Protective Effects of Palm Date and Apricot Kernels Powder in Carbon Tetra Chloride-Induced Liver Disorder in Rats

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Abstract

Effects of some levels 2.5 and 5 % of apricot, palm date kernels and their mixture as powder on biological and biochemical changes of hepatic rats were evaluated. Forty-eight white male albino rats weighing 140±10g were used in this study. Rats divided to 8 groups, each group (6) rats. Hepatotoxicity was induced in rats by injecting carbon tetrachloride (CCl_4) 0.2 ml/100 g body weight of 40 ml/l CCl_4 dissolved in paraffin oil. Identification of phenolic compounds was determined using HPLC technique, serum liver Enzyme such as alanine aminotransferase (ALT), aspartate aminotransferase (AST), total cholesterol **(**TC), triglycerides (TG), high density lipoprotein cholesterol (HDL-c), low density lipoprotein cholesterol (LDL-c), very low density lipoprotein cholesterol (VIDL-c), kidney functions (uric acid, urea and creatinine), oxidative enzymes such as glutathione peroxidase (GSH-Px), superoxide dismutase (SOD) and catalase (CAT) activity were also determined. The obtained results of hepatic rats indicated that apricot, palm date kernels powder and their mixture improve serum liver functions, kidney functions, lipids profile and oxidative enzymes in rats especially 5% mixture of apricot and palm date kernels powder. The HPLC results showed that the apricot kernels contained higher bioactive compounds than palm date. Results also indicated that mixture of apricot, palm date kernels powder recorded the best treatment for improved all tested biochemical analysis. Therefore, apricot and palm kernels powder and their mixture could be used in our beverages and daily dishes, because it has so many health benefits.

Key words: apricot kernels and palm date kernels, Rats, protective effect and Biochemical analysis.

Introduction

The liver is the chief and the most important metabolic organ of the human body. It performs more than 500 essential functions like conversion from food components to critical blood components, vitamin and mineral storage, the production of many essential plasma proteins and minerals, the maintenance of hormone levels and metabolic rate, and the detoxifying of body toxic waste. It secretes bile that helps in lipid digestion **(Ghany and Hoofnagle, 2005)**. Further, it is responsible for synthesizing the blood-clotting factors prothrombin, fibrinogen; and heparin, which prevents the blood from clotting within the blood circulation. In addition, Liver is noteworthy in functions such as metabolisms of lipids, proteins, and carbohydrates. The liver helps in regulating the normal glucose concentration during fasting **(Vuda *et al.,* 2012)**. Any clinical defects or conditions which rise to impairment of liver are known as liver diseases. Hepatic diseases are categorized primarily into two types: acute and chronic liver diseases. The acute liver disease occurs rapidly and usually exists for a very short duration. Chronic liver disease is typically long-term, usually in excess of 6 months. In the clinical circumstances, the chronic disease causes periodical destruction and regeneration of liver parenchyma generates fibrosis and cirrhosis of the liver **(Crawford, 2007)**.

Currently, hepatotoxicity is the most common pathology in the world, representing up to 83 per cent of all cases and the most serious health problems. Free radicals and reactive oxygen species, independent of the original causative agent, are increasingly believed to play a crucial role in the initiation and progression of liver diseases. Carbon tetrachloride (CCl_4) is a selective hepatotoxic chemical agent that is synthesized by the cytochrome P450 into highly reactive metabolites including trichloromethyl free radical (CCl_3•) and trichloromethylperoxy radical (CCl_3O_2•) **(Al-Harbi *et al.,* 2014)**.

Ganesan *et al.,* (2018) reported that dietary management tenders a realistic alternative for prevention and healing of various hepatic diseases. The amount and composition of the food and the intake frequency could affect the progression or prevention of pathological conditions. Bioactive food components are nonessential biomolecules, extensively present in diets and show the capability to control more than one metabolic pathway, which helps to give beneficial effects for several diseases and target tissues in humans. In plants, it is widely present in the forms of alkaloids, phytosterols, organosulfur compounds, carotenoids, polyphenols and nitrogen containing compounds.

Apricot, (*Prunus armeniaca*, L.) is a member of the *Rosacea*, subfamily *Prunoideae*. Apricot is one of the most common crops worldwide, being a good source of nutrients. The apricot kernel is an essential dietary

protein source, as well as oil and fiber. Reportedly, the kernel also has high antioxidant and antimicrobial activity. Apricot kernels are mainly used in the production of oils and benzaldehyde; kernels are also added to bakery products either whole or grounded, and are also consumed as an appetizer. The percentage of the kernel of apricot varies from 18.8 to 38.0%. The chemical constituents of apricot kernels appeared that the protein content of apricot kernels ranged from 14.1 to 45.3%, carbohydrate 25.5-31.5%, fat from 27.7 to 66.7% and ash from 1.9-2.7%, respectively **(Alpaslan and Hayta, 2006)**. Apricot kernels are generally produced in many Mediterranean regions, Turkey exported to European countries and used especially in medicine, cosmetic and oil production. Apricot kernels, especially rich in lipids and proteins, are potentially useful for human nutrition, along with large amounts of oil and fiber **(Abdel-Rahman, 2011)**. On the other hand, **Dicenta *et al.*, (2002)** reported being a major component of apricot kernels, bitter almonds and peach, plum, pear and apple seeds. It is reported that apricot seeds and bitter almonds contain approximately 20-80 μmol/g and 100 μmol/g of amygdalin, respectively. However, research on the ability of bitter apricot kernel to help protect the liver and improve liver function is insufficient.

