التأثير الكيميائي والبيولوجي لمستويات من حبوب لقاح النخيل المجففة على الفئران المصابه بنقص المناعة

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المستخلص :

نقص المناعة هو مصطلح يشير إلى عدد من الحالات التي يفقد فيها الجهاز المناعي جزئيا أو كليًا من قدرته على مكافحة الأمراض المعدية. في بعض الحالات ، يمكن أن يؤثر نقص المناعة أيضًا على قدرة الجسم على أداء وظيفته الطبيعية في مهاجمة الخلايا التي قد تصبح سرطانية. لذا هدفت الدراسة الحالية إلى دراسة بعض المتغيرات الكيميائية لحبوب لقاحالنخيل المجفف (Phoenix dactylifera L) الصنف الحياني وتأثيره على المتغيرات البيولوجيةوالكيميائية الحيوية (لذكور الجرذان البيضاء المعالجة بدواء مثبط للمناعة. تم تقدير المكونات الكيميائية والمحتويات المعدنية والبوليفينول الكلي والفلافونويد الكلي لحبوب لقاح النخيل المجففة. استخدم ثلاثون ذكور جرذ ألبينو وزنها ١٨٠ ± ١٠ جم. تم تقسيمها إلى ٥ مجموعات. المجموعة الأولى كانت تحكم سلبي (–) ، المجموعة الثانية عولجت بمعدلات ٥ ملغ من الدواءالمثبط للمناعة لمدة ٧ أيام لتثبيط المناعة. عولجت المجموعتان ٣ و ٤ و ٥ بنفس المانع وحصلت على ١٠٠،١٥٠ و ٢٠٠ جم / كجم / كجم من حبوب لقاح النخيل المجفف على التوالي. في نهاية التجربة (٢٨ يوم) تم حساب وزنها وكمية الغذاء المتناول و نسبة كفاءة الغذاء ووزن بعض الأعضاء. كما تم أخذ عينات الدم لتحليل نسبة الجلوكوز في الدم ونسبة الدهون وأنزيمات الكبد وإنتاج الغلوبولين المناعي والإنترلوكين ١ والإنترلوكين ٦ و نشاط مضادات الأكسدة وخلايا الدم البيضاء والخلايا الليمفاوية. أظهرت النتائج أن حبوب لقاح النخيل المجفف يحتوي على نسبة عالية من البروتين والمعادن الحيوية مثل الكالسيوم والحديد ومكونات البوليفينول الكلي والفلافونويد. كان له تأثير إيجابي معنوي على المعايير البيوكيميائية المختبرة مثل الجلوكوز في الدم ،

مستوى الدهون ، وظائف الكبد والاستجابة المناعية خاصة عند مستوى ٢٠٠ جم / كجم. لذلك ، استنتج أن حبوب لقاح النخيل المجففة ٢٠٠ جم / كجم / وزن متبوعًا بـ ١٥٠ جم / كجم / كجم في النظام الغذائي أكثر فاعلية فى السيطرة على نقص المناعة. لذا ينصح المرضى المصابين بالعدوى بتناول حبوب لقاح النخيل والتي تعتبر أغذية علاجية لنقص المناعة .

The chemical and biological effect of dried date palm levels on rats with immunity deficiency

Abstract

Immune deficiency is the term for any several disorders in which the immune system loses some or all of its capacity to resist infectious illness. In some instances, immunological deficiency might impair the body's capacity to carry out its normal role of combating cancer-causing cells. This research objects to study the some chemical parameters of dried date palm pollen (*Phoenix dactylifera L.*) El-Hayani cultivar and its effect on biological and biochemical parameters of male albino rats treated with sandimmune syrup as immunity inhibitor. In addition to chemical ingredients, mineral content, total polyphenols, and total flavonoids, the chemical compounds of dried Palm pollen were also studied. Thirty male albino rats their weight was 180± 10 g. were allocated into 5 groups. The first was negative control (-), the second group was rates treated with 5mg of sandimmune syrup for 7 days to inhibit the immunity. Groups 3,4 and 5 were treated with the same inhibitor and received 100,150 and 200 g/kgbw dried date palm pollen, respectively. At the end of the experiment (28 d), their weight ,feed intake , FER and some organs weight were calculated. Also, blood specimens were taken for analysis of serum glucose, lipids profile and liver enzymes, immunoglobulin production, interleukin 1, interleukin 6 and tumor necrosis factors, antioxidants activity compounds, white blood cell and lymphocytes. Results showed that dried date pollen (DDP) had high protein, vital minerals as calcium and iron, total polyphenols and flavonoids components. Also, it had significantly positive effect on the tested biochemical parameters as serum glucose ,Lipids profile, liver functions and immunity response especially at the level 200g/kgbw. Therefore, the dried date palm pollen 200g/kgbw followed by 150 g/kgbw in the diet are more effective compared with controlling immunity

deficiency. Infectious patients are encouraged to consume date palm pollen, which is regarded an immunity-boosting meal.

