Egyptian J. of Nutrition Vol. XXXIII No. 2 (2018)

Therapeutic Effect of Dried Fig, Date and Olive Oil on Immune System in Rats

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Abstract

The aim of the present work was to investigate the effect of dried fig, date and olive oil supplementation on hematological parameters and immune functions in rats.Fifty four male albino rats weighing 120 ± 5 g were used in this study. The first main group (n=6) was fed on the basal diet(-ve control).The second main group (n = 48) was subcutaneously injected with a single dose ofSheep red blood cell (SRBC) to induced immune suppuration. Then rats weredivided into 8 subgroups (6 rats each).Subgroup 1was fed on basal diet (+ve control).Subgroups from 2 - 4 were fed on the basal diet and supplemented with olive oil 5% , dried fig 10%,and date 10%, separately.Subgroups from 5 - 7 were fed onbasal diets supplemented with olive oil 5%, dried fig10%, and date 10% respectively.Subgroup 8 was fed onbasal diet and supplemented with a mixture of olive oil 5%, dried fig 10%, and date 10%for 8 weeks. Chemical composition results of dried fig, date fruit and olive oil recorded high content of vitamins, minerals, calories and carbohydrates.Olive oil show high content of calories, fats,omega-6

and vitamins but low iron. Dried fig, date and olive oil revealed the presence oftotal phenolic and flavonoid. Results indicated that rats groups fed on a mixture of the three tested samples had increased immune suppurationsignificantly (P<0.05). The mean value of IgMand IgGare81.4 and749.0 g/L, respectively for the rats fed on mixture of the tested materials increased,compared to the positive control group. Hematological parameters were significantly increased (P<0.05) for the groups given dried fig, olive oil and date fruit separately or in combination. However, white blood cells count was significantly decreased. Moreover, significantincrease inbody weight gain, feed intake and feed efficiency ratio of the tested groups compared to the positive control group. Also, results show significant increase in the levels of white blood cells and hemoglobin compared to the negative control group. It could be concluded that, dried figs, dates fruit and olive oil stimulates the immune system of rats with induced immune deficiency.

Introduction

The human immune system is represented by a complex network of organs, tissues, cells and molecules that evolved primarily to protect the host against infections. However, the immune system influences much more than host defense: it has crucial roles in immune surveillance of malignancies, it inflicts damage in the context of autoimmune as well as autoinflammatory diseases and it affects host metabolism and aging ***(Mihai et al., 2016).***

The innate immune system provides an early first line of defense against invading pathogens. The cells involved are neutrophils, monocytes, macrophages and dendritic cells, which all interact with the adaptive immune system. These cells develop and mature during fetal life, but at different times, and the function of all components of innate immunity is weak in newborns compared with the later life***(Abbas,2005).***

Epidemiological studies supported by experimental data from both animals and humans, have made a significant contribution to increasing knowledge of the relationship between diet and the immune system, considering nutrient intake as a critical determinant of immunocompetence***(Klasing and Leshchinsky,2000).*** This association was confirmed after the recognition of long chain n-3 polyunsaturated fatty acids (PUFA) as nutrients that participate in the regulation of immune system functions ***(Calder,2003).***

Dates fruits have high composition of carbohydrates, minerals, dietary fibre, vitamins, fatty acids and amino acid gives a unique value in human nutrition ***(Al-Shahib and Marshall,2003).*** Date*(Phoenix dactylifera*) natural products and their constituents are good approach in the control of infection as they are inexpensive, effective without side effects, and its constituents play a significant effect in the prevention or treatment of bacterial diseases***(Bokhari and Perveen,2012).***

Date fruits play a significant role as anti-inflammatory and recent report on the Ajwa dates showed that ethyl acetate, methanolic, and water extracts of Ajwa dates inhibit the lipid peroxidation cyclooxygenase enzymes COX-1 and COX2 ***(Zhang et al.,2013).*** A study in animal model showed that *date*has potential

protective effect via modulation of cytokines expressionsAnd reducing foot swelling and plasma fibrinogen***(Mohamed and Al-Okbi,2004 and Elberry et al.,2011).***

Dietary polyphenols have been shown to inhibit low density lipoprotein(LDL) oxidation, scavenge superoxide and other reactive oxygen species (ROS),increase plasma antioxidant capacity ***(Visioli et al., 2015).***It alsoaffects human platelet function in vitro and in vivo ***(Ostertag et al., 2010).*** Platelets play a central role in the formation of plaques within blood vessels, contributing to early inflammatory events; so, the observed cardiovascular benefits attributed to olive oil may be linked to the anti-platelet activity of olive oil polyphenols and thus to the suppression of platelet activation***(De Roos et al., 2011).***

Virgin olive oil (Oleaeuropaea)is rich in unsaponifiable minor components such as sterols, tocopherols and polyphenols. The polyphenols are natural antioxidants that not only contribute to the stability of the oil, but also have anti-inflammatory and anti-atherosclerotic properties ***(Gonzalez-Santiago et al., 2006 and Ostertag et al., 2010).***

