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Anti-obesity Effect of Date Palm Pith in High- Fat Induced Obese Rats

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Abstract: The effect of different concentrations (5 and 7%) as powder of date palm pith on obese rats was evaluated. Twenty four male albino rats weighting 150 ± 10 g were used in this study and divided into 4 groups, each group contained 6 rats. Rats were treated by high fat diet (20% animal fat) to induce obesity. Glucose, serum liver function (GOT, GPT and ALP), lipids profile (TG, TC, LDL-c, HDL-c, VLDL-c, AI) and kidney function (uric acid, urea and creatinine) and serum protein fraction were determined. Results showed that the lower ALT, AST and ALP liver enzyme of treated group recorded for group fed on 7% date palm pith with significant differences. The lowest cholesterol and triglycerides, LDL-c and VLDL-c, uric acid, urea and creatinine values recorded for 7% date palm pith with significant ($p \leq 0.05$) differences, while the highest (HDL-c) levels recorded for group fed on 7% mixture. As conclusion, obese rats treated with 5 and 7% powder of date palm had improved lipid profile, liver, kidney functions and glucose level. Therefore, date palm pith powder could be used in our beverages and daily level dishes, besides the fact that it has so many other health benefits.

Key words: palm pith, Anti-obesity, serum lipid profile, liver functions, kidney functions.

Introduction

Obesity is more frequent in populations living in environments characterized by a long-term energy positive imbalance due to sedentary lifestyle, low resting metabolic rate, or both. Causes of obesity involve genes, metabolism, diet, physical activity, and the socio-cultural environment that characterizes 21st century living style (**Marti et al., 2008**). 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**).

In context study, **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**). Furthermore, **Mohamed et al., (2014)** reported that weight management is a life-long process and permanent weight reduction is difficult to achieve. The ultimate cause of obesity is an imbalance between calorie intake and energy expenditure resulting from complex interactions between many genetic and environmental factors. Obesity is a chronic disease that affects millions of people worldwide and contributes to substantial morbidity and mortality. A successful weight control program must balance calorie intake with energy expenditure. Diet and exercise have been the mainstays for weight control. Natural products can play a safe and effective role with obesity specially those containing fibers, polyphenols, sterols, and alkaloids. In addition, they are a good supplement for vitamins and minerals.

Plants used in traditional medicine require detailed investigation from an ethno-pharmacological approach for the treatment of liver disorders because hepatic ailments remain a serious health problem caused by drugs, chemicals and alcohol (**Anju et al., 2012**). Date palm tree, *Phoenix dactylifera*, L., is an important plantation crop for many countries extending from North Africa to the Middle East including many states of the Arabian Gulf cooperation countries (**Saleh et al., 2011**).

The palmito, known as "heart of palm" or date palm pith, is the central part or heart of some wild varieties of palm trees, it's one of such plant grown in many localities in arid and semi-arid regions of the world (**Abohatem et al., 2011**). Hearts of palm are relatively rich in protein (2.81% - 2.27%) in fresh weight) and contain 17 amino acids. All the essential amino acids present in heart of palm. Hearts of palm are also excellent source of dietary fiber. They are moderate source of minerals such as Ca, Fe, K, Na, P, and Zn. However, they are low in fat and sugars (**Soto et al., 2005**).

Phytochemicals from fruits have been shown to possess significant antioxidant capacities that may be associated with lower incidence and lower mortality rates of degenerative disease in human. Studies conducted on antioxidant activity and phenolic content of various fruits of *Phoenix dactylifera*, L. demonstrated a linear relationship between antioxidant activity and the total phenolic content of date fruit extract (**Alliath and Abdalla, 2005**). Also, **Chaira et al., (2007)** reported that flesh and pit extracts of date palm fruit have free radical scavenging activities; however, the significant effect after two weeks of palmito extract on serum total lipid level could be attributed to the antioxidant potentials of palmito extract. Additionally, **Vembu et al., (2012)** concluded that aqueous extract of *Phoenix dactylifera* is a valuable diet against obesity. The anti-hyperlipidemic activity of *Phoenix dactylifera* may be due to phytochemical constituents present in it. Further extensive studies are required for its potential uses as an anti-hyperlipidemic drug in clinical practice.

