Effect of red onions and its peels powder as a promising treatment for male infertility of rats induced by diabetes

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ABSTRACT:

Male infertility is a medical condition that is sometimes caused by diabetes. The purpose of this study was to determine the effect of onions and their peel powder at different doses on diabetes-induced infertile male albino rats. Eight male and thirty-two female white albino rats were divided into eight groups (Each group had five rats, one male and four female) their powdered blends were given to the main diet. Seven groups were injected with alloxan (150 mg/kg) to induce diabetes. Samples were tested for biochemical markers 28 days after the experiment finished, lipid, glucose, liver and kidney functions, were determined. Hormones (LH, FSH, and Testosterone) were measured. By counting the number of viable females after mating, counting the number of pregnant females, and counting the number of offspring, it was possible to determine the impact of onion and its peel powder on the fertility of male diabetes-induced rats. The study found that onion and its peels powder significantly improves health and fertility indiabetes- induced infertility. Group 8 with the highest 5% mixture had the highest levels of LH, FSH andTestosterone as well as the best lipid profile, kidney and liver functions.

Key words: Infertility induced by diabetes, onion and peel powder, glucose, kidney functions.

INTRODUCTION

Infertility is defined as the inability to conceive following 12 months of regular unprotected sexual contact **(Labarta *et al.*, 2019).** Approximately 85% of infertile couples can pinpoint a cause. The three most common causes of infertility are tubal disease, ovulatory failure, and male factor infertility. The remaining 15% of infertile couples are suffering from "unexplained infertility." Smoking and obesity are two examples of lifestyle and environmental factors that might have a negative impact on fertility. Ovulatory abnormalities account for roughly 25% of infertility diagnoses, and polycystic ovary syndrome affects 70% of women with anovulation. Infertility can also be a sign of an underlying chronic condition that causes infertility. (**Jama , 2022)**. Men's infertility can have a number of causes, and sperm analysis is typically used to identify it .During a semen analysis, a specialist assesses the quantity, motility, and morphology (form) of the sperm. Analysis of a man's sperm that shows a little amount of aberration does not always mean that he is sterile. A sperm study, on the other hand, can help evaluate whether and how male variables are contributing to infertility.(**Bereket *et al*., 2021**)

Different organs suffer long-term harm, dysfunction, and failure as a result of diabetes mellitus. As a result of diabetes, the male reproductive system is significantly impacted. A vital stage of spermatogenesis involves glucose metabolism. Furthermore, glucose metabolism is required for fundamental cell activity as well as specialised tasks including motility and fertilisation ability in mature sperm. Diabetic disease and experimentally produced diabetes both indicated that either type 1 or type 2 diabetes could have a negative impact on male fertility, particularly sperm quality, such as sperm motility, sperm DNA integrity,

and seminal plasma components. **(Guo *et al*., 2015)**. Diabetes can affect the body's hormonal balance, particularly the levels of testosterone and other reproductive hormones. Low testosterone levels might have a negative impact on sperm production and fertility. plasma alpha **(Lihong *et al*., 2021)**.The onion (*Allium cepa*) belongs to the Amaryllidaceae family. This family is commonly referred to as the amaryllis family, and it includes other plants such as garlic (*Allium sativum*), leeks (*Allium ampeloprasum*), and shallots (*Allium cepa* var. aggregatum) **(Amary llidaceae , 2021)**. These plants share similar characteristics, including the formation of bulbs and the production of pungent, aromatic compounds **(Christenhusz and Byng, 2016)**. There are three varieties of onions: white, red, and yellow. Regardless of subtype, raw onion bulbs contain about 89% water, 4% sugar, 2% dietary fibre, 1% protein, a little amount of fat (100 mg/100 g), and only modest amounts of essential nutrients. As a result, onions have very little energy (40 kcal/100 g).**(US, 2017)**. The most important finding is that a wide range of novel phytochemicals, including S-methyl cysteine sulfoxide, diallyl trisulfide, S-allyl cysteine sulfoxide, and dimethyl trisulfide, as well as quercetin and quercetin glucosides, kaempferol, thiosulfinates, cepaenes, and anthocyanins are present in onions. **(Tedesco *et al*., 2015)**. It also contains antioxidants including flavonoids and sulphur compounds, which help protect the body from oxidative stress and prevent inflammation. These qualities may benefit general health and may lower the risk of chronic diseases **(Loredana *et al*., 2019)**. Onions contain various compounds, including organosulfur compounds and flavonoids, that have been associated with potential anti-cancer effects. These compounds may help inhibit the growth of cancer cells and reduce the risk of certain cancers, particularly those of the digestive system **(Omar *et al*., 2020)**. Onions have been