Olive oil is mainly composed of oleic acid, plus additionaldifferent chemical components such as sterols, alcohols, antioxidants,and other fatty acids (apart from oleic acid) of minor elevance. An interesting study examined the biologicalconstituents of olive oil responsible for the modulation ofthe immune functions and revealed that the immunosuppressiveeffects attributed to olive oil are likely due to oleic acidrather than to other minor components of this fat***(Jeffery et al.,1997 andPuertollano et al.,2007).***

Fig *(FicuscaricaL.)* a deciduous tree belonging to the Moraceae family, is one of the oldest cultivated fruit trees and an important crop worldwide for both fresh and dry consumption. The most of the world's fig production is provided by Mediterranean countries ***(Gozlekci, 2010).***The dried fig contains phenolic substances which contribute to its quality. The phenolic compounds of dried figs can produce a significant increase of the antioxidant capacity of human plasma and can protect plasma lipoproteins from oxidation ***(Vinson, 1999).***

Date(Phoenix dactyliferaL.)fruit is good source of high nutritional value food. Indeedit is rich in carbohydrates, dietary fibers, proteins, mineralsand vitamin B complex, such as thiamine, riboflavin, niacin, pantothenic, pyridoxine, and folate***(Chao and Krueger, 2007; Al-Siddiq et al., 2013;Al-Harrasi et al., 2014; Eoin, 2016 andAl-Alawi et al.,2017).***Therefore, this study was conducted to investigate the effect of dried fig, date and olive oil supplementation on hematological parameters and immune functions in rats.

Materials and Methods

Materials:

Casein, vitamins, minerals and cellulose were obtained from Elgomhoria Company, Cairo, Egypt.Dried Fig (FicuscaricaL.,), olive oil (Oleaeuropaea) and date (Phoenix dactylifera)were obtained from Agriculture Research Center, Giza, Egypt.

Rats: Adults male albino rats (n = 54) of Sprague-Dawelystrain weighing (120 ± 5 g) were purchased from Helwan

Farm of Experimental Animals, Helwan, Egypt. Sheep red blood cells (SRBC) was obtained from VACSERA, Dokki , Egypt.

Chemicals: Kits for biochemical analysis were purchased from Gama Trade Company for Pharmaceutical and Chemicals, Dokki, Egypt.

Methods:

Chemical composition:chemical composition of dried fig,date and olive oil were determined according to the method described in the ***A.O.A.C.(2005).***

Experimental Design: Fifty four male ratswere housed inwell aerated cages under hygienic conditions and fed on basal diet for one weekfor adaptation. The basal diet was consisted of 14% protein (casein), 4% corn oil, 0.25% choline, 1% vitamin mixture, 3.5% mineral mixture,10% sucrose, 5% cellulose, 0.3% DL-methionine and the remainder was starch. The diet was formulated according to (Reeves et al.,1993). After this week rats were divided into two main groups as follows:-

The first main group (n=6) was fed on the basal diet during the experimental period and kept as a negative control group. The second main group (n = 48) was subcutaneously injected with a single dose of SRBC to induced immune suppression ***(Suke et al., (2006)***. Some random blood samples were taken from the eye of injected rats to insure of immune suppression.Then rats were divided into 8 subgroups (6 rats each) as follows: Subgroup (1)was fed on basal diet as positive control group.Subgroups2-4 were fed on basal diet and supplemented with olive oil (5%), dried fig (10%) anddate

(10%), respectively.Subgroups5-7 were fed on basal diet and supplemented withcombination ofolive oil 5% and dried fig,(olive oil 5% and date 10%) and finally, (dried fig10% and date 10%), respectively.Subgroup 8was fed on basal diet supplemented witha mixture of olive oil 5%, dried fig10%and date 10%.

During the experimental period, water and diet were introduced under hygienic conditions. At the end of the feeding period (8 weeks) rats were fasted over night before scarifying and twoblood samples were collected,one sample was centrifuged to obtain serum for biochemical analysis while , the second sample (whole blood) was used to determine the hematological parameters. Spleenwas removed from each rat for histopathological examination.

Biological Evaluation:

Biological evaluations were carried out by determination of feed intake (FI). Overall feed efficiency ratio(FER) (weightgained in grams per grams of feed consumed),body weight gain (BWG%) and organs relative weight were determined according to Chapman ***et al., (1959)*** .

$$\mathbf{BWG\%} = \frac{\mathbf{Final\ body\ weight - Initial\ body\ weight}}{\mathbf{Initial\ body\ weight}} \times \mathbf{100}$$

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

Biochemical analysis:

Immunoglobulin M (IgM) and immunoglobulin G (IgG) were measured according to ***Ziva and Pannall,(1984).***Red blood cell (RBC)count, haemoglobinconcentration(Hb),hematocrit (HCT), mean corpuscular hemoglobin(MCH), mean corpuscular hemoglobin concentration

(MCHC), platelets(PLT),white blood cell (WBC), eosinophils (EO), monocyte(MONO),lymphocyte(LYMPH)and neutrophils (NEUT) were estimated, using standard haematological technique as described by ***Ochei and Kolharktar, (2008).***

Statistical Analysis:The obtained results were analyzed according to SPSS program, version (18). ANOVA test was used to compare results among groups and $P<0.05$ was consider to be significant ***(SPSS, 1986).***

Results

The chemical composition of dried fig and date as shown in Table (1) indicated that, dried fig and date are high in(calories, carbohydrates,total fiber, vitamin K,vitamin B complex, zinc,potassium,calcium,magnesiumandphosphorus)butlow in fats and vitamin E concentration.Results revealed that, olive oilhigh in calories, total fat(monounsaturated fat,polyunsaturated fat,omega-3 fatty acid,omega-6 fatty acid), vitamin K and iron, but low in vitamin B complex and minerals.

