J. Food and Dairy Sci., Mansoura Univ., Vol. 9 (9): 313 - 320, 2018

The Functional Role of Dried Fig, Date and Olive Oil on Rats with Immune Dysfunction

Hoda S. Ibrahim[1]; N. M. Rabeh[1]; Hanan M. Elghandour[2] and Shafika M. Sabry[1]
[1]Nutrition and Food Science Department, Faculty of Home Economics, Helwan University.
[2]Regional Center for Food and Feed, Agricultural Research Center.

ABSTRACT

This work was aimed to determine the effect of dried fig, date and olive oil supplementation on rats with immune dysfunction. Chemical composition of dried fig, date fruit and olive oil has recorded high content of vitamins, minerals and carbohydrates. Olive oil showed high content of calories, fats,omega-6 and vitamins but low in iron. Dried figs, date and olive oil revealed the presence of total phenolic and flavonoid compounds. Rats feeding on dried figs, olive oil and dates fruit separately or in combination had improved significantly the liver functions and lipid profile, compared to +ve control group. On the other hand, rats with induced immune dysfunction had significant decrease($P<0.05$)in the body weight gain (BWG), feed intake (FI) and feed efficiency ratio (FER) compared to the negative group. However, serum catalase activity were significantly ($P<0.05$) increased for rats fed the tested materials, compared to the corresponding values of the positive control group. Results also illustrated that there were no histopathological changes in liver among groups fed on dried figs, olive oil and dates fruit separately or in combination. It could be concluded that, dried figs, dates fruit and olive oil had beneficial effects on liver functions, lipid profile and stimulates the immune system of rats with immune dysfunction.
Keywords: liver function, lipid profile, catalase, malondialdehyde, immune dysfunction.

INTRODUCTION

A large percentage of the world's population depends primarily on herbal medicine. These herbal derived from indigenous plants for preventing, controlling, management and alleviating various disease conditions (Ayinde and Owolabi,2009) ;Otitoju *et al*., (2014) and Njoku-Oji *et al*., (2016) reported that green vegetables specifically play an important role among the food crops, because they provide some vitamins and minerals.

Fig *(Ficuscarica* L) and sycamore (*Ficussycomorus*) are two fruits that are rich in antioxidants. Fig has been used for metabolic, cardiovascular and anti-inflammatory protection due to its medicinal benefits (Duke *et al*., 2002). Slavin, (2006)has found that fig are a good source of minerals, vitamins, dietary fiber and amino acids (Mahmoud *et al*.,2013).

Recently, a particular attention has been attributed to the use of natural plant products as antioxidant intervention to counteract the harmful effect of toxicant exposure (Arem*et al*.,2017). Date palm (*phoenix dactylifera* L.) is used for the treatment of different diseases (Baliga *et al*.,2011).Date fruits contain some nutrients (dietary fibers, sugars, vitamins, proteins, fat) (Rahmani *et al*.,2014).

Vauzour *et al*., (2010) reported that olive oil decreases the risk of chronic diseases such as cancer and heart disease. Olive oil reduces DNA oxidation, cholesterol regulation, low-density lipoprotein oxidation, and also has anti-inflammatory, antithrombotic and vasodilatory properties. These results of olive oil may be due to its monounsaturated fat, oleic acid, and polyphenolic constituents (Perez-Martinez *et al*.,2011 and Servili *et al*.,2011). SO, this work was conducted to investigate the effect of feeding rats with immune dysfunction on dried fig, date and olive oil on serum liver functions,lipid profile and antioxidant enzymes.

MATERIALS AND METHODS

Materials:

Dried fig (*Ficuscarica* L.*)*, date (*Phoenix dactylifera)* and olive oil (*Oleaeuropaea*) were obtained from Agriculture Research Center, Egypt. Fig and date were dried by the solar energy at 40°C for two days then grinded to get the powder (National Research Center, Giza, Egypt),while olive oil was used as liquid.

Rats:

Adults male albino rats (n = 54) of Sprague-Dawely strain weighing (120 ± 5 g) were purchased from Helwan Farm of Experimental Animals, Helwan, Egypt. Sheep red blood cells (SRBC) were obtained from VACSERA, Dokki, Egypt.

Chemicals:

Casein, vitamins, minerals and cellulose were obtained from Elgomhoria Company, Egypt. Kits were purchased from Gama Trade Company, Dokki, Egypt.

Methods:

Determination of Nutritive value:

chemical composition of dried fig, date and olive oil were determined as the method of A.O.A.C.(2005).

Biological Assay:

A group of fifty fourratwas housed in hygienic conditions and fed on basal diet (Reeves *et al*.,1993)for one week for adaptation. After this week, rats were randomly divided into 9 groups .The first group (n=6) was fed on basal diet (negative control group). The 2^{nd}-9^{th} groups (n = 48) were injected with a single dose of SRBC to induce immune dysfunction (Suke *et al*., 2006).The 2^{nd} group was fed on basal diet (+ve control). Groups(3:5) were fed on the basal diet with dried fig 10%, date 10% and olive oil 5% respectively.Group6was fed on the basal diet with(dried fig10% and date 10%). Group7was fed on the basal diet with (dried fig 10% and olive oil 5%).Group8was fed on the basal diet with (date10% and olive oil 5%). Group9 was fed on the basal diet with a mixture of (dried fig 10% , date 10% and olive oil at 1:1:1 ratio) .

After 8 weeks of experiment two blood samples were collected from each rat, one sample was centrifuged to obtain serum for biochemical analysis while the second sample (whole blood) was used to determine hematological parameters. Liver was removed from each rat for histopathological examination.

Feeding and growth parameters :

Feed intake (FI) was determined, feed efficiency ratio (FER),body weight gain (BWG%) and organs relative weight were calculated according to Chapman *et al*., (1959) as this equation:

$$BWG\% = \frac{\text{Final body weight (g)} - \text{Initial body weight (g)}}{\text{Initial body weight (g)}} \times 100$$

$$FER = \frac{\text{weight Gain (g)}}{\text{Food consumed (g)}}$$

$$\text{Organ relative weight} = \frac{\text{organ weight}}{\text{finial body weight}} \times 100$$

Biochemical analysis:

Alanine aminotransferase (ALT)and aspartate aminotranseferase (AST) were estimated according to(Thomas, 1998).Serum alkaline phosphatase (ALP) was determined according to (Roy, 1970).Serum catalase (CAT)and malondialdehyde (MDA) were measured according to(Sinha, (1972, and Draper and Hadly,1990) respectively. Total cholesterol (TC),Triglyceride (TG) and High density lipoprotein (HDL)was carried out as (Meiattini, 1978; Fossati and Praneipe, 1982 and Young, 2001)respectively. VLDL-c and LDL-c were calculated as the equation of Friadwald *et al*.,(1972).

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

LDL-c(mg/dl) =TC-(HDL-c+VLDL-c).