Other studies demonstrated that there is a strong hypolipidaemic impacts of *Phoenix dactylifera* in rats (**Sethupathy et al., (2002)**). Regarding the mechanism of action these plant extracts may have caused decrease in serum cholesterol and triglycerides. Also, **Lei et al., (2007)**, suggested that date palm pits could be useful for prevention or treatment

of obesity. The inhibitive capacities of pits from the tested date palm varieties against lipase activity might perfectly coincident with their total phenolics compounds. In fact, various natural products containing polyphenols have been reported to have anti-obesity by inhibiting lipase activity. Furthermore, **McDougall et al., (2009)** have established that the inhibitory lipase activity of date palm pits might be derived from the phenolic compounds found in some date palm pits such as gallic acid, catechin, epicatechin, ellagic acid myricetin, quercetin, kaempferol, resveratrol, and anthocyanin. Therefore, this work was conducted to study the effect of different concentration (5 and 7%) of date palm pith as powder on serum biochemical analysis of obese rats.

Material and Methods

Materials:

Date palm pith (*Phoenix dactylifera*, var., zaghloul) was obtained from local farm, Shebin El-Kom City, Menoufia Governorate, Egypt. Casein, cellulose, choline chloride powder, and DL- methionine powder, were obtained from Morgan Co. Cairo, Egypt.

The induction of experimental obesity

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

Experimental animals

A total of 24 adult normal male albino rats Sprague Dawley strain weighing 150 ± 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 date palm pith

To prepare the dried date palm pith, heart of palm “palmito” was obtained from local farmer. Date palm pith washed thoroughly under running tap water, dried in shade and then dried in an air oven at 50°C, and ground to a obtain fine powder using a mill.

Experimental design

Twenty four adult male white albino rats, Sprague Dawley Strain, 10 weeks age, weighing (150±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 were divided into 4 groups, each group consists of six rats as follows: Group (1): Rats fed on basal diet as negative control. Group (2): Obese rats induced by high fat diet (20% animal lipid) supplemented in the basal diet and used as a positive control group. Group (3): A group of obese rats fed on date palm pith as powder by 5% of the weight of basal diet. Group (4): A group of inflicted obese rats fed on date palm pith as powder by 7% of basal diet. During the experimental period, the general behavior of rats was observed. The experiment period lasted for 28 days. At the end of the experimental period each rat was slaughtered and blood samples collected. Blood samples were centrifuged at 4000 rpm for ten minute to separate blood serum, which was kept in deep freezer till using.

Blood sampling

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

Biochemical analysis

Serum lipids profile:

Serum total cholesterol was determined according to the colorimetric method described by **Thomas (1992)**. Serum triglyceride was determined by enzymatic method using kits according to the **Young (1975) and Fossati and Principe (1982)**. HDL-c was determined according to the method described by **Friedewaid (1972) and Grodon and Amer (1977)**. VLDL-c was calculated in mg/dl according to **Lee and Nieman (1996)** using the following formula:

$$\text{VLDL-c (mg/dl)} = \text{Triglycerides} / 5$$

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

$$\text{LDL-c (mg/dl)} = \text{Total cholesterol} - \text{HDL-c} - \text{VLDL-c.}$$

Atherogenic index Calculated as of $= (\text{VLDL-c} + \text{LDL-c}) / \text{HDL-c}$. This index calculated according to the formula of **Kikuchi-Hayakawa et al., (1998)**.

Liver functions

Determination of serum alanine amino transferase (ALT), serum aspartate amino transferase (AST), serum alkaline phosphatase (ALP) carried out according to the method of **Hafkenschied (1979)**, **Clinica Chimica Acta (1980)**, and **Moss (1982)**, respectively.

