.17

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

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

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

Treatment/Parameter	(HDL-C) (g/dl)	(LDL-C) (g/dl)	(VLDL-C) (g/dl)
	Mean±SD	Mean±SD	Mean±SD
Control group (-)	31.26±2.60^{c}	25.62± 1.74^{d}	13.32±0.78^{c}
Control group (+)	41.77±4.50^{a}	89.48±1.77^{a}	25.73±0.73^{a}
Obese rats with cocoa seeds powder (5%)	38.11±4.28^{b}	42.64±1.75^{c}	17.33±0.71^{b}
Obese rats with cocoa seeds powder (10%)	36.64±5.26^{b}	48.55±1.87^{b}	16.52±0.81^{b}
Obese rats withcocoa seeds extract (250 mg/kg)	41.00±5.11^{a}	18.21±1.75^{e}	13.77±0.83^{c}
Obese rats with cocoa seeds extract (500 mg/kg)	42.32±4.47^{a}	11.56±1.87^{f}	13.04±0.70^{c}
LSD	1.46	2.14	1.25

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 ($p \leq 0.05$).

Table (5): Effect of gooseberry 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 (-)	6.67±0.12^{b}	20.43±0.20^{b}	0.80±0.02^{b}
Control group (+)	9.53±0.11^{a}	31.92±0.10^{a}	1.27±0.01^{a}
Obese rats withcocoa seeds powder (5%)	7.27±0.10^{b}	18.11±0.42^{b}	0.61±0.05^{b}
Obese rats with cocoa seedspowder (10%)	6.90±0.11^{b}	17.72±0.15^{bc}	0.59±0.03^{b}
Obese rats with cocoa seedsextract (250 mg/kg)	6.33±0.10^{b}	16.89±0.30^{bc}	0.54±0.01^{bc}
Obese rats with cocoa seeds extract (500 mg/kg)	6.08±0.21^{c}	15.58±0.21^{c}	0.46±0.02^{c}
LSD	1.03	1.12	0.35

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

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

REFERENCES

1-AIN (1993): American institute of nutrition purified diet for laboratory Rodent, Final Report. J. Nutrition, 123: 1939-1951 and O. CompactumBenth. J. Essential Oil Res. 8 (6): 657-664.

2-Arellanes, J.A.M.; Rebolledo, G.A.G.; Fischer, M.M. and Leon-Díaz, R. (2016): Medical plant extracts and natural compounds with a hepatoprotective effect against damage. Asian Pacific Journal of Tropical Medicine, Unidad de Investigaci´on M´edica en Farmacología, 9 (12): 1141-1149.

3-Aronne, L. J. and Segal, K. R. (2002): Adiposity and fat distribution outcome measures: assessment and clinical implications. Obesity Journal, 10: 14-21.

4-Arun, M. and Asha, V. V. (2007): Preliminary studies on antihepatotoxic effect of *Physalisperuviana*, Linn. (*Solanaceae*) against carbon tetrachloride induced acute liver injury in rats. Journal of Ethnopharmacology, 111:110-114.

5-Bowser, S.M.; Moore, W.T.; McMillan, R.P.; Dorenkottc, M.R.; Goodrich, K.M.; Ye, L.; O'Keefe, S.F.; Hulver, M.W. and Neilson, A.P. (2017): High-molecular-weight cocoa procyanidins possess enhanced insulin-enhancing and insulin mimetic activities in human primary skeletal muscle cells compared to smaller procyanidins. J. Nutr. Biochem., 39: 48-58.

6-Cheng, M. L.; Zhao, S. M.; Li, W. Z.; Zhang, X.; Ge, C. R.; Duan, G., and Gao, S. Z. (2010): Anti-adipocyte scFv-Fc antibody suppresses subcutaneous adipose tissue development and affects lipid metabolism in mini pigs. Applied Biochemistry and Biotechnology, 162: 687-697.

7-ClinicaChimicaActa (1980): 105, 147-172, (Chemical kits).

Cooper, K.A.; Donovan, J.L.; Waterhouse, A.L. and Williamson, G. (2007): Cocoa and health: a decade of research. Br. J. Nutr., 99:1-11

8-Dillinger, T.L.; Barriga, P.; Escárcega, S.; Jimenez, M.; Salazar Lowe, D.; Grivetti, L.E. (2000): Food of the gods: Cure for humanity. A cultural history of the medicinal and ritual use of chocolate, J. Nutr., 130, 2057–2072.

9-Fossati, P. (1982): Pricipe l. Clin. Chem., 28: 2077 (Chemical Kits).

10-Friedwaid, W.T. (1972): Determination of HDL. Clin. Chem., 18: 499. (Chemical Kits).

11-Grodon, T. and Amer, M. (1977): Determination of HDL. Clin. Chem., 18: 707. (Chemical Kits).

12-Hafkenscheid, J.C. (1979): Determination of GOT. Clin. Chem., 25:155.

13-Hassan, H. A. and El-Gharib, N. E. (2015): Obesity and Clinical Riskiness Relationship: Therapeutic Management by Dietary Antioxidant Supplementation-a Review. Appl. Biochem. Biotechnol., 175 (8): 1-19.

14-Henry, R.J. (1974): Clinical Chemist: Principles and Techniques, 2nd Edition, Hagerstoun (MD), Harcer, ROW, 882.

15-Hirano, R.; Osakabe, N.; Iwamoto, A.; Matsumoto, A.; Natsume, M. and Takizawa, T. (2000): ***et al.,*** Antioxidant effects of polyphenols in chocolate on low-density lipoprotein both in vitro and ex vivo . J. Nutr. Sci. Vitaminol., 46: 199 -204.