Egypt is considered one of the date-producing countries. The fruit of the date palm is composed of a fleshy pericarp and seed, and the seed represents about 15% of the total weight of the date fruits. These date seeds (named also, pits, stones, kernels) are waste products from date industry which can be used as a functional feed ingredient because they are a good source of dietary fiber, phenolic compounds and antioxidant activity in addition to a considerable amount
of feed ingredients such as protein and minerals **(Ahmed *et al*., 2008)**. The palm date kernels contains 3.1-7.1% moisture, 2.3-6.4% protein, 5.0-13.2 fat, 0.9-1.8% ash and 22.5-80.2% dietary fiber. Also, seeds contain high levels of phenolic (3102– 4430 mg Gallic acid equivalents/ 100 g), antioxidants and dietary fiber (78-80 g/100 g) **(Al-Farsi *et al*., 2007)**.

In traditional Egyptian medicine, date palm (*Phoenix dactylifera*, L.) seeds are listed in folk remedies for the management of diabetes, liver diseases, gastrointestinal disorders and. many pathological conditions **(Vayalil, 2012)**.

This work was conducted to study the effect of different concentrations of apricot, palm date kernels and their mixture as powder on biological and biochemical changes of hepatic fibrosis rats.

Material and methods

Materials

Palm date and apricot kernels

Commercially fresh and ground apricot fruit (Prunus armeniaca, L), palm date fruit (*Phoenix dactylifera*, L.) were obtained from local market in 2019 at Assiut Governorate, Egypt.

Chemicals and chemical kits:

Pure white crystalline cholesterol powder, saline solutions casein, cellulose, choline chloride powder, and DL methionine powder, were obtained from Morgan Co. Cairo, Egypt. Chemical kits used in this study (Total cholesterol, Triglycerides, high density lipoprotein, alanine amino transferase, aspartate amino transferase, alkaline phosphatase, urea, uric acid, and creatinine (TC, TG, HDL-C, ALT, AST, ALP,) were obtained from Al-Gomhoria Company for Drugs, Chemical and Medical Instruments, Cairo, Egypt. While, GSH, CAT, SOD kits were obtained from SIGMA Chemical Co., Cairo, Egypt.

Carbon tetrachloride (CCl_4) was obtained from Morgan Chemical Factory, Cairo, Egypt.

Experimental animals

A total of 48 adult normal male albino rats Sprague Dawley strain weighing 140±10 g was obtained from Vaccine and Immunity Organization, Ministry of Health, Helwan Farm, Cairo, Egypt.

Methods

Preparations of apricot and palm date kernels

To prepare the dried powder of apricot and palm kernels. Fruits were washed thoroughly under running tap water, then kernels were removed from fruits, kernels were shade and dried in an air oven at 50 C for 24hr., and ground to obtain fine powder using an air mill according to the method described by **Femenia *et al.*, (1995).**

Identification of phenolic compounds:

HPLC analysis of extracts was performed using an Agilent 1200 chromatograph equipped with a PDA model G1315B, a Bin pump odel G1312A, an auto-sampler model G1313A and a RR Zorbax Eclipse Plus C18 column (1.8 µm, 150 mm ×4.6 mm). The HPLC method was used according to **Radovanović *et al.*, (2010)** with some modification (elution gradient and flow rate).

Experimental design and animal groups
The induction of hepatic fibrosis in rats

Rats were injected subcutaneously at a dose of 0.2 ml/100 g body weight of 40 ml/l CCl_4 dissolved in paraffin oil (**Diao *et al.*, 2011)**. Carbon tetrachloride was injected three times per week for 4 consecutive weeks. Liver fibrosis was determined at the end of experimental with histopathological examination.

Experimental design

Forty-eight 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 ***Reeves et al.*, (1993)** for 7 consecutive days for adaptation. After this adaptation period, rats were divided into 6 groups, six rats per each as follows: group (I): rats fed on basal diet as negative control. Group (2): Hepatotoxic rats injected by 0.2 ml/100 g body weight of (40 ml/l CCl_4) (Morgan Chemical Factory, Egypt) dissolved in paraffin oil (**Dong *et al.*, 2005)**. Carbon tetrachloride was injected three times per week for 6 consecutive weeks and used as a positive control group. Group (3): Hepatotoxic rats fed on basal diet supplemented with apricot kernels as powder by 2.5% of diet. Group (4): Hepatotoxic rats fed on basal diet supplemented with apricot kernels as powder by 5% of diet Group (5): Hepatotoxic rats fed on basal diet supplemented with the palm date kernels 2.5% of diet. Group (6): Hepatotoxic rats fed on basal diet supplemented with the palm date kernels 5% of diet. Group (7): Hepatotoxic rats fed on basal diet supplemented with the mixture (1:1) of apricot and palm date kernels 2.5% of diet. Group (8): Hepatotoxic rats fed on basal diet supplemented with the mixture (1:1) of apricot and palm date kernels 5% of diet. The experiment continued for 28 days, at the end of the experimental period each rat weight separately then, rats were slaughtered and blood samples collected.