Determination of serum proteins:

Serum protein (STP) was determined according to the method described by **Henry (1964)**. Serum albumin (SAIb) was determined according to the method described by (**Doumas et al., 1971**). **Serum globulin (SGlob)** was determined according to the method of (**Chary and Sharma, 2004**) by the following equation:

Serum globulin = Serum total protein (g/dl) - Serum albumin (g/dl).

Kidney functions

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

Determination of blood glucose

Enzymatic determination of plasma glucose was carried out colorimetrically according to the method of **Tinder (1969)**.

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. Different values for two different treatments at ($P \leq 0.05$) were considered significant using Costat Program. Biological results were analyzed by One Way ANOVA.

Results and Discussion

Effect of different levels of date palm pith on glucose level of obese rats

Data presented in table (1) show the effect of different levels of date palm pith powders on glucose level (mg/dl) of obese rats. It could be noticed that the mean value of glucose level (mg/dl) of control (+) group was higher than control (-) group, it was 130.00 ± 2.00 and 80.00 ± 2.00 mg/dl, respectively showing a significant differences. All obese rats fed on various levels of date palm pith powder diets, showed

significant differences in mean values as compared to control (+) group. The values were 90.0 ± 2.0 and 85.0 ± 2.00 mg/dl, for G5 and G4 respectively. The difference between groups 3 and 4 was significant. The best glucose level (mg/dl) was recorded for group 3 (obese rats fed on 5% date palm pith powder) when compared to control (+) group. As reported by **Masmoudi-allouche et al., (2016)**, they proved that date seed extracts can inhibit the activity of α -amylase and pancreatic lipase. Inhibition of the α -amylase enzyme will inhibit digestion of starch, so that absorption is inhibited. The lipase enzyme has functions to digest fat so that the fat absorption process will be inhibited. If the absorption process is inhibited, blood sugar also decreases and diabetes can be prevented. Also, **Abdallaha et al., (2015)**, reported that dates are a source of dietary fiber, phenolic compounds, and natural antioxidants. Phenolic compounds work as an anti-diabetic by fighting the oxidation of free radicals, repairing pancreatic cells, decreasing lipid peroxidation in the cell membrane, and inhibiting the α -amylase, pancreatic α -glucosidase, and lipase enzymes. Blood glucose levels also decrease along with the increasing dose of dates.

Table (1): Effect of different levels of date palm pith on glucose level of obese rats

| Parameter | Glucose (mg/dl) Mean \pm SD |
|-------------------|----------------------------------|
| G1: control (-ve) | 80.00 ^d \pm 2.00 |
| G2: control (+ve) | 130.00 ^a \pm 2.00 |
| G3:DPP powder 5% | 85.00 ^c \pm 2.00 |
| G4: DPP powder 7% | 90.00 ^b \pm 2.00 |
| LSD | 3.765 |

DPP= Date palm pith, Means in the same row with different litters are significantly different at ($p \leq 0.05$).

Effect of different levels of date palm pith on renal function parameters of obese rats

Data tabulated in table (2) show the effect of different levels of date palm pith powder on some renal function parameters of obese rats. It could be noticed that the mean value of uric acid (UA) level (mg/dl) level of control (+) group was higher than control (-) group, it was 6.50 ± 0.08 and 4.6 ± 0.09 mg/dl, respectively showing a significant differences as compared to of control (+) group. All obese rats fed on various levels of date palm pith powder diets, showed mostly significant differences in mean values as compared to control (+) group. The uric acid values were 5.90 ± 0.004 and 5.20 ± 0.03 mg/dl, respectively as

compared to control (+) group. The values between groups 3 and 4 showed significant differences between them. The best treatment for uric acid (UA) level (mg/dl) was recorded for group 4 (obese rats fed on 7% date palm pith powder when compared to control (+) group. On the other hand, it could be noticed that the mean value of urea level (mg/dl) of control (+) group was higher than control (-) group, being 44.00 ± 2.00 and 27.00 ± 2.00 mg/dl, respectively showing a significant difference as compared to of control (+) group. All obese rats fed on various levels of date palm pith powder diets, showed a significant differences in mean values of urea as compared to control (+) group. The values were 38.0 ± 2.00 and 32.0 ± 1.00 mg/dl, respectively as compared to control (+) group. The values between groups 3, and 4 showed nonsignificant differences between them. The best treatment considering urea level (mg/dl) was recorded for group 4 (obese rats fed on 7% date palm pith powder) when compared to control (+) group. In case of creatinine level (CR), it could be noticed that the mean value of creatinine level (mg/dl) level of control (+) group was higher than control (-) group, it being 1.4 ± 0.10 and 0.6 ± 0.02 mg/dl, respectively showing a significant differences.