shown to increase testosterone levels in men. This is because Onions are high in vitamin C, which is essential for immunological function. They also have antibacterial characteristics, which may aid in the battle against specific bacteria and fungi **(Teshika *et al*., 2019)**. Blood Sugar Regulation: Onions may help with blood sugar control. According to some studies, specific chemicals found in onions may help increase insulin sensitivity and manage blood sugar levels, which can be useful for those who have diabetes or are at risk of developing diabetes **(Rauf *et al*., 2021)**. Achieved mainly by boosting luteinizing hormone production, strengthening the antioxidant defence system in the tests, counteracting the harmful effects of free radicals, improving insulin resistance, encouraging the production of nitric oxide, and changing the activity of adenosine 5′-monophosphate-activated protein kinase. However, this impact requires further human validation, namely through clinical trials **(Saleem, 2019)**. This study examines the effects of supplementing male albino rats with onion and peel powder on diabetes-related infertility.

Materials and Methods

Materials

The onion and peel were obtained from a local market in Shibin El Kom City, Menoufia Governorate, Egypt. Casein, cellulose, chloride powder, DL- methionine powder, and alloxan. They were purchased from Morgan Co. in Cairo, Egypt.

Forty "40" individuals Sprague Dawley rats that are normally cyclic (8 males and 32 females) weighing 150±10g purchased from the Helwan farm, Ministry of Health's, Cairo, Egypt. The rats were housed in the Experimental Animals section of the Physiology Laboratory at the Faculty of Home Economics, Menoufia University. The female rats were kept in cages apart from the males during the feeding time, with eight rats

per cage. During the mating season, the rats were kept in eight cages, each with one male and four females. During pregnancy, males and females were divided once more, and each pregnant female was housed in a separate cage until giving birth. Allic acid, catechin, chlorogenic acid, caffeic acid, tyrosol, rutin, ferulic acid, quercetin, synergic acid, and cinnamic acid were supplied by Sigma-Aldrich USA. Al-Gomhoria Company for Chemical, Medical, and Instruments in Cairo, Egypt was also used to obtain the kits for determination.

Methods

Characterization of phenolic acid from onions and their peel powder by HPLC

Using an HPLC (Waters Alliance 2690, Chromatograph Separation Module) fitted with a photodiode array (PDA) detector (Model 2998, Waters), the targeted phenolic components in various onion and peel powder samples were quantified. A Synergi Hydro-RP (250 4.6 mm i.d.) reversed phase column with a particle size of 4 m was shielded by a Phenomenex 4.0 2.0 mm i.d., C18 ODS guard column (Phenomenex, Lane Cove, NSW, Australia). Water/acetic acid (98:2, v/v; eluent A) and acetonitrile/water/acetic acid (100:1:99, v/v/v; eluent B) made up the mobile phase. 10-25% B (0-20 min), 25-35% B (20-30 min), 35-40% B (30-40 min), 40-55% B (40-70 min), 55-80% B (70-75 min), and 80-90% B were the gradient profiles according to the method described by **(Cho *et al.*, 2011).**

Experimental design

Eight males and thirty two females Sprague Dawley cyclic rats weighed 150±10g were used in this experiment. Diabetic rats were given subcutaneous injections of alloxan (150 mg/kg body weight) Rats were fed a basal diet prepared according to **AIN, (1993)** for a whole week as an adaptation. After this period, rats were divided into 8 groups based on

the basal diet used, each group consisted of five rats, one male, and four females. Group 1 consof the normal, healthy male rats that were fed a basal diet and represented a control –ve group. Diabetic animals fed on a basal diet only as a positive control group. Group 3: Diabetic rats fed on a casein diet containing onion (2.5%). Group 4: Diabetic rats fed on a casein diet containing onion (5%). Group 5: Diabetic rats fed on a casein diet containing onion peel powder (2.5%). Group 6: Diabetic rats fed on a casein diet containing onion peel powder (5%). Group 7: Diabetic rats fed on a casein diet containing mixture (1:1) of onion and onion peel powder (2.5%). Group 8: Diabetic rats fed on a casein diet containing mixture (1:1) of onion and onion peel powder (5%). Then, after 20 days of the diet used in each group, **Tietz (1995)** evaluated estradiol, LH, and FSH using the EIA (Enzyme Immunoassay) technique, and males were allowed to mate with females before being separated after confirming the occurrence of pregnancy. After 20-23 days, the number of pregnant females and offspring for each group was reported. The body weight and food consumption were recorded every three days for six weeks.

After a 12-hour fast, blood was drawn from the retroorbital vein. The serum was properly extracted from the blood samples and stored frozen in a deep freezer until analysis. Blood samples were collected into dry, clean centrifuge glass tubes and allowed to coagulate for 30 minutes in a 37°C water bath according to **Schermer (1967)**.