Total phenols and total flavonoids of dried figs, date and olive oil were recorded in Table (2). They contains total phenols, in the following concentrations (36mgGAE,231 mg GAE and 142.21 mg GAE) respectively, and total flavonoids in the following concentrations(192 mg CE, 66 mg CE and125.64 mg CE). Dried fig have the highest concentration of total flavonoids however, olive oil have the highest content of total phenols.

As shown in Table (3),data indicated that body weight gain%for the positive control group with induced immune deficiency was significantly decreased (P**<**0.05), compared to the negative control group (-11.6 ±3.6 VS 25.8 ± 2.6 %), respectively. The body weight gain% increased significantly(P**<**0.05) in all groups which were supplemented with olive oil,dried figs and dates fruit separately or incombination compared to the positive control group .The highest body weight gain % was observed in group of ratsfed on dried figs at level 10% with a mean value of31.0 ± 3.4%. The results indicated that feed intake was increased in groups fed on the tested materials at the different supplemented level compared with the positive control group. Feed efficiency ratio was significantly(P<0.05) decreased in the positive control group compared to the negative control one with a mean value -0.028 ±0.53 VS0.041±0.22, respectively. There were no significant changes in feed efficiency ratio among groups fed onall tested materials,compared to the negative control group.

Table (4) shows the effect of olive oil, dried figs and date fruitseparately or in combination on red blood cell parametersinrats with induced immune deficiency. The positive control group had significant decrease (P<0.05) in the mean value of RBC, Hb andHCT ,compared to the healthy control group. On the other hand, rats fed dietssupplemented with olive oil ,dried figs and dates fruit significantly increased (P<0.05) the mean levels of RBC parameterscompared to the positive control group.There are no significant differences in the level of RBC betweenrats groups fed on diet supplemented with different mixture of fig, date and olive oil. Also the highestred blood cell value was observed in rats group fed on dried figs at level 10% with a mean value 15.5 ± 2.1 ($\times 10^6$/ul).

Table (5) shows the effect of olive oil, dried fig and date separately or in combination on MCH, MCHC and PLT inrats with induced immune suppression. The positive control group had significant reduction (P<0.05) in the mean value of MCH, MCHC and platlate,compared to thehealthy control group. On the other hand, supplementation with olive oil,dried figs and dates significantly increased (P<0.05) the mean value of MCH, MCHC and platlatecompared to positive control group. Also the highest MCH, MCHC and PLTvalues are observed in group fed on dried figs at level 10%.

Results illustrated in Table (6) revealed the effect of olive oil, dried figs and dates fruit separately or as a mixture on total leucocytic count inrats with induced immune suppression. Rats fed on different levels of olive oil,dried figs and dates fruit had significant decreased in the mean value of WBC, EO, MONO,LYMPH and neutrophils compared to the positive control group. On the other hand, the positive control group had significant increase(P<0.05) in the mean value of WBC compared with the control negative group. Also,the positive control group had significant decrease(P<0.05) in the mean value of eosinophil, monocyte, lymphocyte and neutrophil,compared with the control negative group and the groups fed on supplemented diet.

Results recorded in Table (7) show the effect of olive oil,dried fig and date at different levels on serum immunoglobulins (IgM and IgG) of rats with induced immune deficiency. The injection with SRBCto induceimmune deficiency in rats caused significant decrease in the mean value of IgM and IgG compared tothe control negative group. Diets Supplemented with a mixture of the tested materials

showedsignificant increased (P<0.05) in the mean levels of IgM and IgG,respectively compared to the control positive group.Also the highestIgM and IgGare observed in group which fed on the mixture of tested samples with a mean value of 749.0 ±16.4 (g/L), 81.4 ±1.8 (g/L).

Histopathological examination of spleen:

Microscopically, spleen of rats from the negative group revealed no histopathological changes with normal lymphoid follicle (Fig.1). However, spleen of rats from the positive group showed slight lymphocytic necrosis and depletion (Fig. 2). Meanwhile, spleen of rats fed on olive oil 5%, dried fig 10%, respectively revealed no histopathological changes (Figs. 3 & 4). On the other hand, spleen of rats fed on date at the level of 10%, revealed lymphocytic necrosis and depletion (Fig.5). Examined sections from groupsfed on the tested samples as a mixture, revealed no histopathological changes (Figs. 6 & 7). Moreover, spleen of rats which fed on dried fig 10% and date 10% and the mixture of olive oil 5%,date 10% and dried fig 10%, revealed no histopathological changes (Figs. 8 & 9).