Blood sampling

After fasting for 12 hours, blood samples were obtained from hepatic portal vein at the end of each experiment. The 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 in deep freezer till analysis **Schermer, (1967)**.

Biochemical analysis

Liver Enzymes

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

Serum lipids profile

Serum total cholesterol was determined according to the colorimetric method described by **Thomas (1992)**. Serum triglycerides were determined by enzymatic method using kits according to **Young, (1975) and Fossati & Principle, (1982)**. HDL-c was determined according to the method described by **Friedwaid (1972) and Grodon & Amer (1977).**

VLDL-c was calculated in mg/dl according to **Lee and Nieman (1996)** was using the following formula: **VLDL-c (mg/dl) = Triglycerides / 5**

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

Kidney functions

Serum urea was determined according to the enzymatic method of **Patton and Crouch, (1977)**. Serum uric acid was determined calorimetrically according to the method of **Barham and Trinder (1972)**. Creatinine was determined according to kinetic method of **Henry, (1974)**.

Determination of enzyme activities

Determination of catalase (CAT) activity

Liver catalase (CAT) was determined by Goth's colorimetric method, according to the method described by **Goth, (1991)**.

Determination of superoxide dismutase (SOD) activity

Superoxide dismutase (SOD) activity was determined by using a measurement method developed by **McCord and Fridovich, (1969)**.

Determination of glutathione peroxidase (GSH-Px) activity

Glutathione peroxidase (GSH-Px) activity was measured on standard assay conditions in 340 nm (absorbance) at 37°C according to the method developed by **Paglia and Valentine (1967)**.

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 LSD Test. Differences between treatments at $P \leq 0.05$ were considered significant using Costat Program. Biological results were analyzed by One Way ANOVA.

Results and discussion

Identification of phenolic compounds of palm date and apricot kernels

Results tabulated in Table (1) showed the identification of phenolic compounds of apricot and palm date kernels by HPLC technique. The obtained results indicated that the highest phenolic compounds identified in apricot kernels recorded for chlorogenic acid, quercetin and gallic acid. The values were 917.00, 12.60 and 4.90 mg/100g, respectively. On the other hand, the lowest phenolic compounds identified in apricot kernels recorded for caffeic acid, ferulic acid and vanillin. The values were 0.70, 1.40 and 1.65 mg/100g, respectively.

In case of palm date kernels, data indicated that the highest phenolic compounds identified in palm date kernels recorded for Gallic acid, rutin and (+)-catechin. The values were 14.80, 8.50 and 7.68 mg/100g, respectively. On the other hand, the lowest phenolic compounds identified in palm date kernels recorded for vanillic acid, syringic acid and *p*-coumaric acid. The values were 0.30, 0.83 and 1.95 mg/100g, respectively. These results are in agreement with **Ugur *et al.,* (2018)**; they reported that the major phenolic compounds of apricot kernels were chlorogenic acid and rutin. Other phenolic compounds included catechin and its derivatives, naringin and its derivatives, and also caffeic acid. Also, **Saleh *et al.,* (2011)**; they stated that the phenolic compounds of palm date were catechin (r = 0.96), and rutin (r = 0.74) in water extract, whereas this correlation significantly reduced in alcoholic extract (r = 0.66) for catechin and also very weak (r = 0.38) for rutin.

Effect of palm date, apricot kernels powder and their mixtures on liver function of hepatic fibrosis rats

Results given in Table (2) show the effect of palm date, apricot kernel and their mixtures on ALT, AST level of hepatic rats. The obtained results indicated that ALT liver enzyme of positive control rats group recorded the higher value when compared with negative control group with a significant difference at ($P \leq 0.05$). The mean values were 93.50± 0.35and 47.20±0.10 U/L, respectively. While, the mean values of treated groups (hepatic rats) G3, G4, G5, G6, G7 and G8 were lower than positive control group, which were 65.50 ±0.45, 60.00±0.30, 59.50±0.15, 54.00±0.60, 52.00±0.50 and 49.30±0.40 (U/L), respectively. Rats fed on (G8) 5% mixture palm date and apricot showed non-significant difference as compared with negative control group and recorded the best treatment.

On the other hand, the AST liver enzyme of positive control rats group recorded the higher value when compared with negative control group with a significant difference at ($P \leq 0.05$). The mean values were 105.0±0.40 and

50.10±0.80 U/L, respectively. The mean value of treated groups (hepatic fibrosis rats) G3, G4, G5, G6, G7 and G8 were lower than positive control group with a significant difference, which were 86.50±1.20, 80.0±0.50, 76.85±0.90, 68.50±0.60, 59.35±0.60 and 53.75±0.60 (U/L), respectively. The best result was recorded for (G8) rats fed on 5% palm date and apricot kernels mixture.