Keywords :Date pollen; immunity; immunoglobulin production ; antioxidants activities

Introduction

Immunity is considered as all of the body's defense systems against outside environmental elements (microorganisms or their products; foods; chemicals; medications; pollen; animal hair).Originating from the Latin 'immunes', which means 'exempt'. The immune system must distinguish between an individual's own cells and those of pathogenic organisms, must not assault beneficial commensal microorganisms that inhabit the host's stomach, skin, and other tissues**(Turvey and Broide, 2010).**

Antigens are recognised and responded to by the immune system. Immunological identification: The existence of a pathogen must be identified (by the innate and adaptive immunity) for the person to be adequately protected against illness. Using a variety of immunological effects or activities (e.g. antibodies, complement), involve the infection and, if feasible, remove it. Immune control restricts the harm caused by the immune response to antigen to the host. The absence of this control leads to the development of allergies and autoimmune disorders. The adaptive immunity establishes immunological memories when an infectious agent elicits an immune response that may remain and prevent later exposures **(Fine, 2013and Baumann & Gauldie, 2014).**

The ancient Egyptians referred to pollen as "a dust that gives life." Pollen of the date palm (DPP) has been utilized for thousands of years as an Egyptian herbal remedy for enhancing male development and performance. Studies on the phytochemistry of date pollen revealed the prevalence of estrone, -amirin, triterpenoidal saponins, estradiol, estriol, five flavonoids, and a crude gonadotrophic compound. In addition, the elevated phenolic and flavonoid concentration of date pollen was discovered to enhance and raise the resistance of various tissues to various hazardous infections and toxicants**(Daoud *et al.*, 2015; Ayatollahi *et al.*, 2019 and Alalwan *et al.*, 2020).** The research aims to evaluate the chemical and biological effect of dried date palm levels on rats with immunity deficiency.

Material and methods

Materials:

This study was carried out using dried date pollen as powder which obtained from New Valley Governorate. Thirty (30) mature male albino rats each weighing 180± 10gm and 14-16 weeks old of Sprague Dawley strain were obtained from the Laboratory Animal Colony, Helwan, Egypt. The basel diet consisted of casein as a source of protein , corn oil as a source of fat, choline chloride, vitamin mixture, cellulose as a source of fiber, salt mixture and corn starch were obtained from Gomhoria Co., Dokki, Giza. Kits were obtained from Gamma Trade Company, Egypt and sandimmune syrup was obtained from Novarties Co. .

Methods:

Chemical analysis of dried date pollen (DDP)

Triplicate sample of DDP underwent chemical investigation to identify content: Moisture, protein, fat, ash and crude fiber regarding **A.O.A.C.(2005).**Total carbohydrates were determined by difference**.**

Determination of minerals content

Atomic absorption spectrophotometry (PerKin – Elmer Instrument Model 2380, Germany) was utilized to assess mineral concentration , as described by **Nzikou *et al.* (2009)**.

Determination of amino acids

Amino acid determination was carried out according by **Adeyeye and Afolabi (2004).**

Determination of Ascorbic acid (vitamin C), vitamin E and beta carotene

Vitamin C was detected by utilizing 2, 6- dichloro-phenol-indophenol dye **(Lu *et al.*, 2017).** Vitamin E and beta carotene determined according to methods of **Taga et al. (1984) &Klein and Perry (1982)** respectively**.**

Determination of total flavonoid

Aluminum chloride colorimetric technique by **Park *et al* (1997).**

Determination of total phenols

Using Folin Ciocalteu reagent and the **Singleton and Rossi (1965)** technique, the quantity of phenols in DDP was measured**.**

Determination of 2,2-diphenyl-1-picrylhydrazyl (DPPH)

According to the technique suggested by **Xu and Chang (2007)**, the DPPH free radical scavenging capabilities of DDP was evaluated.

Basal diet composition of tested rats

Dietary requirements for the trial were according to **AIN (1993)** which consisted of corn starch (67.6%), casein (11.9%), corn oil (10%), salt mixture (4%) **(Hegsted *et al.*, 1941)**, vitamin mixture (1%)(**Campbell, 1963**), barn (5%), methionine (0.3%) and choline chloride (0.2%)**.**

Experimental design and animal groups

Rats (n=30) were housed in individual stainless steel cages fitted with a wire mesh bottoms and front in room maintained at 25 ±2°C under controlled environmental conditions , in the animal house in Ophthalmology Institute, Giza , Egypt and were fed on standard diet for a week as an adaptation period . Diet was offered to rats in special food cups to minimize looser conditions of feed and water was offered to the rats by glass tubes maintained to one side of the cage, feed and water offered ad-labium and examined every day for 28d. The rats were divided into 5 groups (6 rats in each group):

Group (1): Negative control (-ve), in which normal rats were fed on basal diet for 28 days.

Group (2): Positive control (+ve), in which had sandimmune syrup (5mg\kg bw for a week) and fed on basal diet for 28 days. Groups 3,4 and 5 were treated with sandimmune syrup(5mg\kg bw for a week)and fed on basal diet contained 100,150 and 200g/kgbw DDP (**Daoud *et al.*, 2015)**,for 28 days.