Discussion

The immune system has evolved to protect the host from a universe of pathogenic microbes that are themselves constantly evolving. The immune system also helps the host eliminate toxic or allergenic substances that enter through mucosal surfaces. Central to the immune system's ability to mobilize a response to an invading pathogen, toxin or allergen is its ability to distinguish self from non-self. The host uses both innate and adaptive mechanisms to detect and eliminate pathogenic microbes. Both of these mechanisms include self-nonself discrimination***(David, 2010).***Medicinal plants and

their constituents play a vital and significant action to neutralize or inhibit the free radical by the use of antioxidant activity(Arshad et ***al.,2014).***

Dates have the highest concentrationof polyphenols among the dried fruits.The antioxidant activity of phenolic compounds is a result of their redox properties, which can play an important role in absorbing and neutralizing free radicals ***(Vinson et al.,2005).***Another finding in the support of dates as antioxidant reported that dates are a good source of antioxidants due to the carotenoids and phenolics with quantity 3942 mg/100 g and antioxidants constituents 80400 µmol/100 g (Bilgari et al.,2008).A study examined the antioxidant activities in different type of dates such as Fard, Khasab and Khalas and showed that Khalas is measured to be best quality, had higher antioxidant activity, total carotenoids, and bound phenolic acids than other types of dates ***(Al-Farsi et al.,2005).***

Results indicated that rats with induced immune deficiencyhad decreasedred blood cell parametersand increased WBC, compared to negative control group. These results are inagreement with ***Sadi et al., (2016)*** who reportedthatpectin extract of date significantly elevated the RBC (+ 5.5%, $p<0.01$), Hb (+ 14.35%, $p<0.001$), Ht (+11.85%, $p<0.001$), MCH (+11.29%, $p<0.001$) when compared with lead acetate treated group . No alteration in MCHC, WBC decreased significantly (-72.09%, $p<0.001$) and insignificantly increased in MCV whentreated with pectin of date.

The therapeutic effects of phoenix dactylifera are attributed to its polyphenolic content ***(Al-Farsi and Lee,2008).***

Plantpolyphenols are naturally occurring compounds found in fruit, vegetables, and in products such asfruit- and vegetable-derived sugars, juices, and oils. They are secondary metabolites in the plantsthey are produced from, serving as a defense system to ultraviolet light or pathogens ***(Pandey andRizvi,2009).***

Date exhibits potent anti-oxidative propertiesboth in vitro and in vivo. This allows the fruit to prevent depletion of intrinsic protection fromoxidative cell damage and assist these defense systems in reducing cell damage. Macroscopically,this mechanism may be relevant to the prevention of various adverse drug events common tochemotherapy including hepatotoxicity, nephrotoxicity, gastrotoxicity, and peripheral neuropathy***(Bibi et al.,2015).***The importance of dates has been documented in the Qur'an in Surah Maryam***(Arshad et al.,2014).***

Orally administered to healthy albino rats, theextract of *FicusCarica* significantly increased thehemoglobin concentration, hematocrit and red blood cellcount. However, it also decreased the total white bloodcell count, as well as the percentage of neutrophils, whencompared with the control group ***(Nebedum, et al., 2009).***These results are agreement with our results in this work.The *FicusCarica* extracts could also haveinsecticide effect (Kimet al., 2005), immunostimulant properties ***(Patil etal., 2010),*** and even antiscalent***(Abdel-Gaber et al., 2008).***

Data in this work show that feed intake in positive control group which induced with immune deficiency decreased significantly compared with negative control group. Results show also increase in feed intake in groups fed on dried fig separately or as a mixture compared to the positive control group .But this increase not

significantly with negative group.These results in agreement with the findings by ***Anderson and Woodend, (2003),***who mentioned that high glycemic carbohydrate are associated with a reduction in appetite and food intake in the short time,whereas the satiating effects of lower glycemic carbohydrate appear to be delayed .

Results in our study showed that body weight gain decreased significantly in positive group which induced immune suppretion compared to negative group which fed only on basal diet. These results in agreement with the findings by Al-Siddiq et al., 2013,who reported that groups which treated with different levels of figs (5,10,20) and leaves (4,6%) were have increase values of body weight gain compared to positive control group.Hassanen and Ahmed,2015 found that body weight gain was significantly increased in rats feed on ration mixed with fish oil and virgin olive oil and mixtures when compared with positive group,these findings correlated with those obtained by ***(Kasdallah-Grissa et al.,2008andHamadani et al.,2011)*** while the group injecteddiethylnitrosamineshowed significantly decreased in the body weight gain as compared to negative group ***(Metwally et al.,2011).***

Our result revealed that no significant change in FER in negative control group and groups which supplemented with different levels of tested samples,but significant increase compared to positive group. These results in agreement with the findings by ***Al-Siddiq et al., (2013),*** who reported that diet supplanted with 5 and10% date induced significant increase ($P<0.05$) in F.E.R. compared to positive group (diabetic rats).

Olive oil provides protection through multiple mechanisms. Because oxidation of proteins, DNA and lipids contribute to cancer development, the antioxidants in olive oil may also offer chemoprotective properties***(Visioli,2004).*** Research on olive oil and its components has also focused on their capacity to inhibit proliferation and promote apoptosis in several tumor-cell lines by diverse mechanisms.