Table (2): Effect of different levels of date palm pith on renal function parameters of obese rats

| Parameters | Kidney function | | |
|--------------------------|------------------------------|-------------------------|--------------------------------|
| | Uric acid (mg/dl) Mean±SD | Urea (mg/dl) Mean±SD | Creatinine (mg /dl) Mean±SD |
| G1: control (-ve) | $4.60^d \pm 0.09$ | $27.00^d \pm 2.00$ | $0.60^d \pm 0.02$ |
| G2: control (+ve) | $6.50^a \pm 0.08$ | $44.00^a \pm 2.00$ | $1.40^a \pm 0.10$ |
| G3:DPP powder 5% | $5.90^b \pm 0.04$ | $38.00^b \pm 2.00$ | $1.20^b \pm 0.04$ |
| G4: DPP powder 7% | $5.20^c \pm 0.03$ | $32.00^b \pm 1.00$ | $1.00^c \pm 0.05$ |
| LSD | 0.1227 | 3.394 | 0.1133 |

DPP= Date palm pith, Means in the same row with different litters are significantly different at ($p \leq 0.05$).

All obese rats fed on various levels of date palm pith powder diets, showed significant differences in mean values as compared to control (+) group. The values for G3&G4 were 1.20 ± 0.04 and 1.00 ± 0.50 mg/dl, respectively as compared to control (+) group. The values between groups 3, and 4 showed a significant difference between them. The best treatment considering creatinine (CR) level (mg/dl) was recorded for group 4 (obese rats fed on 7% date palm pith powder) when compared to control (+) group. Finally it could be observed that the higher the level of date palm pith powder in diets, the more the desirable action on

biochemical parameters evaluated for obese rats. All treatment groups revealed improvement of mentioned parameters, provided that the best group was that of 7% date palm pith powder diet. These results are in agreement with **Abdelaziz et al., (2015)**, who noticed a similar reduction in urea concentration from the administration of the extract date palm. It is noteworthy that an elevated serum glucose concentration may promote kidney failure as usually noticed in diabetic nephropathy.

Effect of different levels of date palm pith on liver function levels of obese rats

Data given in table (3) illustrate the effect of different levels of date palm pith powders on liver enzymes (AST, ALT, AST/ALT and ALP) (U/L) of obese rats. It could be noticed that the mean value of AST liver enzyme level (U/L) level of control (+) group was higher than control (-) group, it was being 93.44 ± 2.00 and 27.0 ± 2.00 U/L, respectively showing a significant difference. All obese rats fed on various date palm pith powders diets, showed significant differences in mean values as compared to control (+) group. The values were 37 ± 2.00 and 32 ± 2.00 U/L, respectively. The values between groups 3 and 4 showed a significant difference. The best treatment AST liver enzyme level (U/L) was recorded for group 4 (obese rats fed on 7% date palm pith powders) when compared to control (+) group. It is clear to notice that the mean value of ALT liver enzyme level (U/L) of control (+) group was higher than control (-) group, it was 64.0 ± 2.00 and 25.0 ± 2.00 U/L, respectively showing a significant differences. All obese rats fed on various date palm pith powders diets, showed significant differences in mean values as compared to control (+) group. The values were 33 ± 2.00 and 29 ± 2.00 U/L, respectively. The difference between groups 3 and 4 was significant. The best treatment AST liver enzyme level (U/L) was recorded for group 4 (obese rats fed on 7% date palm pith powders) when compared to control (+) group. In case of AST/ALT, it could be noticed that the mean value of AST/ALT liver enzyme level of control (+) group was higher than control (-) group, it was 1.46 ± 0.01 and 1.08 ± 0.01 , respectively. All obese rats fed on various date palm pith powders diets, showed significant difference in mean values as compared to control (+) group. The values were 1.12 ± 0.01 and 1.10 ± 0.01 , for G3&G5 respectively. The differences between groups 3 and 4 were significant. The best treatment for AST/ALT liver enzymes level was recorded for group 4 (obese rats fed on 7% date palm pith powders) when compared to control (+) group. It could be noticed that