Biological evaluation

During the trial period (28 days), daily dietary intake and weekly body weight measurements were taken. The body weight gain **(BWG),** feed efficiency ratio **(FER),** and some organs weight were determined by **Chapman *et al.*, (1959) as**:

Body weight gain = Final weight (g) – Initial weight (g)

Feed efficiency ratio (FER) = Gain in body weight (g) / Feed intake (g) .

Blood sampling and organs

From all the previously mentioned groups, after a 12-hour fast, blood specimens were obtained at the end of experiment. Utilizing ether-anesthetized

abdominal aorta from rats that had been scarified. Blood specimens were placed in dry, clean centrifuge tubes and allowed to clot at room temperature for 30 min before being spun at 3000 rpm for 10 min for serum separation. Serum was aspirated with care, transported to clean tubes, and stored at -20 °C until the time of analysis **Malhotra (2003)**.All serum specimens were examined to ascertain: glucose was measured using the **Trinder (1969)** technique**,** triglycerides and total cholesterol were measured according to **Fossati and Prencipe (1982)** and **Allain,(1974)** respectively, HDL, VLDL-c and LDL-c were analyzed as **Lopez,(1977) and Lee & Nieman (1996)** respectively. Glutathione peroxidase (GPX), superoxide dismutase (SOD), catalase (CAT), glutathione s-transferases (GSTs), total antioxidant capacity (TAC) and malondialdehyde (MDA) were measured by method of **Zhao (2001), Sun *et al*. (1988), Diego (2011), Hegsted *et al*. (1941), Koracevic (2001), Satoh (1978) and Ohkawa *et al*. (1979)** respectively. Serum cytokines**(**serum IL1 was determined using ELISA kits according to the method of **Smith(1988)**.Serum IL6 was determined using ELISA kits regarding **Van Snick (1990)**.Serum TNF was measured utilizing ELISA kits according to **Maury(1986)**.Immunoglobulin productions were determined by **Anna *et al.(* 2016).** Lymphocytes and white plod cell account were determined by **Drabkin, (1949) and Ebihara & Okano (1995)** respectively**.** At the same time, the organs liver, kidney, and spleen were extracted, washed in saline solution, cleaned with filter paper, and weighed by **Drury and Wallington's (1980)** procedure.

Statistical analyses

The results are expressed as mean ± SD. Difference among treatments at ($P \leq 0.05$) were considered significant (**S.A.S., 1985)**.

Results and discussion

Chemical composition of dried date pollen (DDP)

The proximate values of DDP are shown in Table (1). DDP have moisture contents (19.1 %), protein (34.15%), fat (20.72%), fiber (3.61%), ash(4.31%), carbohydrates (18.11%) and total calories (395.52%).The chemical content of tested DDP was close to the values which reported by **Hassan (2011)** who found that DP contained moisture (28.8%), ash (4.57%), crude fat (20.74%), crude protein (31.11%) and carbohydrate (13.41%)in other study revealed that Egyptian date pollen grains have rich content of protein and carbohydrate (36.28 and 17.14 g/ 100g**(Bishr and Desoukey ,2012).**

Hassan, H.M.M., 2011. Chemical Composition and Nutritional Value of Palm Pollen Grains. Global Journal of
Biotechnology & Biochemistry. 6: 01-07
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Table (1): Chemical composition of 100 g dried date pollen (DDP)

Nutrient components	Contents (%)
Moisture	19.1±2.09
Protein	34.15±6.97
Fat	20.72±3.22
Fiber	3.61±0.67
Ash	4.31±0.84
Carbohydrates	18.11±1.03
Calories	395.52±8.16

Values are means ± SD (n = 3).

Minerals content of dried date pollen (DDP)

Table (2) shows the mineral composition per100 g of the DDP. Magnesium was found to be the most abundant mineral element (709.89 mg/100 g) followed by potassium and calcium. It had moderate amount of selenium while copper followed by sodium were generally low. Similar observation was reported by **Hassan (2011)** who found that date pollen had high content of Mg, Fe, and Zn (318, 226.5, and 124.4 mg/100g) and also similar findings were described by **Al-Hooti *et al.* (1997**), and the obtained findings are in close agreement with those of many other researches, which indicate DDP have suitable values of calcium, potassium and phosphorus, that are significant for metabolism in human cells. Magnesium and calcium are essential for healthy bone development and for energy metabolism, and iron is necessary for RBCs formation. The high potassium and low sodium contents of dates are useful for people with hypertension **(Gasim, 2009).**

Table (2): Minerals content of dried date pollen (DDP)

Minerals	Content per 100g
Iron (mg)	221.89±11.43
Phosphorous (mg)	241.65±10.24

Potassium (mg)	698.06±8.56
Magnesium(mg)	709.89±10.23
Copper (mg)	33.77±5.11
Sodium (mg)	10.02±2.13
Calcium (mg)	428.07±9.36
Zinc (mg)	119.87±9.72
Selenium(µg)	59.23±4.21

Values are means ± SD (n = 3).