Recent studies have clearly shown the important impact of polyunsaturated fatty acids (PUFAs) onhuman health in the prevention of, cardiovascular disease, coronary heart disease and cancer, inflammatory, thrombotic and autoimmune disease; hypertension; diabetes typetwo, renal diseases; and rheumatoid arthritis, ulcerative colitis, and Crohn's disease. Theirnon-substitutable roles in many biological pathways are crucial ***(De Caterina et al., 2000 and Abedi and Sahari, 2014).***

The virgin olive oil (VOO) oxidation process can be delayed by antioxidants.Polyphenols work as primary antioxidants to inhibit oxidationin VOO acting as chain breakers by a donation of a radicalhydrogen to alkylperoxyl radicals generated by the lipidoxidation and formation of stable derivatives during this reaction***(Servili et al.,2009).*** Phenolic compounds (oleuropein, protocatechuic acid) of virgin olive oil have also been shown to inhibit macrophage-mediated LDLoxidation ***(Masella et al.,2004 and Gorzynik-Debicka et al.,2018).***

Oleuropein, hydroxytyrosol, and their derivatives are polyphenolic compounds that areabundant in olive oil. They are powerful antioxidants displaying anticancer, anti-angiogenic andanti-inflammatory properties. They are also found to modulate the human immune system, affectingproliferation of the white blood cells and the production of cytokines ***(Gorzynik-Debicka et al.,2018).***

Evidence has shown that regular consumption of foods rich in phenolic compounds maydecrease the risk for the development of chronic diseases (***Tresserra-Rimbau et al.,2014andTresserra-Rimbau et al.,2016)***, mainly due to their ability tomodulate low-grade inflammation ***(Tangney and Rasmussen,2013).***The mechanisms by which these compounds may exert ananti-inflammatory effect, specifically on cardiovascular diseases, involves: antioxidant activity; modification of the signaling cascade and transcription network (blocking the signaling andexpression of nuclear factor kappa B); decrease of the adhesion of immune cells (T lymphocytesand monocytes) to the endothelium; and improvement of endothelial dysfunction.Due to thecomplex chemical composition of the oil, particularly the EVOO***(Tangney and Rasmussen,2013).***

For histopathological examination of spleen our result in agreement with ***Khalil et al., (2013)*** who reported that his to pathological alterations in the spleen architecture, as manifested by severe depletion and necrosis of lymphocyte in white pulp for positive group which exposed to chromium ($K_2Cr_2O_7$).

Altogether these results suggest toxic alterations within the spleen induced by $K_2Cr_2O_7$, indicating that the immune system may be hampered and so interfering in the body mechanisms of defense. The administration of EVOO ameliorate the immunosuppressive effect of $K_2Cr_2O_7$ through the protection against the lymphoid depletion in rats given combination of $K_2Cr_2O_7$ and EVOO, where the spleen showed hyperplasia of some white pulp and others showed depletion.

Finally, it could be concluded that, dried figs, dates fruit and olive oil stimulates the immune system of rats with induced immune deficiency.

Table (1): The crude chemical composition of dried fig ,date and olive oil.

Nutrients (100g)		Dried fig	Date	Olive oil
Nutrients	Calories (k.cal)	249	284	884
	Proteins (g)	3.3	3	0
	Fats (g)	0.9	2.9	98.9
	Saturated (g)	-	-	14
	Monounsaturated (g)	-	-	73
	Polyunsaturated(g)	-	-	11
	omega-3(g)	-	-	0.8
	omega-6 (g)	-	-	9.8
	Carb. (g)	63.9	73	0
	Total fiber (g)	9.8	5.2	0
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
Minerals	Zn (mg)	0.5	0.44	-
	Iron (mg)	2	-	0.56
	Manganese(mg)	0.5	-	-
	Potassium (mg)	680	696	-
	Magnesium (mg)	68	54	-
	Calcium(mg)	162	64	-
	Phosphorus(mg)	67	62	-
	Copper(mg)	0.3	-	-

Table (2): Total phenols and total flavonoids of dried fig, date and olive oil

Parameters \ Sample (100 g)	Dried fig	Date	Olive oil
Total phenols	36 mg GAE	231mg GAE	142.21mg GAE
Total flavonoids	192 mg CE	66 mg CE	125.64 mg CE

GAE: Gallic acid equivalent, CE: Catchin equivalent.

Table (3): Effect of olive oil, dried fig and date on body weight, feed intake and feed efficiency ratio in rats with suppression of immune system.

Groups \ Parameters	Initial Body Weight(g)	Final Body Weight(g)	BWG (%)	Feed intake (g/day/rat)	FER
Control (-Ve)	120.6 ±1.9^{a}	151.6 ±1.7^{ab}	25.8 ± 2.6 ^{ab}	12.5	0.041± 0.2 ^{a}
Control (+Ve)	120.2 ± 2.3^{a}	106.2 ±5.0 ^{c}	-11.6 ±3.6 ^{c}	8.3	-0.028±0.5 ^{b}
Olive Oil (5%)	118.2 ± 0.9^{a}	149.2 ±3.6^{ab}	26.1 ± 2.3^{ab}	11.0	0.046 ±0.2 ^{a}
Fig (10%)	119.4 ± 2.2^{a}	156.2 ± 2.6 ^{a}	31.0 ± 3.4 ^{a}	11.8	0.051 ±0.3 ^{a}
Date (10%)	120.0 ±1.3^{a}	155.4 ±6.4^{ab}	29.3 ± 4.1^{ab}	11.7	0.050 ±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	0.036 ±0.1 ^{a}
Date (10%) + Olive Oil (5%)	119.2 ±1.4^{a}	151.0 ±2.7^{ab}	26.6 ±1.7^{ab}	11.4	0.046 ±0.1^{a}
Fig (10%)+Date (10%)	121.8 ±1.1^{a}	146.6 ±5.2^{ab}	20.4 ± 4.7 ^{b}	11.3	0.036 ±0.4 ^{a}
Mixture (Fig10%+ Date 10% + Olive Oil 5%)	118.0±1.2 ^{a}	153.0±1.9 ^{ab}	29.7±2.2 ^{ab}	11.7	0.049 ±0.2 ^{a}