16-Jalil, A.M.M.; Ismail, A.; Chong, P.P.; Hamid, M. and Kamaruddin, H.S.S. (2009): Effects of cocoa extract containing polyphenols and methylxanthines on biochemical parameters of obese-diabetic rats. J. Sci. Food Agric., 89: 130-137.

17-Lee, R. and Nieman, D. (1996): Nutrition Assessment. 2nd Ed., Mosby, Missouri, USA.

18-Matsui, N.; Ito, R.; Nishimura, E.; Yoshikawa, M; Kato, M; Kamei, M., Shibata, H. and Hashizume, S. (2005): Ingested cocoa can prevent high-fat diet–induced obesity by regulating the expression of genes for fatty acid metabolism. Nutrition, 21: 594 - 601.

19-Moss, D.W. (1982): Alkaline phosphatase isoenzymes. Clin. Chem. 28: 2007-2016.

20-Patton, C.J. and Crouch, S.R. (1977): Enzymatic determination of urea. J. of Anal. Chem., 49: 464-469.

21-Repta, A.J., Long, D.F. (1980): Reaction of cisplatin with human plasma and plasma fractions. In: cispaltin: current status and new development, edited by Prestayko A.W., Crook S.T., Carter S.K. 1980. Assisted by Alder N.A., New York, Academic Press, 285-304.

22-SAS, (1988): SAS Users Guide: Statistics version 5th Ed. SAS. Institute Inc., Cary N.C.

23-Schermer, (1967): The Blood Morphology of Laboratory Animal. Longmans, Printed in Great Britain, Green and Co. Ltd., pp.350.

24Tavafi, M.; Ahmadvand, H. and Toolabi, P. (2012): Inhibitory Effect of olive leaf extract on gentamicin -induced nephrotoxicity in rats. Iranian Journal of Kidney Disease, 6: 25-32.

25-Thomas, L. (1992): Labor and Diagnose, 4 th Ed. Marburg: Die Medizinischi Verlagsgesellschaft. (Chemical Kits).

26-Watanabe S. (2002): Image of chocolate differs on cultures and psychological situation. In: The various effects of chocolate & cocoa. Proceedings of the International Symposium of Chocolate & Cocoa Nutrition (in Japanese), Tokyo: Chocolate & Cocoa Association of Japan, p. 112- 116.

27-Yamashita,Y.; Okabe, M.; Natsume, M.; Ashida, H. (2012): Prevention mechanisms of glucose intolerance and obesity by cacao liquor procyanidin extract in high-fat diet-fed C57BL/6 mice. Arch. Biochem. Biophys., 2012:1–10.

28-Young, D. (1975): Effects of drugs on clinical laboratory tests. Pestaner, L. Clin. Chem., 21: 5, 1D- 432D. (Chemical Kits).

تأثير بذور ومستخلص الكاكاو على خفض الوزن في الفئران المصابة بالسمنة

أ.د/ ثريا مسلم حسن ـ أ.د/عماد محمد الخولى ـ

استاذ التغذية وعلوم الأطعمة

فاطمة مختار محمد عزام

قسم التغذية وعلوم الأطعمة. كلية الأقتصاد المنزلى . جامعة المنوفية

الملخص العربى

تم تقييم تأثير تركيزات مختلفة (٥ ،١٠%) فى صورة مسحوق ،٢٥٠، ٥٠٠ مجم/ كجم فى صورة مستخلص من بذور الكاكاو في الفئران المصابة بالسمنة.واستخدم ٣٦ فأر في هذه الدراسة وتم تقسيمها إلى ٦ مجموعات، كل مجموعة تحتوي على ٦ فئران. وتم اصابة الفئران بالسمنة بالتغذية على وجبة عالية الدهون (٢٠% دهن حيوانى) بمرض السمنة. وأظهرت النتائج أن أعلى انخفاض لمستوى الجلوكوز وإنزيمات الكبد (ALP,AST,ALT) سجلت مع مجموعة الفئران التي تغذت على مستخلص بذور الكاكاو بتركيز ٥٠٠ مجم/ كجم مع وجود فرق معنوى .أقل قيمة من الدهون الثلاثية والكوليسترول مع مجموعة الفئران التي تغذت على مستخلص بذورالكاكاو بتركيز ٥٠٠ مجم/ كجم. فى حين أن على قيم للكوليستيرول عالى الكثافة سجلت مع مجموعة الفئران التي تغذت على مستخلص بذور الكاكاو بتركيز ٥٠٠ مجم/ كجم.بينما أقل قيم من الكولسيتيرول منخفض الكثافة والكولسيتيرول منخفض الكثافة جدا سجلت مع مجموعة الفئران التي تغذت على مستخلص بذور الكاكاو بتركيز ٥٠٠ مجم/ كجم .أقل قيم لليوريا وحمض اليوريك والكرياتينين سجلت مع مجموعة الفئران التي تغذت على مستخلص بذورالكاكاو بتركيز ٥٠٠ مجم/ كجم. الخلاصة، وجد أن مجموعة الفئران المصابة بالسمنة والتي تغذت على مستخلص بذورالكاكاو بتركيز ٥٠٠ مجم/ كجمسجلت أفضل النتائج فى تحسين صورة دهون الدم ووظائف الكبد والكلى بالمقارنة بالفئران المصابة بالسمنة والتى تغذت على مسحوق بذورالكاكاو.

الكلمات الأفتتاحية: بذورالكاكاو ـ الفئران . التأثير المضاد للسمنة . التحاليل الكيميائية الحيوية.