Statistical Analysis:

The datawere analyzed according to SPSS program. ANOVA test was used to compare among groups and $P<0.05$ was considered to be significant (SPSS, 1986).

RESULTS AND DISCUSSION

Chemical composition of dried fig, date and olive oil is shown in Table (1) indicates that, dried fig and date are rich in calories, carbohydrates and total fiber, vitamin K ,vitamin B complex ,Zn , potassium ,calcium ,magnesium and phosphorus . Also contain reasonable amount of protein. However, low in fats and vitamin E concentration .Results revealed that, olive oil is a good source of calories, monounsaturated fat ,polyunsaturated fat,omega-3 fatty acid,omega-6 fatty acid, vitamin K and iron, but low in vitamin B complex and minerals.

Dried fig is an excellent source of energy, ash, sugar, fiber, carbohydrate as reported by Oettle, *et al*. (1987). Sadhu (1990) also reported that fig has a great nutritive importance due to its content of carbohydrates, essential amino acids, vitamins A, B1, B2, C and minerals (USDA, 2002).Farahnaky, *et al*., (2009) found that chemical composition of the dried fig was about 69.1 % of polysaccharides, 4.3% protein; 2.46% fat, 12.1% carbohydrate and 3.1% ash. The obtained results in our study of chemical composition either for fig were more or less similar. These results supported the high nutritive value of fig.

Total phenols and flavonoids of dried fig, date and olive oil were recorded in table (2).Dried fig have the highest concentration of total flavonoids however, date have the highest content of total phenols .Antioxidants act as free radicals scavenger related to various diseases (Gorrini *et al*., 2013), heart diseases (Moss and Ramji, 2016), Alzheimer's (Frost *et al*., 2014), and Parkinson's disease (Kim *et al*., 2015).Nathan and Cunningham-Bussel, (2013) revealed that when the production of reactive oxygen species (ROS) is greater than the ability of the body to detoxify the reactive intermediates, oxidative stress was produced. The body naturally produces antioxidants such as, superoxide dismutase, catalase, glutathione peroxidase against free radicals.

Date fruit contains phytochemicals (carotenoids, polyphenols (e.g., phenolic acids, isoflavons, lignans, and flavonoids), tannins, and sterols (Martin-Sanchez *et al*., 2014).Vinson *et al*., (2005) illustrated that date fruits have the highest concentration of total polyphenols among the dried fruits .Guo *et al*., (2003) found that date fruits possess a highest antioxidant activity, because the carotenoids and phenolicscontents with quantity 3942 mg/100 g and antioxidants constituents 80400 µmol/100 g (Al-Farsi *et al*.,2005) .

Table 1. Chemical composition of dried fig, date and olive oil.

	Nutrients (100 g)	Dried fig	Date	Olive oil
Nutrients	Calories(kcal)	249	284	884
	Proteins (g)	3.3	3.0	-
	Fats (g)	0.9	2.9	100
	Saturated fat (g)	-	-	14
	Monounsaturated fat(g)	-	-	73
	Polyunsaturated fat (g)	-	-	11
	omega-3 (g)	-	-	0.8
	omega-6 (g)	-	-	9.8
	Carbohydrate. (g)	63.9	73	-
	Total fiber (g)	9.8	5.2	-
Vitamins	Vitamin K (µg)	15.6	2.7	60
	Vitamin B6 (mg)	0.1	0.25	-
	Thiamine (mg)	0.1	0.05	-
	Riboflavin (mg)	0.1	0.06	-
	Niacin (mg)	-	1.16	-
	Vitamin A (IU)	-	149	-
	Vitamin E (mg)	-	-	14.0
Minerals	Zn (mg)	0.5	0.44	-
	Iron (mg)	2.0	-	0.56
	Manganese (mg)	0.5	-	-
	Potassium (mg)	680	696	-
	Magnesium (mg)	68.0	54.0	-
	Calcium (mg)	162.0	64.0	-
	Phosphorus (mg)	67.0	62	-
	Copper (mg)	0.3	-	-

Table 2.Total phenols and total flavonoids of dried fig, date and olive oil.

sample (100g) Parameters	Dried fig	date	Olive oil
Total phenols	36 mg GAE	231mg GAE	142mg GAE
Total flavonoids	192 mg CE	66 mg CE	125 mg CE

GAE: Gallic acid equivalent, CE: Catchin equivalent.

As shown in Table (3), data indicated that body weight gain %for the +ve control group was significantly decreased ($P<0.05$), compared to the negative control group (-11.6 ±3.6 VS 25.8±2.6%), respectively. BWG% increased significantly($P<0.05$) in all groups fed on diets supplemented with dried fig, date fruit and olive oil separately or in combination compared to the positive control group .The highest BWG % was observed in group of rats fed on dried figs at level 10% with a mean value of31.0 ± 3.4%. The results indicated that FI was increased in groups fed on the tested materials at the different supplemented levels. FI was decreased in the positive control group.

Results in the present study showed that BWG decreased significantly in the positive control group which induced immune suppression, these results arein agreement with the findings by El-Shobakai*et al*., 2010,who found that rat treated with figs at (5%,10%,20%) and leaves at

(4%,6%) showed increase values of BWG compared to the positive control group. Hassanen and Ahmed, (2015) revealed that BWG was significantly increased in rats fed on ration mixed with fish oil and virgin olive oil ,these findings were also correlated with those obtained by Kasdallah - Grissa *et al*., (2008) and Hamadani *et al*., (2011) while the group injected with diethylnitrosamine showed significant decreased in the BWG compared to the negative group (Metwally *et al*.,2011).

FER was significantly($P<0.05$) decreased in the +ve control group compared to the -ve control with a mean value -1.6 ±0.5 VS2.4±0.2, respectively. There were no significant changes in FER among groups fed on all tested materials compared to the negative control group.

These results arein the line with the findings by Al-Siddiq *et al*., (2013), who reported that diet supplemented with 5% and10% date induced significant increase ($P<0.05$) in FER, compared to control positive rats. Date seed and flesh in the diets have increased the average daily gain, weight gain and back fat deposition of the lambs, probably to the presence of natural anabolic agents in date's by products (Elgasim *et al*., 1995).

Table 3. Effect of dried fig ,date andolive oil on body weight, feed intake and feed efficiency ratio of rats with immune dysfunction.