Values are expressed as means ±SE.

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

Table (4): Effect of olive oil, dried fig and date on red blood cell parameters in rats with suppression of immune system.

Parameters / Groups	RBC(× 10^6/ul)	Hb (g/dl)	HCT (%)
Control (-Ve)	13.6±0.4^{ab}	47.9±1.1^{a}	64.2 ±2.5^{a}
Control (+Ve)	8.8±0.1^{c}	30.0± 0.7^{e}	32.2±1.4^{d}
Olive Oil (5%)	11.5± 0.6 ^{b}	37.8± 0.3^{d}	52.0±2.5^{c}
Fig (10%)	15.5± 2.1^{a}	40.4±1.4 ^{cd}	53.6±1.2^{c}
Date (10%)	13.1 ±0.2^{ab}	40.2± 0.7 ^{cd}	52.3±1.0^{c}
Fig (10%)+Olive Oil (5%)	12.3± 0.9^{b}	41.8±1.7^{bc}	54.6±0.9^{bc}
Date (10%)+Olive Oil (5%)	13.5±0.2^{ab}	40.1±1.5 ^{cd}	51.3±0.1^{c}
Fig (10%)+Date (10%)	12.4±0.5^{b}	37.7±0.6^{d}	50.5±1.7^{c}
Mixture (Fig10%+ Date10% + Olive Oil 5%)	13.6±0.05^{ab}	44.6±0.3^{ab}	59.4±0.7^{ab}

Values are expressed as means ±SE.

Values at the same column with different superscript letters are significant differ at P<0.05.RBC = Red Blood Cell, Hb= Hemoglobin, HCT=Hematocrit.

Table (5): Effect of olive oil, dried fig and date on MCH, MCHC and PLT in rats with suppression of immune system.

Parameters / Groups	MCH (g/dl)	MCHC(g/dl)	PLT(× 10^3/ul)
Control (-Ve)	21.6±0.9^{a}	38.5±1.3^{a}	1173.5±0.5^{a}
Control (+Ve)	13.1±0.2^{e}	25.2±2.2^{d}	750.0±4.0^{f}
Olive Oil (5%)	16.5±0.5^{d}	30.5±1.4^{c}	850.0±11.0 ^{e}
Fig (10%)	17.8±0.2^{cd}	31.4±1.8^{c}	928.5±2.5^{c}
Date (10%)	16.7±0.1^{d}	32.5±0.1^{c}	872.5±3.5^{d}
Fig (10%)+Olive Oil (5%)	18.8± 0.9^{bc}	35.3±2.3^{abc}	949.0±1.0^{b}
Date (10%)+Olive Oil(5%)	17.3±0.3^{cd}	33.8±0.6^{abc}	940.0±4.0^{bc}
Fig(10%)+Date(10%)	17.6±0.3^{cd}	33.0±0 .9^{bc}	940.0±2.0^{bc}
Mixture(Fig10%+ Date10% +Olive Oil5%)	19.8±0.1^{b}	37.9±0.9^{ab}	941.0±1.5^{bc}

Values are expressed as means ±SE.

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

MCH = Mean Corpuscular Hemoglobin, MCHC= Mean Corpuscular Hemoglobin Concentration, PLT=Platelets.

Table (6): Effect of olive oil, dried fig and date on total leucocytic count in rats with suppression of immune system.