Amino acids content of dried date pollen (DDP)

Amino acids of DDP are shown in Table (3). Date pollen contained 7 essential amino acids and 9 nonessential ones **(Hassan, 2011).**Regarding the essential amino acids, the findings demonstrated that it had high leucine content followed by isoleusine and lysine content .Meanwhile, DDP contained nearly amount of theronine, phenylalanine and valine contents . the lowest EAA value was methionine . Nonessential amino acids had high content of aspartic acid and serine in comparison with the other NEAA. It was also noticed that DDP contained rarely values of glysine, tyrosine and valine .Also alanine and arginine were in similar values. Furthermore, histidine was the lowest one. The nutritional quality of food is often determined by comparing its individual amino acids to **FAO/WHO/UNU (2007)** reference standards**.** Essential and non-essential amino acids are distinguished by the capacity of the human body to synthesis necessary amounts. An amino acid is necessary if the body cannot produce it in adequate quantities. Similar findings were reported by **Bishr and Desoukey (2012)**, the DDP results revealed a different mix of amino acids**.** Numerous research have shown that 2-5 amino acids account for about 50% of the protein weight in pollen, whereas the other amino acids (15-18) account for the remaining 50% **(Szczêsny, 2006).**The amino acid composition of pollen grains varies depending on environmental and dietary circumstances of the plants**(Stanley, 2017).**

Table (3): Amino acids content of dried date pollen (DDP)

Amino acids	Content per 100g
Essential Amino acids	
Isolucine	6.91±0.32
Leucin	7.83±1.14
Lysine	5.53±0.47

Theronine	4.21±0.03
Methionine	1.64±0.41
Phenylalanine	4.23±0.62
Valine	4.27±0.76
Non Essential Amino acids	
Alanine	5.98±1.05
Arginine	5.97±0.78
Glutamic acid	8.79±0.44
Glysine	3.60±0.22
Serein	6.08±0.06
Histidine	2.65±0.65
Aspartic acid	10.55±1.39
Proline	3.95±0.67
Tyrosin	3.25±0.84

Values are means ± SD (n = 3).

Vitamins content of dried date pollen (DDP)

Table (4) showed that DDP contained antioxidant vitamins as vitamin E, C and beta carotene. it had high content from beta carotene (210.45±9.76 IU/100g) followed by Vit.E (3756.32±10.43 IU/100g).The studies showed that date pollen contained vitamin E in the range of 40 to 320 mg/kg , beta carotene in the range of 10-200 mg and vitamin C between 50 to 560mg/kg**(Szczêsna, 2006 and Stanley, 2017).**As an antioxidant, vitamin E shields membranes from oxidation by interacting with lipid radicals generated in the lipid peroxidation chain reaction**(Azzi*et al.*, 2002).**Vitamin E performs its antioxidant effect by donating the hydrogen or hydroxyl group of its chroman ring to destroy free radicals**(Shang, 2003).**The recommended daily amount of ascorbic acid for adults is 60 mg, while for children it is 20 mg (for children) **(Bishr and Desoukey, 2012).** The body requires Vitamin C for formation of collagen, blood and hormones. Additionally, it aids in the formation of bones and teeth, prevents scurvy, and acts as an antioxidant against free radicals. Vitamin C suppresses, minimizes, and ends the development of free radicals by giving hydrogen and an electron, therefore transforming ascorbic acid into dehydroascorbic acid and so modifying its constitution **(Szczêsna, 2006)**. In the case of vitamin A, it has antioxidant action in humans and is essential for eyesight, bone development, and reproduction.

Table (4): Vitamins content of dried date pollen (DDP)

Vitamins	Content per 100g
Vit.C(mg)	91.07±8.54
Vit.E(IU)	3756.32±10.43
Beta carotene (mg)	210.45±9.76

Values are means ± SD (n = 3).

Total phenols, total flavonoids and DPPH of dried date pollen (DDP)

Data in Table (5) revealed that DDP contained total phenol , total flavonoid and DPPH as antioxidant compounds at the levels 58.972±4.87, μgGAE/g, 42.541±6.83 μgGAE/g and 79.65± 5.32 % respectively. The inhibitory impact for linoleic acid oxidation and consequent bleaching of -carotene was 210.45, guaranteeing the DPPH radical scavenging test result (79.65%). Gallic acid equivalents were utilizing to assess the total phenolic content. Phenolics exhibit their antioxidant effect primarily by scavenging free radicals. The aforementioned finding is in agreement with the antioxidant activity investigated for pollen essential oil, as well as the references reporting the responsibility of plant phenolics, as flavonoids, for potent antioxidant, antimutagenic, and anticarcinogenic activity, and revealing that DDP contains flavonoids and phenolics that exert their antioxidant role by scavenging free radicals, chelating metals, and inhibiting lipid peroxidation. The –OH at position C3 of the flavonoid composition is involved in chelating and scavenging action **(Middleton and Kandaswami, 1994; Rice-Evans *et al.*, 1997 and Arafat *et al.* ,2013) .**

Table (5): Total phenols, total flavonoids and DPPH of dried date pollen (DDP)

Compounds	Content
Total phenol μgGAE/g	58.972±4.87
Total flavonoid μgGAE/g	42.541±6.83
DPPH (%)	79.65± 5.32

Values are means ± SD (n = 3).