the mean value of ALP liver enzyme level (U/L) level of control (+) group was higher than control (-) group, it was 226.0±3.00 and 194.0±2.00 U/L, respectively with a significant differences. All obese rats fed on various date palm pith powders diets, showed significant differences in mean values as compared to control (+) group. The values were 192±6.00 and 186±4.00 U/L, respectively. The values between groups 3 and 8 showed a significant difference between them.

Table (3): Effect of different levels of date palm pith on liver functions of obese rats

| Parameters Groups | AST (U/L) Mean±SD | ALT (U/L) Mean±SD | AST/ALT Mean±SD | ALP (U/L) Mean±SD |
|--------------------------|--------------------------|--------------------------|-------------------------|---------------------------|
| G1: Control (-ve) | 27.00 ^d ±2.00 | 25.00 ^d ±2.00 | 1.08 ^c ±0.01 | 194.00 ^b ±2.00 |
| G2:Control (+ve) | 93.44 ^a ±2.00 | 64.00 ^a ±2.00 | 1.46 ^a ±0.01 | 226.00 ^a ±3.00 |
| G3:DPP powder 5% | 37.00 ^b ±2.00 | 33.00 ^b ±2.00 | 1.12 ^b ±0.01 | 192.00 ^b ±2.00 |
| G4: DPP powder 7% | 32.00 ^c ±2.00 | 29.00 ^c ±2.00 | 1.10 ^c ±0.01 | 186.00 ^c ±4.00 |
| LSD | 3.765 | 3.765 | 0.0188 | 5.408 |

DPP= Date palm pith, Means in the same row with different litters are significantly different at ($p \leq 0.05$).

The best treatment considering ALP liver enzyme level (U/L) was recorded for group 4 (obese rats fed on 7% date palm pith powders) when compared to control (+) group. According to **Attia et al., (2016)**, it was suggested that date fruit extract (DFE) or date pits extract (DPE) can prevent liver fibrosis by suppressing genotoxicity and nuclear factor- κ B inflammatory pathway and by promoting collagen degradation. Both DFE and DPE significantly attenuated CCl₄-induced oxidative damage as indicated by reducing lipid, protein and DNA oxidation in addition to increasing the levels of hepatic catalase activity. Both extracts blocked the accumulation of collagen I in the liver and ameliorated the increased expression of collagen III and α -smooth muscle actin suggesting suppression of profibrotic response induced by CCl₄. Date fruit extract (DFE) and (date pits extract) DPE also up-regulated the expression of heme oxygenase-1 and attenuated the nuclear factor- κ B activation and cyclooxygenase-2 expression reflecting their anti-inflammatory potential.

Effect of different levels of date palm pith on lipid profile level of obese rats

Data presented in table (4) show the mean value of lipid profile (total cholesterol, triglycerides, HDL, LDL, VLDL and AI level (mg/dl) of obese rats fed on different levels of date palm pith diets. It could be noticed that the mean value of total cholesterol level (mg/dl) level of