Parameters / Groups	Initial Body Weight (g)	Final Body Weight (g)	BWG (%)	FI (g/day/rat)	FER
Control (-Ve)	120.6 ±1.9^{a}	151.6 ±1.7^{a,b}	25.8 ± 2.6^{a,b}	12.5	2.4± 0.2^{a}
Control (+Ve)	120.2 ± 2.3^{a}	106.2 ±5.0^{c}	-11.6 ±3.6^{c}	8.3	-1.6±0.5^{b}
Fig (10%)	119.4 ± 2.2^{a}	156.2 ± 2.6^{a}	31.0 ± 3.4^{a}	11.8	3.1 ±0.3^{a}
Date (10%)	120.0 ±1.3^{a}	155.4 ±6.4^{a,b}	29.3 ± 4.1^{a,b}	11.7	3.0 ±0.4^{a}
Olive Oil (5%)	118.2 ± 0.9^{a}	149.2 ±3.6^{a,b}	26.1 ± 2.3^{a,b}	11.0	2.8 ±0.2^{a}
Fig(10%)+Date(10%)	121.8 ±1.1^{a}	146.6 ±5.2^{a,b}	20.4 ± 4.7^{b}	11.3	2.1 ±0.4^{a}
Fig (10%)+ Olive Oil (5%)	119.0 ± 1.3^{a}	143.4 ±1.1^{b}	20.5 ±0.9^{b}	11.2	2.1 ±0.1^{a}
Date (10%)+ Olive Oil(5%)	119.2 ±1.4^{a}	151.0 ±2.7^{a,b}	26.6 ±1.7^{a,b}	11.4	2.7 ±0.1^{a}
Mixture(Fig10%+ Date10% +Olive Oil5%)	118.0 ±1.2^{a}	153.0 ±1.9^{a,b}	29.7± 2.2^{a,b}	11.7	3.0 ±0.2^{a}

***Values are expressed as means ±SE.**

***Values at the same column with different letters are significant at P<0.05.**

The result of changes of the relative organs weight is shown in Table (4). Rats group of the positive control group with induced immune deficiency had increase in the mean value of relative liver ,kidney and spleen weight as compared to the-ve group. Supplemented diet with dried fig(10%), date(10%) and olive oil(5%) separately or in combination caused reduction in the mean value of relative liver, kidney and spleen weight compared to the +ve control except rats group fed on olive oil only caused significant increase in the relative weight of liver and spleen compared to the positive control group .There sults are harmony with El-Siddiq *et al*., 2013, who illustrated that diabetic rats fed on the basal diet containing different levels of figs and leaves have lower organs weight to body weight ratio. The reduction in organs weight up on treatment with figs and its leaves ,may be attributed to the antioxidant compounds present and that can be a promising intervention to prevent progression of kidney disease (Masatoshi *et al*., 2002).

Table 4. Effect of dried fig, date and olive oil on relative organs weight of rats with immune dysfunction.

Parameters / Groups	Liver (%)	Kidney (%)	Spleen (%)
Control (-Ve)	2.2 ±0.10^{b,c}	0.44 ±0.04^{c}	0.114 ±0.00^{b}
Control (+Ve)	2.3 ±0.10^{b}	0.67 ±0.05^{a}	0.118 ±0.01^{b}
Dried Fig (10%)	1.9 ±0.16^{c,d}	0.56 ±0.02^{a,b,c}	0.118 ±01^{b}
Date (10%)	1.6 ±0.11^{d}	0.53 ±0.03^{b,c}	0.122 ±01^{b}
Olive Oil(5%)	3.3 ±0.12^{a}	0.66 ±0.04^{a,b}	0.172 ±0.02^{a}
Dried Fig(10%)+Date(10%)	1.9± 0.08^{c,d}	0.54 ±0.02^{a,b,c}	0.128 ±00^{b}
Dried Fig (10%)+Olive Oil (5%)	1.8 ±0.08^{d}	0.50 ±0.08^{c}	0.114 ±01^{b}
Date (10%)+Olive Oil(5%)	2.0 ±0.11^{c,d}	0.56 ±0.02^{a,b,c}	0.114 ±01^{b}
Mixture(Dried Fig10%+ Date10% +Olive Oil5%)	1.7 ±0.05^{d}	0.47 ±0.02^{c}	0.116 ±02^{b}

***Values are expressed as means ±SE.**

***Values at the same column with different letters are significant at P<0.05.**

The activities of serum ALT,AST and ALP were significantly increased ($P<0.05$) in rats with immune deficiency as compared with the corresponding values of normal group Table (5).Feeding immune deficiency group on dried fig, date and olive oil separately or in combination resulted in a significant decrease ($P<0.05$) in serum ALT,AST and ALP levels, compared to the +ve group. There were no significant changes in the levels of serum ALT and AST among the groups fed either dried fig, date and olive oil separately or in combination at the tested levels. However ,rats fed on a mixture of the three tested samples had the highest reduction in liver enzymes as compared to the other group .Mahmoud *et al*., (2013), observed that diet supplemented with different levels of fig and sycamore recorded improvement in liver function. Vitamins A , C and polyphenols found in fig and sycamore *(Ficus sycamore)* exerted their antioxidant action through stabilizing the membrane of hepatocytes by scavenging the free radicals formed by the hypercholesterolemia thus preventing lipid peroxidation of hepatocyte membranes, consequently, render the activity of AST and ALT near to the normal levels (Heibatollah *et al*., 2008).

Al-Seeni *et al*., (2016) recorded that treating hepatotoxic rats with olive oil or *N. Sativa*reversed the activity of liver functions and restored them towards normal values. Saafi *et al*., (2011) concluded also that the aqueous date fruit extract repaired the damage of the liver

Table 5. Effect of dried fig, date and olive oil on serum liver functions of rats with immune dysfunction.

Parameters Groups	ALT (µ/L)	AST (µ/L)	ALP (µ/L)
Control (-Ve)	24.6 ±1.0^{f}	29.3± 01.3^{f}	277.5± 06.3^{h}
Control (+Ve)	74.1 ±3.5^{a}	117.4 ±10.5^{a}	608.6 ±07.9^{a}
Dried Fig (10%)	48.5 ±1.9^{d}	76.9 ±4.1^{b,c}	472.9 ±16.1^{c,d}
Date (10%)	56.3 ±2.7^{b}	89.8 ±3.7^{b}	521.1 ±7.1^{b}
Olive Oil (5%)	39.2 ±0.4^{d}	73.7 ±3.9^{c}	483.1 ±12.2^{c}
Dried Fig(10%)+Date(10%)	34.2 ±0.6^{e,d}	44.8 ±2.3^{e,d}	425.6 ±10.4^{e,f}
Dried Fig (10%)+Olive Oil (5%)	37.8 ±0.6^{d}	49.4 ±2.8^{e,d}	450.8 ±03.6^{d,e}
Date (10%)+Olive Oil(5%)	35.4 ±1.7^{e,d}	57.9 ±1.5^{d}	416.2 ±08.7^{f}
Mixture(Dried Fig10%+ Date10% +Olive oil l5%)	30.7 ±0.8^{e}	42.7 ±1.3^{e}	337.3 ±08.1^{g}

***Values are expressed as means ±SE.**

***Values at the same column with different letters are significant at P<0.05.**

Positive control group exhibits significant increase (P<0.05) in the level of TC,TG,VLDL-C and LDL-C as seen in table (6). However, the level of serum HDL-C was significantly (P<0.05) lowered, compared to the control normal group. Diets supplemented with dried fig, date and olive oil separately or in combination showed significant reduction (P<0.05) in the mean values of serum lipid profile. However, serum HDL-C was increased significantly (P<0.05), compared to the -ve control group .Groups of rats fed on either the three tested samples or the in combination of date and olive oil gave the highest beneficial effect in improving lipid profile than the other tested groups.