Effect of different levels of dried date pollen on Body weight gain (BWG), feed intake (FI) and feed efficiency ratio (FER) of rats treated with immunity inhibitor (sandimmune syrup)

Results in Table (6) illustrated that the affecting of BWG, feed intake (FI) and feed efficiency ratio (FER) for rats treated by immunity inhibitor .As shown in the table, BWG , FI g/28 day and FER of positive control group were greatly declined significantly ($P \leq 0.05$) than negative control group. While groups treated with immunity inhibitor and fed on diet containing 100,150 and 200mg/kg body weight appeared a high gradual elevation in BWG, FI and FER as compared to positive control group. The fifth group recorded best results of BWG, FI and FER which received 200mg/kgbw. Potential health problems associated with low immunity have been linked to decreased energy intakes, weight gain and the weight loss epidemic as indicated by **a Silva (2013)** who reported that Low immunity produced protein energy malnutrition (PEM) as well as increased thymocyte apoptosis and a stronger proinflammatory thymocyte response to leptin due to elevated leptin receptor expression. Also, **Ortiz (2009**) observed the interacting relationship between nutrition, growth, and immune development, with infections, microbial colonization of the gut, and T cell activation. The statistical analysis showed significant positive relations between treatments of BWG, FI, and FER and DDP than positive control group, these findings are in line with those revealed by **Arafat *et al.* (2013)**who described DDP contain growth promoter factors as triterpens, flavonoids ,alkaloid, tannin and coumarins, which improve the immunity index by adsorption mechanism which involves oppositely charged ionic interaction as dipole–dipole, dipole-induced dipole and induced dipole-induced dipole, hydrogen bonding, chemical bonding and ion exchange.

Table (6) : Effect of different levels of dried date pollen on Body weight gain (BWG), feed intake (FI) and feed efficiency ratio (FER) of rats treated with immunity inhibitor (sandimmune syrup)

Parameters / Groups	BWG (g/28d)	FI (g/day)	FER (g/rat/day)
	Mean ±SD	Mean ±SD	Mean ±SD
Negative control (G1)	35.52^{a}± 3.32	13.15^{a} ±0.02	0.096^{a}±0.006
Positive control(G2)	5.14^{e}± 0.91	6.06^{c} ±1.51	0.030^{e}±0.002
100 mg DDP /kgbw(G3)	9.03^{d}±0.62	7.95^{c} ± 0.05	0.041^{d}±0.001
150mg DDP /kgbw(G4)	13.36^{c}± 1.03	8.83^{b} ± 0.76	0.054^{c}±0.003
200mg DDP /kgbw(G5)	24.38^{b}±3.65	10.07^{a} ± 2.08	0.086^{b}±0.004

Values are means ± SD (n = 6).Means in the same column with different litters are significantly different Significant ($p \leq 0.05$).

Effect of different levels of dried date pollen on some organs weight of rats treated with immunity inhibitor (sandimmune syrup)

Table (7) results illustrated the effect of sandimmune syrup as a immunity inhibitor in rats with DDP on some organs weight. As shown in the table, the best organs weight improvement was recorded for group 5 which received 200mg/kg followed by 150mg/kgbw from DDP. The significance of the DDP in human nutrition stems from its nutrient-rich content, which includes carbs, dietary fibers, vitamins, lipids, amino acids, protein, and vital minerals. In addition to its nutritional benefits, research has shown that DDP has powerful antioxidant and antimutagenic properties. In addition, they reported the effect of DDP extract against disorders, where free radicals play a significant role in pathophysiology, and this compound was shown to be very effective as a hepatoprotective, antioxidant, antihyperglycemic, immunomodulatory, and antihyperlipidemic agent, and the cardiotonic substance was concurrent with an increase in antioxidants including superoxide dismutase, catalase, and glutathione **(Rice-Evans *et al.*, 1997; Arafat *et al.*,2013 and Ibrahim *et al.*,2014) .**

Abed MA(2005) Determine of carbohydrates, protein and phenoliccompounds content in
pollen grains of three of Palm Phoenix dactylifera. Basrah Journal ForDate Palm Research
4:141-149.
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Table (7) : Effect of different levels of dried date pollen on some organs weight of rats treated with immunity inhibitor (sandimmune syrup)

Groups / Parameters	Negative control (G1)	Positive control(G2)	100 mg DDP /kg bw(G3)	150 mg DDP /kgbw(G4)	200 mg DDP /kgbwG5)
Liver	$4.02^{e}\pm0.16$	$7.19^{a}\pm0.07$	$6.88^{b}\pm0.55$	$6.09^{c}\pm0.15$	$5.94^{d}\pm0.44$
kidneys	$1.31^{e}\pm0.12$	$1.65^{a}\pm0.32$	$1.62^{b}\pm0.05$	$1.57^{c}\pm0.76$	$1.50^{d}\pm0.14$
Spleen	$0.72^{d}\pm0.08$	$1.30^{a}\pm0.16$	$1.29^{a}\pm0.11$	$1.12^{b}\pm0.83$	$0.99^{c}\pm0.02$

Values are means ± SD (n = 6).Means in the same column with different litters are significantly different Significant ($p\leq0.05$).