control (+) group was higher than control (-) group, it was 114.33 ± 1.0 and 110.0 ± 2.0 mg/dl, respectively with a significant difference. All obese rats fed on various levels of date palm pith diets, showed a significant differences in mean values as compared to control (+) group. The values were 98 ± 1.0 and 90 ± 2.0 mg/dl, respectively. The values between groups 3 and 4 showed a significant difference . The best treatment considering total cholesterol level (mg/dl) was recorded for group 4 (obese rats fed on 7% date palm pith) when compared to control (+) group. In case of triglycerides levels, it is clear to mention that the mean value of triglycerides level (mg/dl) level of control (+) group was higher than control (-) group, it was 67.0 ± 1.0 and 48.0 ± 2.0 mg/dl, respectively with a significant difference. All obese rats fed on various levels of date palm pith diets, showed significant differences in mean values as compared to control (+) group. The values were 63 ± 1.0 and 60 ± 2.0 mg/dl, respectively. The values between groups 3 and 4 showed a significant difference . The best treatment considering triglycerides level (mg/dl) was recorded for group 4 (obese rats fed on 7% date palm pith) when compared to control (+) group. On the other hand, the mean value of HDL-c levels (mg/dl) level of control (-) group was higher than control (+) group, it was 55.0 ± 2.0 and 45.0 ± 1.0 mg/dl, respectively with a significant difference. All obese rats fed on various levels of date palm pith diets, showed significant differences in mean values as compared to control (+) group. The values were 50 ± 2.0 and 48 ± 1.0 mg/dl, respectively. The values between groups 3 and 4 showed a non-significant difference between them . The best treatment considering HDL-c level (mg/dl) was recorded for groups 3 and 4 (obese rats fed on 5 and 7% date palm pith) when compared to control (+) group. In case of LDL-c levels, it is clear to mention that the mean value level (mg/dl) of control (+) group was higher than control (-) group, it was 55.93 ± 0.99 and 45.40 ± 0.40 mg/dl, respectively with a significant difference. All obese rats fed on various levels of date palm pith diets, showed significant differences in mean values as compared to control (+) group. The values were 37.4 ± 0.40 and 28.00 ± 0.40 mg/dl, respectively. The values between groups 3 and 4 showed a significant difference . The best treatment considering LDL-c level (mg/dl) was recorded for group 4 (obese rats fed on 7% date palm pith) when compared to control (+) group.

Table (4): Effect of different levels of date palm pith on total cholesterol, triglycerides, HDL, LDL, VLDL and atherogenic index ratio of obese rats

| Parameter Group | Total cholesterol (mg/dl) | Triglycerides (mg/dl) | HDL (mg/dl) | VLDL (mg/dl) | LDL (mg/dl) | AI (Ratio) |
|------------------------------|------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | Mean±SD | Mean±SD | Mean±SD | Mean±SD | Mean±SD | Mean±SD |
| G1: Control (-ve) | 110.00 ^b ±2.00 | 48.00 ^d ±2.00 | 55.00 ^a ±2.00 | 9.60 ^d ±0.40 | 45.40 ^b ±0.40 | 0.99 ^b ±0.035 |
| G2: Control (+ve) | 114.33 ^a ±1.00 | 67.00 ^b ±1.00 | 45.00 ^c ±1.00 | 13.4 ^a ±0.2 | 55.93 ^a ±0.99 | 1.54 ^a ±0.02 |
| G3: Powder 5% | 98.00 ^c ±1.00 | 63.00 ^a ±1.00 | 48.00 ^b ±1.00 | 12.6 ^b ±0.20 | 37.4 ^c ±0.40 | 1.04 ^b ±0.02 |
| G4: Powder 7% | 90.00 ^d ±2.00 | 60.00 ^c ±2.00 | 50.00 ^b ±2.00 | 12.00 ^c ±0.40 | 28.00 ^d ±0.40 | 0.80 ^c ±0.035 |
| LSD | 2.977 | 2.977 | 2.977 | 0.595 | 1.087 | 0.053 |

DPP= Date palm pith, Means in the same row with different litters are significantly different at ($p \leq 0.05$).