Ohta *et al.,* (2004) Reported that carbon tetrachloride (CCl_4) is a highly toxic chemical agent which is used as an industrial solvent. CCl_4 is widely used to induce hepatic steatosis and to study the effects of protective agents, especially antioxidants. There has been detailed study of CCl4's toxic effects on the liver. Metabolic activation of CCl_4 by cytochrome P450 to free radicals, namely trichloromethyl peroxy radicals, is reported to increase lipid peroxidation and protein oxidation in the liver, resulting in widespread damage to the membranes and injury to the liver. Metabolic activation of CCl_4 by cytochrome P450 to the free radicals, namely trichloromethyl proxy radicals, is reported to enhance lipid peroxidation and protein oxidation in the liver, resulting in widespread membrane damage and liver injury. Membrane damage also causes alterations in lipoprotein secretion and lipoprotein and lipid droplet accumulation in hepatocytes.

These results are supported by **Abdel-Rahman (2011)** who demonstrated that ground apricot kernel (GAK) administration specifically (1.5 mg/kg/BW/rat) can effectively improve liver fibrosis caused by DMN, and can be used as a hepatic fibrosis treatment option and prevention measures. The act of why high amounts of GAK was improved biochemical values as compared to low or moderate levels tested in this study may be due to increased levels of oleic acid and other phenolic compounds in apricot kernels. Also, **Abdul-Aziz and Ali, (2014)**, reported that the dates palm (*Phoenix dactylifera*) seeds could be a promising and could be attributed to antioxidant and free radical scavenging. **El-Far *et al.,* (2016)** stated that a significant reduction in elevated ALT, AST, and alkaline phosphatase (ALP) activates due to CCl_4 in rats subjected to both pre- and post-treatments with the aqueous extracts of *P. dactylifera* fresh and seeds.

It's improved the CCl_4-induced alterations in liver function parameters (AST, ALT, ALP and albumin) and this hepatoprotective effect might be attributed to the antioxidant and free radical scavenging activities.

Effects of palm date, apricot kernels powder and their mixtures on serum total cholesterol and triglycerides of hepatic fibrosis rats

The effect of palm date, apricot kernels and their mixtures on total cholesterol and triglycerides of hepatic fibrosis rats are shown in Table (3). It is clear to notice that the total cholesterol of positive control group recorded the

higher value when compared with negative control group with a significant difference at (P≤0.05). The mean values were 130.0±1.40 and 95.0±0.10 mg/dl, respectively. The mean value of treated groups (hepatic fibrosis rats) G3, G4, G5, G6, G7 and G8 were lower than positive control group with a significant difference, which were 119.0±0.30, 112.0±0.10, 116.0±0.30, 109.0±0.40, 110.0±0.20 and 101.0±0.30 mg/dl, respectively.

In the other hand, the triglycerides levels of positive control group recorded the higher value when compared with negative control group with significant difference at (P≤0.05). The mean values were 100.00±2.21 and 63.0±0.20 mg/dl, respectively. The mean values were 130.0±1.40 and 95.0±0.10 mg/dl, respectively. The mean value of treated groups (hepatic fibrosis rats) G3, G4, G5, G6, G7 and G8 were lower than positive control group with a significant difference, which were 89.00±0.50, 84.50±1.30, 82.50±0.15, 77.0±0.60, 78.0±0.10 and 70.50±0.30 mg/dl, respectively. The best result for total cholesterol and triglycerides was recorded for (G8) rats fed on 5% palm date and apricot kernels mixture. These results are in agreement with **Torres-Duran *et al*., (1998)** they reported that levels of TG and TC in the liver also have been estimated to explain the status of liver. High level of TG and TC in the liver is the indication of the liver injury. They also indicated that TC and TG increased in CCl_4-induced fatty liver. **Yakubu *et al.,* (2008)**, they reported that changes in the levels of major lipids such as cholesterol and triacylglycerol could provide useful information on the predisposition of the heart of animals to atherosclerosis and its associated coronary heart disease. A significant decrease in triacylglycerol may be associated with impaired lipolysis, although a reduction in HDL-C may not be clinically beneficial to animals at all doses tested, as the rate at which plasma cholesterol is transferred to the liver would also decrease. **Abuelgassim, (2010)** suggested that the lipid-lowering effect observed in dates palm might be due to it dietary fiber content. The result also suggests that date palm could have a protective effect against hyperlipidemia through improvement of lipids profile.