Effect of different levels of dried date pollen on serum glucose of rats treated with immunity inhibitor (sandimmune syrup)

Table (8) results revealed that the effect of low immunity in rats with levels of DDP on serum glucose. As shown in the table, the best glucose level which was found in group 5? DDP caused a considerable decrease in blood glucose and an increase in serum insulin, data indicated that DDP may have a hypoglycemic impact owing to the presence of minerals, flavonoids, and phytoestrogens. Minerals found in palm pollen have a significant role in the treatment of diabetes mellitus, such as magnesium, which regulates insulin activity and insulin-mediated glucose absorption. Zinc enhances the synthesis and release of insulin, chromium enhances insulin's action, and selenium, which has been shown to promote glucose absorption, modulates glycolysis and pentose phosphate processes. Also, according to the same author, polyphenols chemicals contained in date palm pollen are regarded as a potent inhibitor of alpha glycosidase and alpha amylase, resulting in a decrease of

carbohydrate digestion and absorption which might battle the hyperglycemia prevalent in diabetes **(Abbas & Abdel-Monem ,2011 and Chakroun *et al*.,2016)**

Table(8): Effect of different levels of dried date pollen on serum glucose of rats treated with immunity inhibitor (sandimmune syrup)

Variable	Negative control (G1)	Positive control(G2)	100 mg DDP /kg w(G3)	150 mg DDP /kgbw(G4	200 mg DDP /kgbwG5)
Glucose (mg/dl)	97.42^{e} ± 2.90	167.55^{a} ± 4.78	159.32^{b} ± 8.08	143.56^{c} ± 7.08	139.35^{d} ± 3.92

Values are means ± SD (n = 6).Means in the same column with different litters are significantly different Significant ($p \leq 0.05$).

Effect of different levels of dried date pollen on serum glucose of rats treated with immunity inhibitor (sandimmune syrup)

Data in Table (9) described the effect of different levels of DDP on serum lipid profile of rats with low immunity. Data in this table explained that serum of LDL-c, VLDL-c, TC and TG were pronounced increased significantly ($P \leq 0.05$) besides decreased significantly ($P \leq 0.05$) of HDL-c of positive control group than negative control group . The rats fed on diet containing levels of DDP revealed dramatically decreases of serum LDL-c, VLDL-c, TC and TG at the same time greatly increases of HDL-c. As shown in the table, the best treatment was recorded in group 5 which received 200mg/kg bw. Positive effects of DDP have been attributed to antioxidants, and especially phenolic compound. Polyphenols can improve the lipid profile in cardiovascular patients. The method of DDP's hypolipidemic impacts might include its recognized ingredients, including phytosterols and polyunsaturated fatty acids (that declined plasma total and LDL-c compared with saturated fatty acids).Additionally, fatty acids and sterols in date palm pollen may inhibit intestinal cholesterol absorption (**Chakroun *et al*.,2016 and Ibrahim *et al*., 2017).**

Table(9): Effect of different levels of dried date pollen on lipid profile of rats treated with immunity inhibitor (sandimmune syrup)

Groups / Parameter	Negative control (G1)	Positive control(G2)	100 mg DDP /kg w(G3)	150 mg DDP /kgbw(G4	200 mg DDP /kgbwG5
Total cholesterol (TC) (mg\dl)	75.75^{e}±4.25	119.01^{a} ± 1.37	110.9^{b}±1.62	103.62^{c}±2.24	97.13^{d}±2.38
Triglycerides (TG) (mg\dl)	72.15^{e}± 3.94	124.85^{a}± 2.7	100.80^{b}±2.4	110.23^{c}±4.20	72.4^{d}±2.56
low density cholesterol (LDL-c) (mg\dl)	20.23^{e}± 5.8	57.42^{a}± 2.5	50.12^{b}± 2.7	43.22^{c}± 2.7	35.5±3.5^{d}
High density cholesterol (HLDL-c (mg\dl)	41.09^{c}± 2.7	36.62^{d}± 3.4	40.62^{c}± 6.4	43.35^{b}±5.03	47.15^{a}±7.6
Very low density cholesterol (VLDL-c (mg\d)	14.43^{d}± 2.18	24.97^{a}± 5.85	20.16^{b}± 3.29	17.05^{c}± 4.29	14.48^{d}± 2.01

Values are means ± SD (n = 6).Means in the same column with different litters are significantly different Significant ($p \leq 0.05$).