On the other hand, VLDL-c levels, it is clear to mention that the mean value of triglycerides level (mg/dl) level of control (+) group was higher than control (-) group, it was 13.4±0.20 and 9.6±0.40 mg/dl, respectively with a significant difference. All obese rats fed on various levels of date palm pith diets, showed significant differences in mean values as compared to control (+) group. The values were 12.6±0.20 and 12.00±0.40 mg/dl, respectively. The values between groups 3 and 4 showed a significant difference. The best treatment considering VLDL-c level (mg/dl) was recorded for group 4 (obese rats fed on 7% date palm pith) when compared to control (+) group. It could be noticed that the mean value of atherogenic index (AI) ratio of control (+) group was higher than control (-) group, it was 1.54±0.02 and 0.99±0.035 , respectively with a significant difference. All obese rats fed on various levels of date palm pith diets, showed significant differences in mean values as compared to control (+) group. The values were 1.04±0.02 and 0.8±0.035 , respectively. The values between groups 3 and 4 showed significant difference between. The best treatment considering atherogenic index (AI) ratio was recorded for group 4 (obese rats fed on 7% date palm pith) when compared to control (+) group. The results are

in agreement with that obtained by many authors. **Lei *et al.*, (2007)**, found that the methanol extract from date palm pits is endowed with the potent lipase inhibition activity which is comparable to that of orlistat. This drug is the only pancreatic lipase inhibitor currently approved for a longterm treatment of obesity. Our results suggest that date palm pits could be useful for prevention or treatment of obesity. The inhibitive capacities of pits from the tested date palm varieties against lipase activity might perfectly coincident with their total phenolics compounds. In fact, various natural products containing polyphenols have been reported to have anti-obesity by inhibiting lipase activity. Also, **McDougall *et al.*, (2009)** have established that the inhibitory lipase activity of date palm pits might be derived from the phenolic compounds found in some date palm pits such as gallic acid, catechin, epicatechin, ellagic acid myricetin, quercetin, kaempferol, resveratrol, and anthocyanin.

Effect of different levels of date palm pith on total protein, albumin, globulin and albumin / globulin ratio of obese rats:

Data tabulated in table (5) showed the mean value of total protein, albumin, globulin and albumin/globulin ratio (g/dl) of obese rats fed on different levels of date palm pith powders. It is clear to notice that the mean value of total protein (TP) level (g/dl) level of control (-) group was higher than control (+) group, it was 8.20 ± 0.10 and 6.70 ± 0.10 g/dl, respectively with a significant difference. All obese rats fed on different levels of date palm pith powders diets, showed significant differences in mean values as compared to control (+) group. The values were 8.0 ± 0.10 and 8.1 ± 0.05 g/dl, respectively. The difference between groups 3 and 4 was showed non- significant . The best treatment total protein level (g/dl) was recorded for group 4 (obese rats fed on 7% date palm pith powders) when compared to control (+) group. It could be noticed that the mean value of albumin level (g/dl) level of control (-) group was higher than control (+) group, it was being 5.90 ± 0.06 and 5.10 ± 0.04 g/dl, respectively with a significant difference. All obese rats fed on different levels of date palm pith powders diets, showed non- significant differences in mean values as compared to control (+) group. The values were 5.6 ± 0.01 (G4) and 5.4 ± 0.02 (G3) g/dl, respectively.

Table (5): Effect of different levels of date palm pith on total protein and albumin an globulin and albumin / globulin ratio of obese rats

| Parameter Groups | Total protein (g/dl) | Albumin (g/dl) | Globulin (g/dl) | Albumin / globulin ratio |
|--------------------------|-------------------------|-------------------------|-------------------------|--------------------------|
| | Mean±SD | Mean±SD | Mean±SD | Mean±SD |
| G1: Control (-ve) | 8.20 ^a ±0.10 | 5.90 ^a ±0.06 | 2.30 ^c ±0.05 | 2.57 ^b ±0.03 |
| G2:Control (+ve) | 6.70 ^b ±0.10 | 5.10 ^c ±0.04 | 1.60 ^d ±0.05 | 3.19 ^a ±0.03 |
| G3:DPP powder 5% | 8.00 ^a ±0.10 | 5.40 ^b ±0.20 | 2.60 ^a ±0.05 | 2.08 ^d ±0.02 |
| G4: DPP powder 7% | 8.10 ^a ±0.05 | 5.60 ^b ±0.10 | 2.50 ^b ±0.05 | 2.24 ^c ±0.02 |
| LSD | 0.1697 | 0.2211 | 0.0941 | 0.0980 |

DPP= Date palm pith, Means in the same row with different litters are significantly different at ($p \leq 0.05$).