In a study by Mahmoud *et al*.,(2013), who reported an improve in lipid profile of hypercholesterolemic rats that fed on diet supplemented with fig this may be due to the presence of antioxidants including; vitamin A, vitamin C and polyphenols in fig . Vitamin A is believed to alter the rate of cholesterol absorption in the intestine while vitamin C has a role in activating the conversion of cholesterol into bile acids and then eventually excreted. Salama *et al*., (2008) reported that vitamin C increasing the mobilization and transport of cholesterol to the liver by increasing the activity of lecithin cholesterol acyltransferase enzyme which in turn plays an essential role in cholesterol reduction.

Polyphenols was reported to exert its hypocholesterolemic effect by reducing cholesterol absorption in the intestine or its production by liver or stimulation of the biliary secretion of cholesterol and cholesterol excretion in the faeces (Skottova *et al*., 2003). Gorinstein *et al*., (2002)revealed that polyphenols decreased LDL-C levels and prevent their oxidation *in vivo*. Lowering TC and LDL-C and improving HDL-C values has been caused a lower risk of CHD (Libby *et al*., 2000), and could Also fasten the removal of cholesterol from peripheral tissues to liver for catabolism and excretion(Young *et al*., 2004). Moreover, high HDL-C levels may compete with LDL receptor sites on arterial smooth muscle cells and thus inhibit the uptake of LDL, and could protect the LDL against oxidation *in vivo* because lipids in HDL are preferentially oxidized before those in LDL (Young *et al*., 2004). Shukla *et al*., (2004) shown that figs possess antioxidant, hypolipidemic, and hypoglycemic activities.

All extracts of fig leaves caused a decrease of serum cholesterol levels, and this effect is dose-dependent as reported by Rassouli *et al*., (2010).Borochov-Neori *et al*., (2015) found that the flavonol fractions extracted from date fruit enhanced cholesterol removal from macrophages. This positive antioxidant effect might protect the cell membrane from being oxidized by free radicals that generated both extra- and intracellularly.

Date fruits play a significant role as anti-inflammatory estimated by Zhang *et al*.,(2013), who reported that the extracts of Ajwa dates inhibit the lipid peroxidation cyclooxygenase enzymes, and play avital role in reducing foot swelling and plasma fibrinogen (Mohamed and Al-Okbi, 2004).*Phoenix dactylifera* pollen has potential protective effect via modulation of cytokines expressions (Elberry *et al*.,2011).

Consumption of olive oil decreased total and LDL-c compared to butter (Engel and Tholstrup, 2015), which may decrease risk of a heart attack or stroke. Also, supplementation of extra-virgin olive oil (about 2 tablespoons per day) in adults led to decreased total and LDL-c within 6 weeks (Haban *et al*., 2004), the susceptibility of LDL to oxidation, however, depends not only on the change in the LDL fatty acid content promoted by olive oil, but also on the phenolic content bound to the LDL (Arrigo *et al*., 2008) and alsolowered blood pressure. An olive polyphenol extract also decreased total and LDL-c in postmenopausal women (Filip *et al*., 2015). Monounsaturated fatty acid reduced the susceptibility of LDL to oxidation (Lopez-Miranda *et al*.,2006). As a result of olive oil consumption

Rats with induced immune deficiency exhibited significant reduction (P<0.05) in the mean value of catalase activity (table 7) as compared to the normal control group .However, the mean value of malondialdehyde activity was significantly (P<0.05) increased in positive control group compared to the normal group.

Table 6. Effect of dried fig ,date and olive oil on serum lipid profile of rats with immune dysfunction.

Parameters Groups	TC (mg/dl)	TG (mg/dl)	HDL-c (mg/dl)	LDL-c (mg/dl)	VLDL-c (mg/dl)
Control (-Ve)	73.0 ±2.2^{e}	35.2 ±0.5^{d}	58.9 ±1.9^{a}	7.0 ±1.1^{f}	7.0 ±0.1^{d}
Control (+Ve)	122.1 ±1.6^{a}	64.6 ±1.2^{a}	22.6 ±2.1^{e}	86.5 ±0.9^{a}	12.9 ±0.2^{a}
Dried Fig (10%)	97.5 ±4.6^{c}	51.6 ±0.7^{b}	48.6 ±2.1^{c}	38.5 ±2.3^{c}	10.3 ±0.1^{b}
Date (10%)	107.9 ±2.6^{b}	54.7 ±2.9^{b}	38.6 ±1.1^{d}	58.3 ±2.1^{b}	10.9 ±0.5^{b}
Olive Oil(5%)	94.2 ±2.5^{c}	52.0 ±0.6^{b}	56.3 ±3.0^{a,b}	27.5 ±2.8^{d}	10.4 ±0.1^{b}
Dried Fig(10%)+Date(10%)	82.8 ±1.9^{d}	43.5 ±1.8^{c}	53.2 ±1.2^{a,b,c}	20.8 ±0.9^{d,e}	8.7 ±0.3^{c}
Dried Fig (10%)+Olive Oil (5%)	85.1 ±3.4^{d}	45.6 ±1.9^{c}	53.6 ±1.3^{a,b,c}	22.3 ±2.7^{d,e}	9.1 ±0.3^{c}
Date (10%)+Olive Oil(5%)	84.7 ±2.8^{d}	43.0 ±25^{c}	50.2 ±2.1^{b,c}	25.8 ±4.4^{d,e}	8.6 ±0.5^{c}
Mixture(Dried Fig10%+ Date10% +Olive Oil5%)	84.8 ±0.4^{d}	43.1 ±1.6^{c}	57.3 ±1.7^{a}	18.8 ±2.0^{e}	8.6 ±0.3^{c}

***Values are expressed as means ±SE.**
***Values at the same column with different letters are significant at P<0.05.**

Table 7. Effect of dried fig ,date and olive oil on serum catalase and malondialdehyde of rats with immune dysfunction.