Effect of different levels of dried date pollen on activities of glutathione peroxidase (GPX), superoxide dismutase (SOD) , catalase (CAT) , glutathione S-transferases (GST), total antioxidant capacity (TAC)and

malondialdehyde (MDA) enzymesof rats treated with immunity inhibitor (sandimmune syrup)

Results in Table (10) exhibited that activating levels of GPX, SOD and CAT of positive control group were dramatically reduced significantly (P≤0.05) thannegative control group. With respect to all rats fed on diet containing different levels of DDP and treated with immunity inhibit or achieved high significantly (P≤0.05) gradual increases in antioxidant levels comparison to positive control group. The best treatment was observed for group 5 (at level of 200mg/kgbw from DDP) where it had the action effect in increasing antioxidant enzymes. The isoflavonoid of DDP have action capacity to minimize the toxicity prompted by low immunity in male rats by minimizing the damage and toxicity effects on liver cells with a considerable increase in total antioxidant capacity, and by normalizing the levels of liver enzymes GSH, SOD, GPX, CAT, and GST relative to the positive control group, the liver cells were protected from damage and toxicity**(**Ibrahim et al., 2017**).** Results in the same table illuminated that there great decreases of levels GST and TAC as well high increases of MDA of positive control comparison to negative control group, whereas all low immunity rats fed on diet containing different levels of DDP recorded markedly improvement in levels of GST and TAC , at the same time showed dramatically decreased in level MDA. In compared to the positive control group, group 5 had the best therapy, where was proved its efficient effect in enhancement GST and TAC and reducing MDA. found that phytochemical contents in DPP as polyphenols, flavonoids and minerals contents had essential important roles in inhibiting both of structural injury through the decay of oxidative stress, DNA disintegration of liver and malondialdehyde (MDA) which are related with liver damage induced by lead and cadmium, furthermore this compounds have antioxidant characteristics such as enhanced structural damage and decreased inflammatory cell infiltration in the liver, alleviates hepatic impairments, apoptosis and structural injury in liver thus increase total antioxidant capacity (TAC) (**Basuny *et al*., 2013 and Al-Samarai *et al*.,2016).**

Table(10): Effect of different levels of dried date pollen on activities of glutathione peroxidase (GPX), superoxide dismutase (SOD) , catalase (CAT) , glutathione S-transferases (GST), total antioxidant capacity (TAC)and malondialdehyde (MDA) enzymes of rats treated with immunity inhibitor (sandimmune syrup)

Parameter / Groups	Negative control (G1	Positive control(G2)	100 mg DDP /kg w(G3)	50 mg DDP /kgbw(G	200 mg DDP /kgbwG
GPX (ng/dl)	92.03^{a}±6.3	69.30^{d}±3.13	70.14^{d}±1.67	74.85^{c}±1.34	80.96^{b}±1.68
SOD (U/L)	64.15^{a}±4.8	45.01^{e}±7.79	49.98^{d}±4.23	53.95^{c}±7.85	59.94^{b}±4.92
CAT(mmoL/L)	85.72^{a}±3.8	51.23^{e}±4.71	60.99^{d} ±1.78	69.28^{c}±2.67	77.55^{b}±5.59
GST(mmoL/L)	45.57^{a}±2.19	31.66^{c}±3.08	32.91^{c}±1.56	37.66^{b}±1.33	41.99^{a}±1.20
TAC(nmoL/L)	1.83^{a}±0.01	0.91^{d}±0.05	1.26^{c}±0.064	1.52^{b}±0.07	1.80^{a}±0.02
MDA(nmoL/L)	**19.97^{e}±1.80**	**41.41^{a}±4.77**	**36.88^{b}±1.44**	**31.88^{c}±1.22**	**28.97^{d}±0.96**

Values are means ± SD (n = 6).Means in the same column with different litters are significantly different Significant ($p \leq 0.05$).

Effect of different levels of dried date pollen on interleukin 1, interleukin 6 and tumor necrosis factors of rats treated with immunity inhibitor (sandimmune syrup)

As shown in Table (11) acrylamide alone greatly increased the activities of serum interleukin (IL1, IL6 and (TNF-a) when compared with the negative control group and other treated groups with quercetin .It could be found that activities of pervious parameters level decreased with the increase in the concentration of quercetin combined with acrylamide ,but the activity was still lower than the positive control value and higher than the negative control group. Interleukins have the main role of modulating development, division, and stimulation during inflammatory and immunological reactions. Interleukins are a wide category of proteins that may induce several cellular and tissue responses by attaching to high-affinity cell surface receptors.Interleukin-6 is a cytokine that regulates metabolic, regenerative, and neurological functions in addition to inflammation and infection reactions (**Kishimoto *et al.*,1992).**On the other hand,DDP inhibits the production of

the pro-inflammatory cytokines TNF-_, IL-1_, IL-6, IL-12, and IFN- - by LPS- or PMA-enhanced splenic lymphocytes, monocytes, macrophages, and dendritic cells **(Basuny *et al.*, 2013).** Interleukins are a group of proinflammatory cytokines that modulate adhesion molecules, metalloproteinases, and proangiogenic factors involved in tumor invasion and DDP may suppress TNF- and Interleukin (IL)-1 levels of LPS enhanced mRNA, hence reducing microglial activation-induced apoptotic neuronal cell necrosis.It suppresses the production of pro-inflammatory cytokines, tryptase, and histamine from mast cells produced from human umbilical cord blood; this suppression is thought to entail the regulation of calcium influx and Phospho-protein kinase C (PKC). DDP is regarded as a promising anticancer agent owing to its chemoprotective action against malignant cell lines via metastasis and apoptosis(**Basuny *et al*., 2013 and Al-Samarai *et al*.,2016).**