Effects of palm date, apricot kernels powder and their mixtures on serum lipoprotein- cholesterol of hepatic fibrosis rats

Results presented in Table (4) show the effect of palm date, apricot kernel and their mixtures on the serum lipoprotein - cholesterol of hepatic fibrosis rats. The results indicated that the HDL-c of negative control rats group recorded the higher value when compared with positive control group with significant difference at (P≤0.05). The mean values were 53.00±1.40 and 30.50±1.20 mg/dl, respectively. While, the mean value of treated groups (hepatic rats) G3, G4, G5, G6, G7 and G8 were 41.60±0.50, 44.50±0.30,

45.50±1.20, 48.50±1.15, 47.40±1.50 and 50.00±1.00 mg/dl and showed a significant difference when compared with positive control group.

As for LDL-c results showed that the mean value for positive control group was significantly higher than negative control group, which was 79.50±1.35 and 29.40±0.11 mg/dl, respectively. While, the mean value of treated groups (hepatic rats) G3, G4, G5, G6, G7 and G8 were 59.60±1.91, 51.00±0.23, 54.10±1.30, 45.10±1.12, 47.00±1.13 and 36.90±1.10 mg/dl and showed a significant difference when compared with positive control group.

In case of VLDL-c, the positive control rats group recorded the highest value when compared with negative control group with a significant difference at ($P \leq 0.05$). The mean values were 20.00±1.10 and 12.60±0.16 mg/dl, respectively. While, the mean value of treated groups (hepatic fibrosis rats) G3, G4, G5, G6, G7 and G8 were 17.80±1.52, 16.50±0.10, 16.40±1.40, 15.40±0.50, 15.60±0.20, and 14.10±1.20 mg/dl and showed a significant difference when compared with positive control group. The obtained results from Table (4) showed that group 8 which fed on 5% palm date, apricot kernels mixture recorded the best result for lipid profile. These results are in agreement with **Tanwar *et al.*, (2018),** they reported that blood lipid profile demonstrated that the detoxified apricot kernel group exhibited significantly ($p<0.05$) increased levels of HDL-cholesterol (48.79%) and triglycerides (15.09%), and decreased levels of total blood cholesterol (6.99%), LDL-C (22.95%) and VLDL-C (7.90%) as compared to that of the raw (untreated) kernels group. Overall, it can be concluded that wild apricot kernels flour could be detoxified efficiently by employing a simple, safe, domestic and cost-effective method, which further has the potential for formulating protein supplements and value-added food products. **Also, Abdul-Aziz and Ali, (2014)**, stated that the lipid-lowering effect observed in dates palm extract might be due to it dietary fiber content and active compounds such as antioxidant. The result also suggests that date palm could have a protective effect against hyperlipidemia through improvement of lipid profile.

Effect of palm date, apricot kernels powder and their mixtures on enzymes activities (GSH, SOD and CAT) level of hepatic fibrosis rats

Results tabulated in Table (5) show the effect of palm date, apricot kernels and their mixtures as powders on **enzymes activities (GSH, SOD and CAT)** level of hepatic fibrosis rats. The obtained results indicated that the

higher glutathione (**GSH-Px)** level recorded for negative control group, while the lower level recorded for positive control group with a significant difference ($P \leq 0.05$). The mean values were 230.00±2.32 and 117.20±1.09 Ug-^{1}protein, respectively. While, the mean value of treated groups (hepatic rats) G3, G4, G5, G6, G7 and G8 were 135.10±1.17, 155.30±1.11, 165.50±1.13, 181.50±1.14, 175.50±1.15, and 210.50±1.12 Ug-^{1}protein and showed a significant difference when compared with positive control group.

As for SOD enzymes results showed that the mean value for negative control group was a significantly higher than positive control group, which was 24.00±0.02 and 13.10±0.12 Ug-^{1}protein, respectively. While, the mean value of treated groups (hepatic rats) G3, G4, G5, G6, G7 and G8 were 15.17±0.10, 17.15±0.01, 16.20±0.04, 18.50±0.15, 17.10±0.16 and 20.13±0.03 Ug-^{1}protein and showed a significant difference when compared with positive control group.

On the other hand, results of CAT enzymes showed that the mean value for negative control group was a significantly higher than positive control group, which was 203.00±0.15 and 108.50 ±0.11Ug-^{1}protein, respectively. While, the mean value of treated groups (hepatic rats) G3, G4, G5, G6, G7 and G8 were 140.0±0.20,145.0±0.01,160.0±0.31,168.0±0.01,165.90±0.51and172.2± 0.015 Ug-^{1}protein and showed a significant difference when compared with positive control group. These results agree with **Gaeta *et al.,* (2002)**; they reported that the antioxidant system involves both enzymatic and non-enzymatic agents. The first step in the enzymatic system is superoxide dismutase (SOD), which catalyzes the dismutation of superoxide anion (O·2) to H_2O_2. The conversion of H_2O_2 to H_2O by either glutathione peroxidase (GPx) or catalase forms the second step of enzymatic system. Superoxide dismutase and GPx enzyme activities and the balance between them are very crucial for protection against oxidative stress. Increased activity of these antioxidant enzymes results in decreased formation of hydroxyl radical. Also, **Abdel-Rahman (2011)** mentioned that the diet supplemented with ground apricot kernel (GAK) led to improving liver function, lipid peroxides, and liver CAT, SOD and GSH. Hierarchically high levels of GAK (1.5 mg/kg/BW/rat) gave the best results compared to other tested levels. **Abdul-Aziz and Ali, (2014)**, they reported that date palm (*Phoenix dactylifera)* seeds restored the activities of hepatic antioxidant enzymes (superoxide dismutase and glutathione S-transferase) that were declined after CCl_4 treatment.