Parameters Groups	Catalase (U/L)	Malondialdehyde (ng/ml)
Control (-Ve)	104.7±3.6^{a}	4.4 ± 0.4^{g}
Control (+Ve)	14.5 ±1.0^{g}	32.0 ±1.8^{a}
Dried Fig (10%)	35.4 ± 0.5^{f}	16.5 ±0.5^{c}
Date (10%)	36.3 ±1.4^{f}	22.3 ±1.0^{b}
Olive Oil (5%)	30.9 ±1.3^{f}	13.8 ±0.5^{c,d}
Dried Fig(10%)+Date(10%)	45.3 ±2.1^{e}	8.4 ± 0.5^{e,f}
Dried Fig (10%)+Olive Oil (5%)	72.0 ±3.6^{c}	11.8 ±1.3^{d}
Date (10%)+Olive Oil(5%)	54.0 ±2.3^{d}	11.0 ± 0.2^{d,e}
Mixture(Dried Fig10%+ Date10% +Olive Oil5%)	90.9 ±1.0^{b}	6.0 ±0.1^{f,g}

***Values are expressed as means ±SE.**
***Values at the same column with different letters are significant at P<0.05.**

Moreover ,the mean values of catalase activity were significantly (P<0.05) increased as a result of feeding rats on dried fig, date and olive oil at level (10%,10% ,5%),respectively compared to the corresponding values of the positive control group .However, the mean value of malondialdehyde activity were significantly (P<0.05) decreased as a result of feeding immune deficiency rats on dried fig, date and olive oil, compared to +ve control group. Rats fed on a mixture of the three tested samples caused the highest increase in catalase activity compared to the other groups, moreover this group showed the lowest activity in malondialdehyde level compared to other tested groups. The three tested samples had beneficial effects on catalase activity as well as on the malondialdehyde levels.

These results are in agreement with (Hassanen and Ahmed,2015;Abir *et al*.,2008andTulubas *et al*.,2013)who reported that activities of MDA was significantly increased while serum Catalase level was significantly decreased in rat injected with diethylnitrosamine (DEN). Supplemented diet with fish oil, virgin olive oil and mixed with fish oil and virgin olive oil increased the activities of enzyme antioxidant, (Catales).In conclusion ,dried fig ,date and olive oil have a functional role on rats with immune dysfunction at the tested levels.

Histopathological examination of liver:

Liver of rats from the (-Ve) control group illustrated normal histological structure of hepatic lobule as shown in photo (1). On the other hand, liver of rats from the (+Ve) control group revealed cytoplasmic vacuolization of hepatocytes, photo (2). However, liver of rats from group fed on dried fig (10%) showed small focal hepatic necrosis associated with inflammatory cells infiltration (photo 3). Some examined sections from rats group fed on date (10%) revealed no histopathological changes (photo 4).Photo (5) showing slight activation of Kupffer cells was the only histopathological finding observed in liver of rat from group fed on olive oil (5%). Moreover, slight cytoplasmic vacuolization of centrilobular hepatocytes was the only histopathological finding observed in liver of rats from group fed on combination of dried fig 10% and date 10% (photo 6). Liver of rats from group fed on combination of dried fig 10% and olive oil 5%, showed binucleation of hepatocytes as illustrated in photo (7). Liver of rats from group which fed on combination of date 10% and olive oil 5%, revealed no histopathological changes as shown in photo (8). However, liver of rats from group fed on mixture of dried fig 10%, date 10% and olive oil 5%, revealed no histopathological changes(photo 9).So, introducing the tested samples to the rats with immune dysfunction in the diet improved the liver histopathologically .

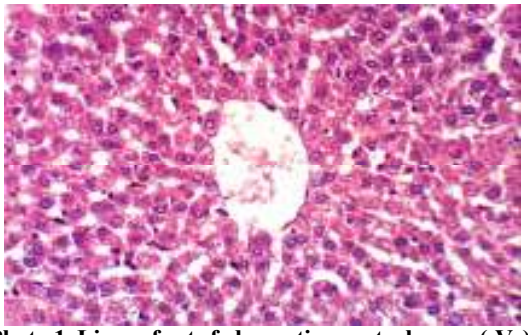

Photo 1. Liver of rats fed negative control group(-Ve).

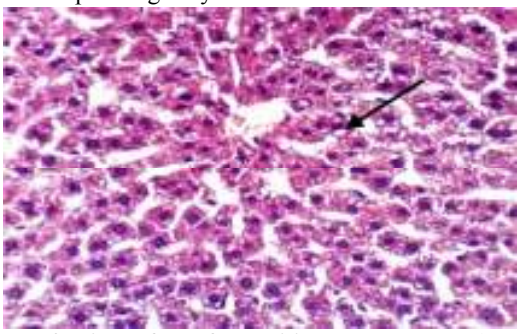

Photo 2. Liver of rats fed positive control group (+Ve).

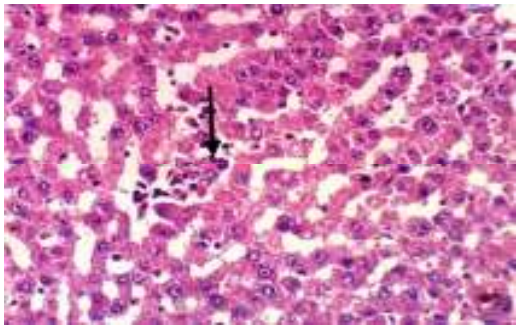

Photo 3. Liver of rats fed on dried fig 10%.

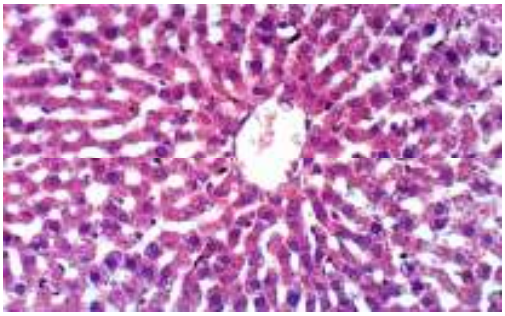

Photo 4. Liver of rats fed on date 10%.

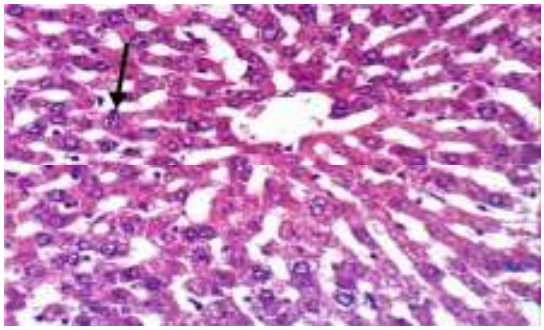

Photo 5. Liver of rats fed on olive oil 5%.

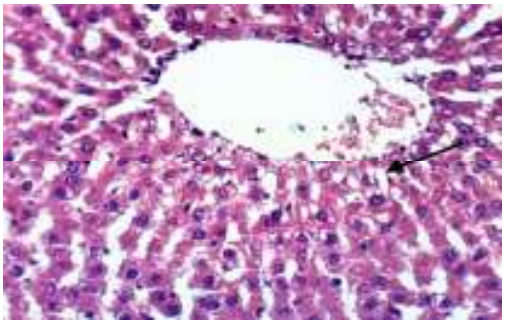

Photo 6. Liver of rats fed on dried fig 10% and date 10%.