Table (11):Effect of different levels of dried date pollen on interleukin 1, interleukin 6 and tumor necrosis factors of rats treated with immunity inhibitor (sandimmune syrup)

Groups / Parameters	Negative control (G1)	Positive control(G2)	100 mg DDP /kg w(G3)	150 mg DDP /kgbw(G4	200 mg DDP /kgbwG5
Interleukin 1 IL1(pg/ml)	5.09^{e}±0.08	103.04^{a}±2.57	80.48^{b}±1.76	66.06^{c}±0.62	47.39^{d}±1.08
Interleukin 6 IL6(pg/ml)	15.09^{e}±4.98	124.93^{a}±7.06	107.57^{b}±6.81	89.86^{c}±9.23	69.70^{d}±8.37
Tumor necrosis factors TNF (pg/ml)	16.79^{e}±2.66	160.86^{a}±5.41	143.33^{b}±7.66	123.17^{c}±11.16	82.82^{d}±6.74

Values are means ± SD (n = 6).Means in the same column with different litters are significantly different Significant ($p \leq 0.05$).

Effect of different levels of dried date pollen on IGA,IGG,IGM, WBC and Lymphocytes of rats treated with immunity inhibitor (sandimmune syrup)

Higher values were recorded in IGA,IGG,IGM, WBC and Lymphocytes in the negative control (Table 12). However There were significant differences in mean values of tested parameters in different treatment groups ($p \leq 0.05$) except lymphocytes (%) which showed there is no significant among negative control and group 5 and also between group 3 and group4 . The highest value of tested parameters was recorded in the fifth group which received 200 g/kg bw. Immunoglobulin G (Ig G) is an antibody type. IgG constitutes roughly 75% of all human serum antibodies, making it the most prevalent form of antibody. IgG is created in a late reaction to an infection and has a lengthy half-life in the body. IgG is most helpful for passive immunization via transfer because to its extended half-life in serum. IgM is the first antibody generated in response to a main antigen challenge. On future antigen presence, however, follicular B cells undergo isotype switching, leading to the generation of IgG, IgG, IgE, or IgA. **(Gupta and Gupta,2017).**Anti-aging, anti-inflammatory, antioxidant, and anti-proliferative defensive actions rely heavily on phenolic chemicals. DDP contains a high concentration of phenols, which function as antioxidants by interacting with many free radicals. Hydrogen atom transfer, transfer of a single electron, successive proton loss electron transfer, and chelation of transition metals are the mechanisms by which antioxidants exert their effects. Additionally, flavonoids have pharmacological actions that inhibit a variety of enzymes, including aldose reductase, xanthine oxidase, phosphodiesterase, Ca(+2)-ATPase, lipoxygenase, cycloxygenase, etc. They regulate hormones such as estrogens, androgens, and thyroid hormone **(Kim *et al.*, 2004; Basuny *et al.*, 2013 and Al-Samarai *et al.*,2016).**

Table (12):Effect of different levels of dried date pollen on IGA,IGG,IGM, WBC and Lymphocytes of rats treated with immunity inhibitor (sandimmune syrup) .

Parameters / Groups	IGA(mg/dl)	IGG(mg/dl)	IGM(mg/dl)	WBC (10e3/mm3)	Ly.(%)
Negative control (G 1)	170.78 ± 8.02^{a}	602.9 ± 13.22^{a}	157.03 ± 6.48^{a}	$6.38^{a}\pm1.19$	$41.3^{a}\pm5.58$
Positive control (G2)	55.13 ± 5.12^{e}	407.14 ± 12.56^{e}	44.97 ± 7.09^{e}	$3.01^{e}\pm0.39$	$26.57^{c}\pm5.86$
100 mg DDP /kgbw(G3)	71.45 ± 6.82^{d}	437.03 ± 21.34^{d}	51.85 ± 9.11^{d}	$3.76^{d}\pm0.15$	$28.7^{c}\pm0.98$
150 mg DDP /kgbw(G4)	84.65 ± 3.09^{c}	467.05 ± 15.94^{c}	63.81 ± 7.97^{c}	$4.55^{c}\pm0.87$	$34.7^{b}\pm8.83$
200 mg DDP /kgbw(G5)	91.98 ± 9.45^{b}	487.07 ± 16.14^{b}	74.67 ± 8.98^{b}	$4.72^{b}\pm0.83$	$39.3^{a}\pm6.03$

Values are means ± SD (n = 6).Means in the same column with different litters are significantly different Significant ($p\leq0.05$).

Conclusion

Dried date pollen has rich content of protein, minerals, antioxidants vitamins, total phenols and flavonoid. So, the study showed the ability of DDP to improve the blood sugar, lipid profile liver enzymes and immunity parameters for rats which treated with a syrup inhibited the immunity which the classical definition of immunity as the resistance of the body to disease.

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