Karabulut *et al.,* (2014) stated that bitter apricot kernel feeding had beneficial effects on CCl_4-induced liver injury and damage probably due to its

amygdaline contents and high radical-scavenging capacity. Dietary intake of amygdaline and bitter apricot kernels ratio of 5% can reduce the risk of liver steatosis and damage caused by free radicals.

Effect of palm date, apricot kernels powder and their mixtures on kidney functions of hepatic fibrosis rats

Results presented in Table (6) show the effect of palm date, apricot kernel and their mixtures on kidney functions (urea, uric acid and creatinine) of hepatic rats. It is clear to notice that the urea level of positive control rats group recorded the higher value when compared with negative control group with significant difference at (P≤0.05). The mean values were 68.00±0.20 and 32.00±1.10 mg/dl, respectively. While, the mean value of G3, G4, G5, G6, G7 and G8 indicated a significant difference; it was 55.60±0.10, 48.15±0.40, 50.75±0.50, 44.50±0.30, 46.90±0.50 and 36.60±0.31 mg/dl, respectively when compared with positive control group.

On the other hand, the uric acid level of positive control rats group recorded the higher value when compared with negative control group with significant difference at (P≤0.05). The mean values were 3.10±0.10 and 1.00±0.30 mg/dl, respectively. While, the mean value of G3, G4, G5, G6, G7 and G8 indicated a significant difference; it was 1.85±0.30, 1.50±1.50, 1.80±0.40, 1.34±0.60, 1.45±1.40 and 1.20±1.30 mg/dl, respectively when compared with positive control group.

In case of creatinine level, the positive control rats group recorded the higher value when compared with negative control group with significant difference at (P≤0.05). The mean values were 64.00±0.50 and 22.00±0.42 mg/dl, respectively. While, the mean value of G3, G4, G5, G6, G7 and G8 indicated a significant difference; it was 56.00±3.04, 51.35±1.20, 46.50±1.30, 38.10±1.50, 36.50±1.40 and 30.10±1.30 mg/dl, respectively when compared with positive control group. The obtained results from Table (6) showed that group 8 which fed on 5% palm date, apricot kernels mixture recorded the best result for kidney functions. These results are in agreement with **Vardi *et al.*, (2013)**, they reported that apricot diet had a clearly protective effect against lipid peroxidation and reduced renal MDA production. Also, they demonstrated that pretreatment apricot diet significantly decreased the apoptotic cell ratio when compared to the MTX-treated group. In similar studies, **Huang *et al.*, (2008)** indicated that lipid peroxidation and impairment of antioxidant status may be involved in the sequence of events leading to methotrexate (MTX)-induced renal damage. Additionally, increased serum creatinine and urea levels may reflect renal dysfunction and an activation of apoptotic cell markers, such as PARP, which also possibly contribute to MTX-caused kidney injury. Prophylactic administration of apricot may provide new therapeutic

implications for the treatment of kidney diseases, which are characterized by apoptotic cell death and renal failure. Also, **El-Mousalamy *et al.*, (2016)** reported that treatment with palm date fruit and seed aqueous and methanolic extracts caused significant improvement in kidney functions and morphology as evidenced by significant decrease in serum creatinine, urea, uric acid and urinary albumin excretion as well as significant reduction in glomerular and tubule interstitial damage scores compared to diabetic untreated rats. Palm date fruit and seed extracts protect the kidneys from diabetic nephropathy in rats that may be attributed to their antioxidant properties.

Finally, it could be observed that the higher the level of palm date kernels or apricot kernels in diets the more the desirable action on biological and biochemical parameters evaluated for hepatic fibrosis rats. All treatment groups revealed improvement of mentioned parameters, provided that the best group was that of 5% palm date, apricot kernels mixture diet. Over and above, no synergistic action, occurred when combining both fruits by-product together, provided that the mix palm date, apricot kernels diet revealed also some improvement Further research is required.

Table (1): Identification of phenolic compounds of apricot and palm date kernels

apricot kernels	Concentration mg/100gm	palm date kernels	Concentration mg/100gm
Gallic acid	4.90	**Caffeic acid**	5.60
Procatechin acid	3.10	**Rutin**	8.50
Chlorogenic acid	917.00	**(+)-Catechin**	7.68
Catechin	2.30	**Vanillic acid**	0.30
Caffeic acid	0.70	**Syringic acid**	0.83
Epicatechin	2.50	**Gallic acid**	14.80
Quercetin	12.60	***p*-Coumaric acid**	1.95
Ferulic acid	1.40	**Chlorogenic acid**	ND
Vanillin	1.65	**Ferulic acid**	ND
***p*-coumaric acid**	3.77	**Epicatechin**	ND