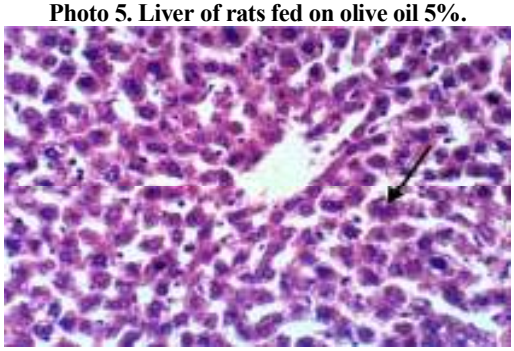

Photo 7. Liver of rats fed on dried fig 10% and olive oil 5%.

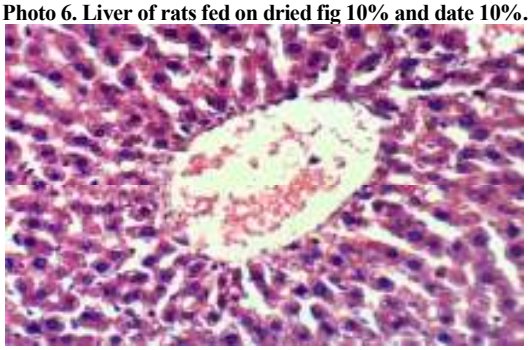

Photo 8. Liver of rats fed on date 10% and olive oil 5%.

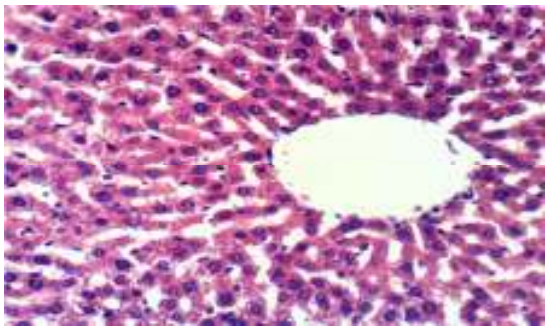

Photo 9. Liver of rats fed on mixture of dried fig 10% , date 10% and olive oil 5%.

REFERENCES

Abir, K.; Amel, N.; Nadia, K.; Saloua, E.; Najoua, G.; Abdelaziz, K. and Mohamed, H. (2008): Dietary virgin olive oil protects against lipid peroxidation and improves antioxidant status in the liver of rats chronically exposed to ethanol. Nutrition Research 28,472–479.

Al Farsi, M;.Alasalvar, C.; Morris, A.; Baron, M. and Shahidi, F. (2005):Compositional and sensory characteristics of three native sun-dried date (Phoenix dactylifera L.) varieties grown in Oman. J Agric Food Chem . 53:7586−7591.

Al-Seeni, M.; El Rabey, H.; Zamzami, M. and Alnefayee, A.(2016): The hepatoprotective activity of olive oil and *Nigella sativa* oil against CCl_4 induced hepatotoxicity in male rats. BMC Complement Altern Med.2016; 16: 438.

Al-Siddiq, M.;Aleid, S. and Kader, A. (2013): Dates Postharvest Science, Processing Technology and Health Benefits, 1st Ed. New Delhi: Wiley-Blackwell.

Arem, A.; Behija, E.; Lahouar, L.; Thouri, A.; Ghrairi, F. and Achour, L. (2017): Date palm fruit extract attenuated oxidative stress induced by two haloacetic acids in Wistar rats. Mediterranean Journal of Nutrition and Metabolism , 141–152.

Arrigo, F.; Cicero, M. and Simona, N. (2008): Changes in LDL Fatty Acid Composition as a Response to Olive Oil Treatment Are Inversely Related to Lipid Oxidative Damage. Journal of the American College of Nutrition, Vol. 27, No. 2, 314–320 .

Ayinde, B. and Owolabi, O. (2009): Effects of the aqueous extract of FicuscapensisThunb. (Moraceae) leaf on gastrointestinal motility. Journal of Pharmacognosyand Phytotherapy.1(3):031-035.

Baliga, M.; Baliga, B.; Kandathil, S.; Bhat, H. and Vayalil, P. (2011): A review of the chemistry and pharmacology of the date fruits (*Phoenix dactylifera*L.). Food Res Int.44(7):1812-22.

Borochov-Neori, H.; Judeinstein, S.; Greenberg, A.; Volkova, N. ;Rosenblat, M. and Aviram, M. (2015): Antioxidant and antiatherogenic properties of phenolic acid and flavonol fractions of fruits of "Amari" and "Hallawi" date (Phoenix dactylifera L.) varieties. J. Agric. Food Chem. 63, 3189–3195.

Draper, H. and Hadley, M. (1990):Malondialdehyde determination as index of lipid peroxidation. Methods Enzymol. 186, 421-431.

Duke, J.; Bogenschutz-Godwin, M.; Du Celliar, J. and Duke, P. (2002): Hand Book of Medicinal Herbs, second ed. CRC Press, Boca Raton, USA, pp: 314-315.

Elberry, A.; Mufti, S.; Al-Maghrabi, J.; Abdel-Sattar, E.; Ashour, O.; Ghareib, S. and Mosli, H. (2011): Anti-inflammatory and antiproliferative activities of date palm pollen (*Phoenix dactylifera*) on experimentally-induced atypical prostatic hyperplasia in rats. J Inflamm (Lond) 23:40.

Elgasim, E.; Alyousef, Y. and Humeida, A. (1995): Possible hormonal activity of date pits and flesh fed to meat animals. Food Chemistry 52:, 149-152.

El-Shobakai, F.; El-Bahay ,A.; Esmail, A.; AbdElMegeid, A. and Esmail ,N. (2010): Effect of Figs Fruit (Ficuscarica L.)And Leaves on Hyperglycemia in Alloxan Diabetic Rats.World Journal of Dairy &Food Sciences 5(1):47-57.

Engel, S. andTholstrup, T. (2015): Butter increased total and LDL cholesterol compared with olive oil but resulted in higher HDL cholesterol compared with a habitual diet. Am J ClinNutr. 102(2):309-15.

Farahnaky, A. and Majzoobi, M. (2009): Effect of glycerol on the moisture sorption isotherms of figs. Journal of Food Engineering, 93: 468-473.

Filip, R.; Possemiers, A.; Heyerick, I.; Pinheiro, G.; Raszewski, M.; Davicco, A. and Coxam,V. (2015) : Twelve-month consumption of a polyphenol extract from olive (Oleaeuropaea) in a double blind, randomized trial increases serum total osteocalcin levels and improves serum lipid profiles in postmenopausal women with osteopenia." J Nutr Health Aging. 19(1):77–86.