The differences between groups 3 and 4 was non- significant .The best treatment in albumin level (g/dl) was recorded for group 5 (obese rats fed on 7% date palm pith powders) when compared to control (+) group. On the other hand, the mean value of globulin level (g/dl) of control (-) group was higher than control (+) group; it was being 2.30±0.05 and 1.60±0.05 g/dl, respectively with a significant difference. All obese rats fed on different levels of date palm pith powders diets, showed a significant differences in mean values as compared to control (+) group. The values were 2.60±0.05 and 2.50±0.05 g/dl, respectively. The differences between groups 3 and 4 was non- significant .The best treatment of globulin level (g/dl) was recorded for group 3(obese rats fed on 5% date palm pith powders) when compared to control (+) group. In case of albumin/globulin ratio (g/dl), it is clear to notice that the mean value of albumin level (g/dl) level of control (+) group was higher than control (-) group, it was 3.19±0.03 and 2.57±0.03 respectively with a significant difference. All obese rats fed on different levels of date palm pith powders diets, showed a significant differences in mean values as compared to control (+) group. The values were 2.24±0.02 and 2.08±0.02 for G3 &G5%, respectively. The difference between groups 3 and 4 was significant . The best treatment albumin/globulin ratio level was recorded for group 4 (obese rats fed on 5% date palm pith powders) when compared to control (+) group. The results were in agreement with **Ibrahim et al., (2014)**, they reported that rats fed on date flour in replacing part of wheat flour at three levels (5, 10 and 15%) at the end of experimental time had increases of total protein content (g/dl), albumin (g/dl) and globulin (g/dl) and that increase was significant.

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التأثير المضاد للسمنة لجمار النخيل فى الفرن المصابة بالسمنة المستحثة بغذاء على الدهن

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الملخص العربى:

تم تقييم تأثير تركيزات مختلفة (5% , 7%) فى صورة مسحوق من جمار النخيل فى الفرن المصابة بالسمنة. واستخدم 24 فأر فى هذه الدراسة وتم تقسيمها إلى 4 مجموعات، كل مجموعة تحتوي على 6 فئران. وتم اصابة الفئران بالسمنة بالتغذية على وجبة عالية الدهون (20% دهن حيوانى) بمرض السمنة. وتم تقدير كلا من مستوى الجلوكوز ووظائف الكبد والكلى والكوليستيرول الكلى والجليسيردات الثلاثية وصورة دهون الدم ومشتقات بروتين السيرم. أظهرت النتائج أن أعلى انخفاض لإنزيمات الكبد, AST, ALP, ALT سجلت مع مجموعة الفئران التي تغذت على 7% جمار النخيل مع وجود فرق معنوى. أقل قيمة من سكر الدم والدهون الثلاثية والكوليستيرول و الكوليستيرول منخفض الكثافة و الكوليستيرول منخفض الكثافة جدا واليوريا و حمض اليوريك والكرياتينين مع مجموعة الفئران التي تغذت على 7% من جمار النخيل مع وجود فرق معنوى. فى حين أعلى قيم للكوليستيرول على الكثافة سجلت مع مجموعة الفئران التي تغذت على 7% من جمار النخيل. الخلاصة, وجد أن مجموعة الفئران المصابة بالسمنة والتي تغذت على 5% 7% من جمار النخيل سجلت أفضل النتائج فى تحسين صورة دهون الدم ووظائف الكبد والكلى ومستوى سكر. وظهرت الدراسة إلى إمكانية استخدام مسحوق جمار النخيل كمشروب أو يضاف إلى الوجبات الغذائية اليومية بجانب حقيقة أن له العديد من الفوائد الصحية الأخرى .

الكلمات الأفتتاحية: جمار النخيل، التأثير المضاد للسمنة ، صورة دهون الدم، وظائف الكبد، وظائف الكلى.