Table (2) Effect of palm date, apricot kernels powder and their mixtures on liver functions of hepatic fibrosis rats

Parameters / Groups	AST U/L	ALT U/L
G_1 C (-)	$50.10^{h}\pm 0.80^{g}$	$47.20^{e}\pm 0.10$
G_2 C (+)	$105.00^{a}\pm 0.40$	$93.50^{a}\pm 0.35$
G_3(2.5% Palm date kernels)	$86.50^{b}\pm 1.20$	$65.50^{b}\pm 0.45$
G_4 (5% Palm date kernels)	$80.00^{c}\pm 0.50$	$60.00^{c}\pm 0.30$
G_5 (2.5% Apricot kernels)	$76.85^{d}\pm 0.90$	$59.50^{c}\pm 0.15$
G_6 (5% Apricot kernels)	$68.50^{e}\pm 0.60$	$54.00^{d}\pm 0.60$
G_7 (2.5% Kernels mixture)	$59.35^{f}\pm 0.60$	$52.00^{d}\pm 0.50$
G_8 (5% Kernels mixture)	$53.75^{g}\pm 0.60$	$49.30^{e}\pm 0.40$
LSD (P≤0.05)	**2.35**	**2.26**

Each value represents the mean ± SD. Mean under the same column bearing different superscript letters are different significantly ($p\leq 0.05$).

Table (3): Effect of palm date, apricot kernel and their mixtures on total cholesterol and triglycerides of hepatic rats

Parameters / Groups	Total cholesterol (TC) mg/dl	Triglycerides (TG) mg/dl
G_1 C (-)	$95.00^{f}\pm 0.10$	$63.00^{f}\pm 0.20$
G_2 C (+)	$130.00^{a}\pm 1.40$	$100.00^{a}\pm 2.21$
G_3(2.5% Palm date kernels)	$119.00^{b}\pm 0.30$	$89.00^{b}\pm 0.50$
G_4 (5% Palm date kernels)	$112.00^{d}\pm 0.10$	$84.50^{c}\pm 1.30$
G_5 (2.5% Apricot kernels)	$116.00^{c}\pm 0.30$	$82.50^{c}\pm 0.15$
G_6 (5% Apricot kernels)	$109.00^{d}\pm 0.40$	$77.00^{d}\pm 0.60$
G_7 (2.5% Kernels mixture)	$110.00^{d}\pm 0.20$	$78.00^{d}\pm 0.10$
G_8 (5% Kernels mixture)	$101.00^{e}\pm 0.30$	$70.50^{e}\pm 0.30$
LSD (P≤0.05)	**3.602**	**3.425**

Each value represents the mean ± SD.

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

Table (4): Effect of palm date, apricot kernels and their mixtures on lipid profile of hepatic rats

Parameters / Groups	(HDL-c) (mg/dl)	(LDL-c) (mg/dl)	(VLDL-c) (mg/dl)
G_1 C (-)	53.00^{a} ±1.40	29.40^{g}± 0.11	12.60^{d}± 0.16
G_2 C (+)	30.50^{e} ±1.20	79.50^{a}± 1.35	20.00^{a}± 1.10
G_3(2.5% Palm date kernels)	41.60^{d}±0.50	59.60^{b}± 1.91	17.80^{b}± 1.52
G_4 (5% Palm date kernels)	44.50^{c}±0.30	51.00^{d}±0.23	16.50^{b}± 0.10
G_5 (2.5% Apricot kernels)	45.50^{c}±1.20	54.10^{c}±1.30	16.40^{b}± 1.40
G_6 (5% Apricot kernels)	48.50^{b}±1.15	45.10^{e}±1.12	15.40^{bc}± 0.50
G_7 (2.5% Kernels mixture)	47.40^{bc}±1.50	47.00^{e}±1.13	15.60^{bc}±0.20
G_8 (5% Kernels mixture)	50.00^{b} ±1.00	36.90^{f}±1.10	14.10^{d}±1.20
LSD (P≤0.05)	**2.421**	**2.74**	**2.02**

Each value represents the mean ± SD.

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

Table (5) Effect of palm date, apricot kernels powder and their mixtures on enzymes activity level of hepatic fibrosis rats

Parameters / Groups	GSH (Ug^{-1}protein)	SOD (Ug^{-1}protein)	CAT (Ug^{-1}protein)
G_1 C (-)	230.0^{a}±2.32	24.00^{a}±0.02	203.0^{a}±0.15
G_2 C (+)	117.20^{h}±1.09	13.10^{f}±0.12	108.5^{g}±0.11
G_3(2.5% Palm date kernel)	135.10^{g}±1.17	15.17^{e}±0.10	140.0^{f}±0.20
G_4 (5% Palm date kernels)	155.30^{f}±1.11	17.15^{d}±0.01	145.4^{e}±0.01
G_5 (2.5% Apricot kernels)	165.50^{e}±1.13	16.20^{d}±0.04	160.1^{d}±0.31
G_6 (5% Apricot kernels)	181.50^{c}±1.14	18.50^{c}±0.15	168.0^{c}±0.01
G_7 (2.5% Kernels mixture)	175.50^{d}±1.15	17.10^{d}±0.16	165.9^{c}±0.51
G_8 (5% Kernels mixture)	210.50^{b}±1.12	20.13^{b}±0.03	172.2^{b}±0.015
LSD (P≤0.05)	**4.751**	**1.237**	**4.021**

Each value represents the mean ± SD.