Fossati, P. and praneipe, L. (1982):Triglycerides determination after enzymatic hydrolysis .Clin.Chem .,28:2077.

Friadwald ,W.; Levy, K. and Fredrickson, D. (1972):Estimation of the concentration of low density lipoprotein cholesterol in plasma without use of the preparative ultracentrifuge .Clin. Chem.226:499-504.

Frost, B.; Hemberg, M.; Lewis, J. and Feany, M. (2014): Tau promotes neurodegeneration through global chromatin relaxation. Nat. Neurosci. 17, 357–366.

Gorinstein, S.; Leontowicz, H.; Lojek, A.; Leontowicz, M.; Ciz, M. ;Krzeminski, R.; Gralak, M.; Czerwinsk, J.; Jastrzebski, Z.; Trakhtenberg, S.; Grigelmo-Miguel, N. and Soliva-Fortuny, R. (2002): Olive oils improve lipid metabolism and increase antioxidant potential in rats fed diets containing cholesterol. J. Agric. Food Chem., 50: 6102-6108.

Gorrini, C.; Harris, I. and Mak, T. (2013): Modulation of oxidative stress as an anticancer strategy. Nat. Rev. Drug. Discov. 12, 931–947.

Guo, C.; Yang, J.; Wei, J;.Li, Y.; Xu, J. and Jiang, Y. (2003): Antioxidant activities of peel, pulp and seed fractions of common fruits as determined by FRAP assay. Nutr. Res. 23, 1719–1726.

Haban, P.; Klvanova, J.; Zidekova, E. and Nagyova, A. (2004): Dietary supplementation with olive oil leads to improved lipoprotein spectrum and lower *n*-6 PUFAs in elderly subjects. Med. Sci. Monit., 10, 149–154.

Hamadani, M.;Asadiagajari M.;Vahdatpour T.;Bahrami Y.;Salehzadeh K. and Vahdatpour, S. (2011): Efficiency of dietary fish oil for regulation of hyperlipidemia and hyperglycemia in diabetic rats. Annals of Biological Research, 2(3):75-81.

Hassanen, N. and Ahmed , M.(2015): Protective Effect of Fish Oil and Virgin Olive Oil on Diethyl nitrosamine Toxicity in Rats. International Journal of Nutrition and Food Sciences ; 4(3): 388-396.

Heibatollah, S.; Reza, N.; Izadpanah, G. and Sohailla, S. (2008): Hepatoprotective effect of *Cichoriumintybus*on CCl4-induced liver damage in rats. African J. Biochem Res., 2(6): 141-144.

Ibrahim, H.; Ali, L. and Essam, M. (2008): The functional role of some tomato products on lipid profile and liver function in adult rats. Journal of Medicinal Food, 11(3): 551-559.

Kasdallah-Grissa A.; Nakbi A.; Koubaa N.; El-Fazaa, S.; Gharbi N.; Kamoun, A. and Hammami, M. (2008): Dietary virgin olive oil protects against lipid peroxidation and improves antioxidant status in the liver of rats chronically exposed to ethanol. Nutrition Research, 28:472–479.

Kim, G.; Kim, J.; Rhie, S. and Yoon, S. (2015): The role of oxidative stress in neurodegenerative diseases. Exp. Neurobiol. 24, 325–340.

Libby, P.; Aikawa, M. and Schonbeck, U. (2000): Cholesterol and atherosclerosis. Biochimicaet Biophysica Acta, 1529: 299-309.

Lopez-Miranda, J.; Badimon, L.; Bonanome, A.; Lairon ,D.; Kris- Etherton, P.; Mata, P. and Perez-Jimenez, F.(2006): Monounsaturated fat and cardiovascular risk. Nutr Rev 64(Suppl):S2–S12.

Mahmoud, M.; Qura, A.; Badawy, I.; Abdel-Hady, Y. and Badawi, A. (2013): Hypocholesterolemic effect of antioxidant containing fruits in rats fed on high-cholesterol and fat diet. J. Appl. Sci. Res., 9(7): 4233-4244.

Martin-Sanchez, A.; Cherif, S.; Ben-Abda, J.; Barber-Valles, X.; PerezAlvarez, J. andSayas-Barbera, E. (2014): Phytochemicals in date co-products and their antioxidant activity. Food Chem. 158, 513–520.

Meiattini, F. (1978): The 4-hydroxybenzoate /4-aminophenazone Chromogenic System .Clin. Chem.24(12):2161-2165.

Mesatoshi, M.; Otani, H. and Yuawa, S. (2002) : Mechanisms of Ageing and Development .J. Hepatol., 123(8-30):1041-1046.

Metwally, N.;Kholeif, T.;Ghanem, K.;Farrag, A.;Ammar, N. and Abdel-Hamid, A. (2011): The protective effects of fish oil and artichoke on hepatocellular carcinoma in rats. European Review for Medical and Pharmacological Sciences, 15: 1429-1444.

Mohamed, D. and Al-Okbi, S. (2004): In vivo evaluation of antioxidant and anti inflammatory activity of different extracts of date fruits in adjuvant arthritis. Pol J Food Nutr Sci.13/54:397–402.

Moss, J. and Ramji, D. (2016):Nutraceutical therapies for atherosclerosis. Nat. Rev. Cardiol. 13, 513–532.

Nathan, C. and Cunningham-Bussel, A. (2013): Beyond oxidative stress: an immunologist's guide to reactive oxygen species. Nat. Rev. Immunol. 13, 349–361.

Njoku-Oji, N.; Nwike, C.; Dimkpa, U.; Ifegwu, N.; Anike, L.; Maduka, S.; Sobanke, O. and Uchefuna, R. (2016): Hematological Changes Following Oral Administration of Aqueous Leaf Extract of Ficuscapensis in Albino Rats. International Blood Research & Reviews 5(1): 1-7 , Article no.IBRR.23083 .ISSN: 2321–7219.

Oettle, G.; Emmett, P. and Heaton, K. (1987): Glucose and insulin responses to manufactured and whole-food snacks. Am J Clin.Nutr., 45: 86-91.

Otitoju, G.; Nwamarah, J.; Otitoju, O. and Iyeghe, L. (2014): Nutrient composition of some lesser known green leafy vegetables in Nsukka LGA of Enugu State. Journal of Biodiversity and Environmental Sciences ISSN: 2220-6663.4(4):233-239.

Perez-Martinez, P.; Antonio, G.; Javier, D.; Francisco, P. and Jose L. (2011): Mediterranean diet rich in olive oil and obesity, metabolic syndrome and diabetes mellitus. Current Pharmaceutical Design, 17, 1-9.

Rassouli, A.; Ardestani, F.; Asadi, F. and Salehi, M. (2010): Effects of Fig tree (Ficuscarica) leaf extracts on serum and liver cholesterol levels in hyperlipidemic rats. International Journal of Veterinary Research , 4 (2), 77-80.