Parameters / Groups	WBC ($\times 10^3$/ul)	EO ($\times 10^3$/ul)	MONO ($\times 10^3$/ul)	LYMPH ($\times 10^3$/ul)	NEUT ($\times 10^3$/ul)
Control (-Ve)	4.7± 0 .3^{c}	0.055± 0.05^{b}	0.56± 0.03^{c}	2.55± 0.05^{c}	1.90± 0.06^{c}
Control (+Ve)	11.0± 0.9^{a}	0.01± 0.00^{b}	0.13± 0.02^{d}	1.05± 0.05^{d}	0.75± 0.05^{d}
Olive Oil (5%)	7.0± 0.6^{b}	0.10± 0.07^{a,b}	0.89± 0.01^{b}	4.47± 0.08^{b}	2.75± 0.04^{b,c}
Fig (10%)	8.1± 0.7^{b}	0.05 ± 0.04^{b}	1.16± 0.22^{b}	4.25± 0.54^{b}	3.02± 0.62^{b,c}
Date (10%)	7.3± 0.01^{b}	0.10± 0.02^{a,b}	0.98± 0.05^{b}	5.30± 0.07^{b}	3.40± 0.23^{b}
Fig (10%)+Olive Oil (5%)	6.8 ± 0.8^{b}	0.04 ± 0.02^{b}	0.96± 0 .01^{b}	4.545± 0.83^{b}	3.25± 0.34^{b}
Date (10%)+Olive Oil(5%)	7.2± 0.2^{b}	0.09± 0.03^{b}	1.01± 0.09^{b}	5.24± 0.39^{b}	3.18± 0.03^{b}
Fig(10%)+Date(10%)	7.4± 0.3^{b}	0.03± 0.02^{b}	1.04± 0.16^{b}	5.62± 0.38^{b}	2.87± 0.60^{b,c}
Mixture(Fig10%+ Date10% +Olive Oil5%)	6.9±0 .6^{b}	0.20 ±0.01^{a}	1.58± 0.07^{a}	7.95± 0.75^{a}	7.35± 0.45^{a}

*Values are expressed as means ±SE.

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

WBC=White blood cell, EO=Eosinophil ,MONO=Monocyte ,LYMPH= Lymphocyte ,NEUT=Neutrophils.

Table (7): Effect of olive oil, dried fig and date on serum IgG and IgM in rats with suppression of immune system.

Parameters / Groups	IgG(g/L)	IgM(g/L)
Control (-Ve)	458.9 ±11.3^{d}	41.2± 3.2^{e}
Control (+Ve)	354.5 ±24.7^{e}	19.3 ±1.3^{f}
Olive Oil (5%)	538.4 ±6.1^{c}	58.4 ±1.8^{c}
Fig (10%)	532.9 ±15.2^{c}	58.0 ±0.9^{c}
Date (10%)	482.6 ±4.0^{c,d}	49.1 ±1.6^{d}
Fig (10%)+Olive Oil (5%)	690.7 ±21.2^{b}	73.5 ±0.6^{b}
Date (10%)+Olive Oil(5%)	638.3 ±31.2^{b}	70.1 ±0.8^{b}
Fig(10%)+Date(10%)	644.9± 12.7^{b}	74.0 ±1.2^{b}
Mixture(Fig10%+ Date10% +Olive Oil5%)	749.0 ±16.4^{a}	81.4 ±1.8^{a}

Values are expressed as means ±SE.

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

IgG= Immune globulin G,IgM= Immune globulin M.

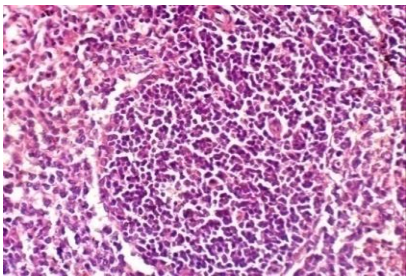


Photo (1):
Spleen of rat from negative group

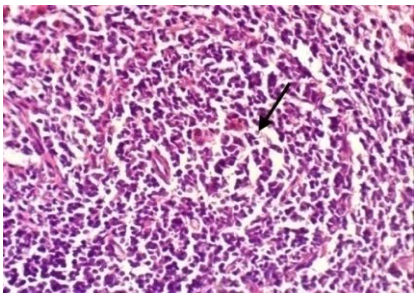
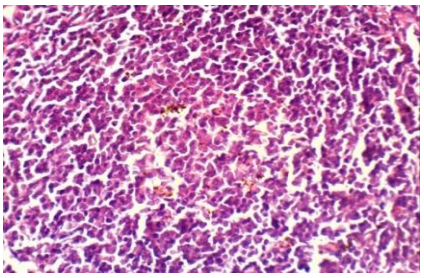
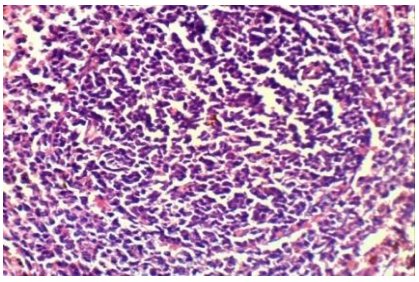


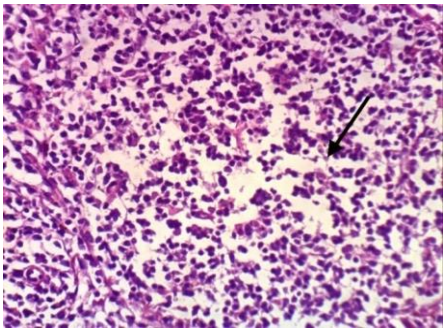
Photo (2):
Spleen of rat from positive group



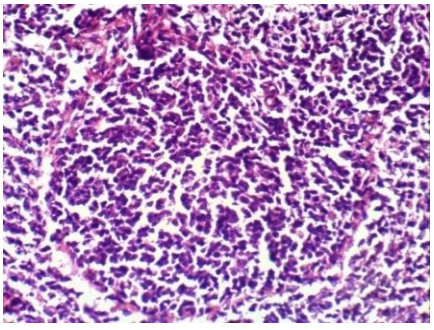
Photo(3):
Spleen of rat from group fed on (olive oil 5%).