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

Table (6): Effect of palm date, apricot kernels and their mixtures on kidney functions of hepatic fibrosis rats

Parameters / Groups	Urea mg/dl	Uric acid mg/dl	Creatinine mg/dl
G_1 C (-)	$32.00^{f} \pm 1.10$	$1.00^{c} \pm 0.30$	$22.20^{g} \pm 0.42$
G_2 C (+)	$68.00^{a} \pm 0.20$	$3.10^{a} \pm 0.10$	$64.00^{a} \pm 0.50$
G_3(2.5% Palm date kernels)	$55.60^{b} \pm 0.10$	$1.85^{b} \pm 0.30$	$56.00^{b} \pm 3.04$
G_4 (5% Palm date kernels)	$48.15^{c} \pm 0.40$	$1.50^{b} \pm 1.50$	$51.35^{c} \pm 1.20$
G_5 (2.5% Apricot kernels)	$50.75^{c} \pm 0.50$	$1.80^{b} \pm 0.40$	$46.50^{d} \pm 1.30$
G_6 (5% Apricot kernels)	$44.50^{d} \pm 0.30$	$1.34^{b} \pm 0.60$	$38.10^{e} \pm 1.50$
G_7 (2.5% Kernels mixture)	$46.90^{d} \pm 0.50$	$1.45^{b} \pm 1.40$	$36.50^{e} \pm 1.40$
G_8 (5% Kernels mixture)	$36.60^{e} \pm 0.31$	$1.20^{b} \pm 1.30^{c}$	$30.10^{f} \pm 1.30$
LSD (P≤0.05)	**2.80**	**0.75**	**2.93**

Each value represents the mean ± SD.

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

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التأثير الوقائي للكبد لمسحوق بذور المشمش والبلح على اضطرابات الكبد فى الفئران المستحث برابع كلوريد الكربون

تم دراسة تأثير تركيزات مختلفة٢.٥ و٥ ٪ من نوى المشمش والبلح ومخلوتهم كمسحوق على التغيرات البيولوجية والكيميائية الحيوية للجرذان المصابة بالتليف الكبدي. في هذه الدراسة تم استخدام ثمانية وأربعون من ذكور الجرذان البيضاء التي تزن (١٤٠+_ ١٠ جرام). قسمت الجرذان إلى ٨ مجموعات، كل مجموعة بها (٦) فئران. تم احداث الإصابة بالتليف الكبدي في الجرذان عن طريق حقن رابع كلوريد الكربون (0.2 ml/ 100 gm) من وزن الجسم مذاب في زيت البرافين بنسبه ٤٠ مل/لتر من رابع كلوريد الكربون . تم تحديد التعرف على المركبات الفينولية في نوى المشمش والبلح بجهاز الكروماتوجرافى عالي الأداء، أنزيمات الكبد في الدم مثل الانين امينو ترانسفيراز (ALT) و اسبارتات امينو ترانسفيراز (AST) ، والكوليسترول الكلى والجليسيردات الثلاثية، الكوليسترول المرتفع الكثافه، الكوليسترول المنخفض الكثافة، الكوليسترول المنخفض جدا الكثافة، وظائف الكلي (حمض البوليك، اليوريا، الكرياتينين)، ونشاط الانزيمات المؤكسدة مثل الجلوتاثيون أوكسيديز، سوبر أوكسيد ديسميوتيز، الكتاليز تم تقديرها أيضا. أظهرت النتائج أن الفئران المصابة بالتليف الكبدي والتي تغذت على مسحوق نوى المشمش والبلح ومخلوطهم معا أدت إلى حدوث تحسن ملحوظ في كلا من مستويات وظائف الكبد والكلى وصورة دهون الدم ونشاط الانزيمات المؤكسدة في الجرذان خصوصا التي تغذت على مخلوط مخلوط نوى المشمش والبلح بتركيز٥%. كذلك اظهرت نتائج الكروماتوجرافى الغازي عالي الأداء أن نوى المشمش يحتوي على تركيزات عالية من المركبات النشطة الفعالة بالمقارنة بنوى البلح. كذلك اظهرت النتائج أيضا أن مخلوط نوى المشمش والبلح سجل أفضل معامله لتحسين جميع التحاليل الكيميائية الحيوية المختبرة. لذا يمكن استخدام مسحوق نوى المشمش والبلح ومخلوطهم معا في مشروباتنا وأطباقنا اليومية لما له من فوائد صحية كثيره.

الكلمات المفتاحية: نوى المشمش – نوى البلح ـ الجرذان ـ التأثير الواقي – التحاليل البيوكيميائية.