Rahmani, A.; Aly, S.; Ali, H.; Babiker, A.; Srikar, S. and Khan, A. (2014): Therapeutic effects of date fruits (*Phoenix dactylifera*) in the prevention of diseases via modulation of anti-inflammatory, anti-oxidant and anti-tumour activity. Int J ClinExp Med. 7(3):483-91.

Roy, E. (1970): Colorimetric determination of Co. St Louis. Toronto. Princeton. Pp. 1088-1273.

Saafi, E.; Louedi, M.; Elfeki, A.; Zakhama, A.; Najjar, M. and Hammami, M. (2011): Protective effect of date palm fruit extract (Phoenix dactylifera L.) on dimethoate induced-oxidative stress in rat liver. Exp. Toxicol. Pathol.63,433–441.

Sadhu, M. (1990): Fig. In T. K. Kose& S. K. Mitra (Eds.), Fruits: Tropical and subtropical (pp: 650-663). Calcutta: NayaProkash.

Servili, M.; Sordini, B.; Esposto, S.; Urbani, S.; Veneziani, G.; Di Maio, I.; Selvaggini, R. and Taticchi A. (2011): Biological Activities of Phenolic Compounds of Extra Virgin Olive Oil. Antioxidants , 3, 1-23.

Sinha, A. (1972): Colorimetric assay of catalase enzyme. Anal, Biochem. 47, 389-394.

Shukla, R.; Gupta, S.; Prabhu, K. and Murthy, P. (2004): Antioxidant effect of aquas extract of the park of Ficusbengalensis in hypergholesteremic rabbits. J. of Ethnopharmacology, 92: 47-51.

Skottova, N.; Vecera, R.; Urbanek, K.; Vana, P.; Waltreova, D. and Cvak, L. (2003): Effects of phenolic fraction of silymarin on lipoprotein profile in rats fed cholesterol-rich diets. Pharmacological Research, 47: 17-26.

Slavin, J. (2006): Figs: past, Present, Future. Nutrition Tody, 41: 180-184.

SPSS,(1986): Statistical package for social science ,version 19.SPSSInc.,II.USA.

Suke, S.; Ahmed, R.; Tripathi, A.; Chakraborti, A. and Banerjee, B .(2006):Immunotoxicity of phosphamidon following subchronic exposure in albino rats., Indian Journal of Experimental Biology, 44:316-320.

Thomas, L. (1998): Alanine aminotransferase (ALT) ,aspartate amino transeferase (AST).Clinical Laboratory Diagnostic .1st ed.Frankfurt:TH-Books Verlagsgesellschaft.p.55-65.

Tulubas, F.; Gurel, A.; Oran, M.; Topcu, B.; Caglar, V. and Uygur, E. (2013): The protective effects of o-3 fatty acids on doxorubicin-induced hepatotoxicity and nephrotoxicity in rats. Toxicology and Industrial Health,1-7.

USAD, (Unit State Department of Agriculture), Agricultural Research Service, Release 15, (2002): Nutrient Data Laboratory Home Page, http://www.nal.usda.gov /finic/foodcomps.

Vauzour, D.; Rodriguez- Mateos, A.; Corona, G.; Oruna - Concha, M.and Spencer, J. (2010): Polyphenols and Human Health: Prevention of Disease and Mechanisms of Action. Nutrients,2 ,1106-1131.

Vinson, J.; Zubik, L.; Bose, P.; Samman, N. and Proch, J. (2005): Dried fruits: excellent in-vitro and in-vivo antioxidants. J. Am. Coll. Nutr. 24, 44–50.

Young , S. (2001): Effect of diseases on Clinical Lab .Tests 4th ad AACC.

Young, C.; Karas, R. and Kuvin, J. (2004):Hdlc and coronary heart disease, Cardiol. Rev., 12(2): 107-109.

Zhang, C.; Aldosari, S.; Vidyasagar, P.; Nair, K. and Nair, M. (2013): Antioxidant and anti-inflammatory assays confirm bioactive compounds in Ajwa Date fruit. J. Agric. Food Chem. 61:5834–5840.

التأثيرالوظيفى للتين المجفف، التمر وزيت الزيتون على الفئران ذى الخلل المناعي.

هدى سلامة ابراهيم [١] ، نعيم محمد رابح [١] ، حنان محمد الغندور [٢] و شفيقة محمود صبرى [١]

[١]قسم التغذية وعلوم الاطعمة – كلية الاقتصاد المنزلي- جامعة حلوان

[٢]المركز الاقليمى للاغذيه و الاعلاف مركز البحوث الزراعية

أجريت هذه الدراسة لمعرفة تأثير التين المجفف،التمر وزيت الزيتون على القياسات الدموية والوظائف المناعية في الفئران .أظهرت نتائج التحليل الكيميائي ارتفاع محتوي التين المجفف ,التمر وزيت الزيتون من الفيتامينات، الاملاح المعدنية والطاقة والكربوهيدرات.يحتوى زيت الزيتون على كمية كبيرة من السعرات,الدهون,اوميجا ٦,الفيتامينات ولكنها منخفضة فى الحديد.يحتوي كلا من التين المجفف,التمر وزيت الزيتون علي مركبات الفينولات و الفلافونيد. تشير نتائج تحليل سيرم الفئران الي أن المجموعة الضابطة الموجبة التى تغذت على الغذاء الاساسى وتم احداث خلل مناعى بها الى ارتفاع معنوى فى قيم كلا من (الكوليسترول ,الدهون الثلاثي, الليبوبروتينات منخفضة الكثافة والليبوبروتينات منخفضة الكثافة جدا) وحدوث انخفاض معنوى فى الليبوبروتينات مرتفعة الكثافة مقارنة بالمجموعة السالبة. اوضحت النتائج ان المجاميع التى تغذت على التين المجفف ,التمر وزيت الزيتون منفردا او خليط ادى ذلك الى حدوث تحسن فى وظائف الكبد مقارنة بالمجموعة الموجبة.علاوة على ذلك فان الفئران التى تم احداث خلل مناعى بها ادى ذلك لانخفاض معنوى فى الزيادة فى الوزن ,معدل تناول الطعام، كفاءة الغذاء بالمقارنة بالمجموعة السالبة . ايضا حدوث زيادة معنوية فى قيم نشاط انزيم الكتاليز فى المجاميع التى تغذت على التين المجفف ,التمر وزيت الزيتون بالمقارنة بالمجموعة الموجبة . توضح نتائج الهستوباثولوجى عدم حدوث اى تغييرات فى الكبد بين المجاميع التى تغذت على التين المجفف,التمر وزيت الزيتون . توصي الدراسة بتناول التين المجفف ,التمر وزيت الزيتون لتنشيط وزيادة كفاءة الجهاز المناعي في الفئران ذى الخلل المناعى.