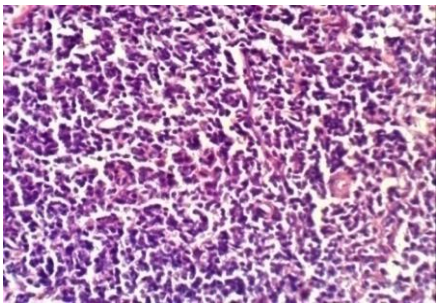
Photo(4):
Spleen of rat from group fed on (dried fig 10%).



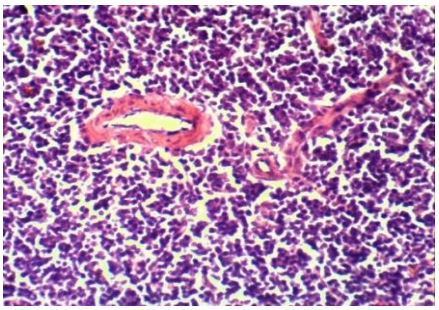
Photo(5):]
Spleen of rat from group fed on (date 10%) .



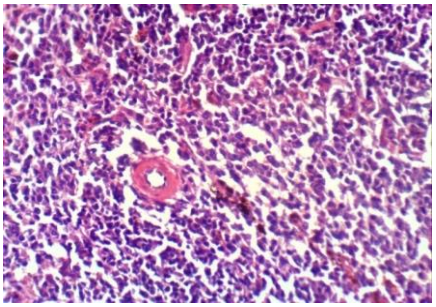
Photo(6):
Spleen of rat from group fed on (olive oil 5% and dried fig).



Photo(7): Spleen of rat from group fed on (olive oil 5% and date 10%).



Photo(8): Spleen of rat from group fed on (dried fig 10% and date 10%).



Photo(9): Spleen of rat from group fed on mixture of (olive oil 5% ,dried fig 10% and date 10%).

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Egyptian J. of Nutrition Vol. XXXIII No. 2 (2018)

التأثير العلاجي للتين المجفف، التمر وزيت الزيتون على الجهاز المناعى فى الفئران.

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الملخص العربى

أجريت هذه الدراسة لمعرفة تأثير التين المجفف،التمر وزيت الزيتون على القياسات الدموية والوظائف المناعية فى الفئران. تم استخدام ٤٥ من ذكور الفئران من سلالة الالبينو يتراوح وزنهم (١٢٠±٥ جرام) تم تقسيم كالتالى: المجموعة الاولي الرئيسية وهي المجموعة الضابطة السالبة وتتغذي علي الغذاء الاساسي فقط . المجموعة الثانية الرئيسية تغذت على الغذاء الاساسى وتم حقنها بجرعة من كرات الدم الحمراء للاغنام (٦ فئران في كل مجموعة) لاحداث نقص بالمناعة للفئران. ثم تم تقسيمهم الى ٨ مجاميع فرعية.المجموعة الاولى الفرعية تغذت علي الغذاء الاساسي فقط وهي تمثل المجموعة الضابطة الموجبة.المجاميع الفرعية من ٢-٤ تم تغذيتهم على الغذاء الاساسى مع اضافة كلا من زيت الزيتون بنسبة ٥% والتين المجفف بنسبة ١٠% والتمر بنسبة ١٠% منفردا . المجاميع الفرعية من ٥- ٧ تم تغذيتهم على الغذاء الاساسى مع اضافة خليط من زيت الزيتون بنسبة ٥% والتين المجفف بنسبة ١٠% ، خليط من زيت الزيتون بنسبة ٥% والتمر بنسبة ١٠% ، خليط من التين المجفف بنسبة ١٠% والتمر بنسبة ١٠% على التوالى . اما المجموعة الفرعية الثامنة تم تغذيتها على خليط من زيت الزيتون ٥%, والتين المجفف١٠% والتمر١٠% لمدة ٨ أسابيع.أظهرت نتائج التحليل الكيميائي ارتفاع محتوياالتين 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 التى تغذت على الثلاث عينات محل الدراسة (التين المجفف ١٠% ,التمر ١٠% وزيت الزيتون ٥%) أدي الي حدوث ارتفاع معنوي فى المقاييس المناعية **(P<0.05)**حيث كانت نسبة**IgG, IgM** ٧٤٩, ٨١,٤ **(g/L)**على التوالى مقارنة بالمجموعة الضابطة الموجبة. مقاييس الدم قد ارتفعت بدرجة معنوية(**P<0.05**) فى المجاميع التى تغذت على التين المجفف ,التمر وزيت الزيتون منفردا او كخليط. بينما انخفضت نسبةكرات الدم البيضاء

بتلك المجاميع.علاوة علي ذلك، كان هناك زيادة معنوية فى كلا من معدل الزيادة فى الوزن ,الطعام المتناول ومعدل كفاءة الطعام فى المجاميع تحت الدراسة التى تم اختبارها مقارنة بالمجموعة الضابطة الموجبة. توصي الدراسة بتناول التين المجفف ,التمر وزيت الزيتون لتنشيط وزيادة كفاءة الجهاز المناعي في الفئران المصابة بنقص المناعة.