Biochemical Analysis

Luteinising hormone LH hormone was performed using the method of **(Fahim *et al.*, 1982**), Testosterone hormone was performed using the method of **(Pradelles *et al.*, 1985)**, Serum total cholesterol was determined by using the method proposed by **Thomas (1992)**, The serum triglyceride level was determined using an enzymatic method according

to the **(Young, 1975) and Fossati & Prencipe, 1982),** High-density lipoprotein cholesterol HDL-c.was determined According to **Friedewaid (1972) , Grodon and Amer (1977) & Lee and Nieman (1996),** very low-density lipoprotein cholesterol VLDL-c was computed in milligrams per deciliter using the following formula: VLDL-c(mg/dl) = Triglycerides / 5, while low-density lipoprotein cholesterol LDL-c was calculated in mg/dl according to **Lee and Nieman (1996)** as follows:

LDL-c (mg/dl) = Total cholesterol – (HDL-c + VLDL-c), Alanine aminotransferase (ALT), Aspartate aminotransferase (AST) and alkali phosphate (ALP) were determined using the method proposed by **Henry, (1974) and Belfield and Goldbery, (1971).** According to **Henry, (1974)**, enzymatic methods were employed to quantify serum urea, uric acid, and creatinine.

Statistical analysis

The SPSS programme was used to analyze the results that were collected. Results from the ANOVA test were compared between groups, and a significance level of $P<0.05$ was considered **(Sendcor and cochran, 1979).**

RESULTS AND DISCUSSION

Identification and quantification of phenolic compounds in onions and their peel powder by HPLC.

Onion bulbs and peels are known to have a significant quantity of phytochemicals, such as phenolic compounds, which contribute to their therapeutic effects. **(Goodarzi *et al.*, 2013).** The structure-activity correlations of antioxidant phenolics, as well as the linkages between total antioxidant activity and total phenolic levels, can be shown by conducting qualitative and quantitative analyses of relevant individual phenolics in spices **(Ye CL *et al.*, 2013)**.

High-performance liquid chromatography was used to characterise the phenolic components of processed onion bulbs and peel powder. As demonstrated in Table (1), onion and peel powder possess a high concentration of phenolic chemicals. Onion and peel powder possess a high concentration of phenolic chemicals. Eighteen compounds from onion bulbs and peels were extracted: quercetin, ferulic acid, malonylglucoside, p- Coumaric acid, kaempferol, Sinapic acid, cyanidin, p-hydroxybenzoic acid, benzofuranone acid, p-hydroxybenzoic acid, p-Coumaric acid, isorhamnetin, synergic acid, Epicatechinacid, vanillic acid, isoquercetin, isorhamnetin, and protocatechuic acid.

The highest amounts of phenolic compounds spotted for ouercetin, inonions and peels, were 55.16 and 61.0 mg while the lowest amounts recoded for protocatechuic acid were 0.99 and 1.76 respectively. The extraction of both nonpolar and semipolar soluble phenolic acids could explain why methanolic extracts have higher phenolic acid contents. **(Goodarzi *et al.*, 2013).**

Table (1): Fractionation of phenolic compounds in onions and their peel powder using HPLC

Phenolic compounds	Concentration(mg/100g) Percent	
	onions	peels
Quercetin	55.16	61.0
ferulic acid,	50.3	5930
malonylglucoside	51.17	58.2
p-Coumaric acid	42.11	46.2
kaempferol	39.0	40.0
Sinapic acid	ND	ND
cyanidin	35.3	67.0
p-hydroxybenzoic acid	32.21	43.2
benzofuranoneacid	27.1	30.9
P- hydroxybenzoic acid	24.21	30.8
p-Coumaric acid	21.16	37.7
Isorhamnetinacid	20.11	27.9

Synergic acid	ND	ND
Epicatechinacid	20.5	27.0
vanillic acid	20.0	26.0
isoquercetin	15.0	22.0
isorhamnetin	13.5	17.6
protocatechuic acid	0.99	1.76

ND= Not detected.

Effect of Red onions and their peel powder as a promising treatment for male infertility in diabetic rats:

Data presented in Table (2) show the effect of Red onions and its peels on the fertility of one male and four female rats in each group. The fertility rate was calculated using both the number of fertile females (females that gave birth) and the total number of offspring. It was diabetic that in group 1 (Control –ve) All females in the control negative group, which represented typical healthy rats, gave birth to approximately 35 rats. Group 2 (Control +ve) had a considerable drop in fertility; only one female was able to deliver about five offspring. The induced diabetes in male rats is a major contributor to numerous infertility aetiologies. Diabetes can create a sex hormone imbalance in patients **(Maric, 2009)**. According to studies, men with diabetes had lower testosterone levels and higher levels than those without diabetes. The testosterone levels, on the other hand, are greater **(Hackett and Heald, 2016)**.Insulin levels have a large influence on activated signalling. The cascade increases gonadotropin-releasing hormone secretion in the hypothalamus, which stimulates pituitary secretion of luteotropic hormone (LH) and follicle-stimulating hormone (FSH), eventually causing the gonads to secrete sex hormones **(Maric, 2009)**. In groups 3, 4, 5, 6, 7, and 8, Which were treated with different concentrations of red onions and their peels were employed to improve the fertility of diabetes-induced males. In general, increasing the amount of onions and their peels in the basal diet resulted

in a progressive increase in infertility. The groups (3 and 4) fed 2.5 and 5% onion powder discovered that 3 pregnant females gave a total 20 and 25 offspring, whereas the groups (5 and 6) fed 2.5 and 5% peels found that 4 pregnant females gave 29 and 30 offspring. The complete recovery of infertility was observed in groups (7 and 8) fed onions and peels mixes of 2.5 and 5% onions and peels; the results show that 4 and 5. Several research have been conducted to establish the role of red onions and their peels as a natural antifertility agent. **(Mahesh., *et al*. 2022).**

Table (2): Effect of Red onions and their peel on fertility of diabetic male rats

Groups	Total number of fertile females	Total number of offspring	No. of male offspring	% age of male	No. of female	% age of female	Sex ratio
Control negative (-)	5	35	20	57%	15	42%	1.35 %
Control positive (+)	1	5	1	0.2%	0	0	0
G3 Rats + onions (2.5%)	3	20	12	60%	8	40%	1. 5 %
G4 Rats + onions (5%)	3	25	13	52%	12	48%	1.08 %
G5 Rats + peels (2. 5%)	4	29	18	62%	11	37%	1. 6 %
G6 Rats + peels (5%)	4	30	18	60%	12	40%	1. 5 %
G7 Rats+ mixture (2.5%)	4	32	20	62%	12	37%	1. 6%
G8 Rats+ mixture (5%)	5	34	22	68%	12	35%	1. 9 %

Effect of Red onions and their peel powder on Gonadotropin hormones (LH, Testosterone and FSH) of diabetic male rats :

The results shown in Table (3) indicated the influence of onions and their peel on LH, testosterone, and FSH hormones throughout a 20-day period. Positive control group significantly reduced LH, testosterone, FSH hormones compared to negative control group. Diabetes rats exposed to alloxan-induced diabetes reduced hormone levels, impacting reproductive efficiency through high plasma levels. Diabetes can create a sex hormone imbalance in patients According to studies, men with

diabetes had lower testosterone levels and higher levels than those without diabetes. Changes in sex hormone levels, on the other hand, may be a risk factor for diabetes **(Eskedar , 2021).**

When Red onions and their peels powder were added to the basal diet, LH, oestrogen, and FSH hormone levels increased. The highest levels achieved with 5% red onion and peel mix. The levels of LH, FSH, and testosterone were gradually increased with increasing red onions and their peels concentrations due to the treatment of diabetic, which in turn enhanced the modulation of gonadotropin expressions **(Lihong *et al.*, 2021).** Increased FSH levels in rats due to red onions and peel powder addition. **(Akhigbe and Ige, 2012).** Studies show onions positively impact FSH hormone production, with fresh onion juice increasing FSH hormone levels in Wistar male rats.**(Khaki *et al.*, 2009).** Furthermore, for eight weeks, aqueous onion extract (1 mL/100 g body weight) significantly boosted aldosterone hormone in both normal and aluminium chloride-treated male rats . **(Akhigbe and Ige, 2012).** As a result, the beneficial effect of onion on testosterone may be due, at least in part, to increased levels of aldosterone hormone.The administration of Red onions and their peels powder resulted in a decrease in CYP17A1 protein. **(Akhigbe and Ige, 2012)**.

Table (3): Effect of red onions and their peel on gonadotropin hormones (LH, Testosterone and FSH) of diabetic male rats

Groups	LH (g)	Testosterone (g/day)	FSH (%)
Control negative (-)	$2.73^{a} \pm 0.25$	$2.21^{a} \pm 1.67$	$0.80^{a} \pm 0.011$
Control positive (+)	$1.11^{f} \pm 0.015$	$0.57^{d} \pm .011$	$0.23^{g} \pm 0.25$
G3 Rats + onions (2.5%)	$1.32^{ef} \pm 0.12$	$0.66^{d} \pm 0.023$	$0.27^{f} \pm 0.015$
G4 Rats + onions (5%)	$1.43^{e} \pm 0.41$	$0.88^{c} \pm 0.015$	$0.31^{e} \pm 0.022$
G5 Rats + peels (2. 5%)	$1.83^{d} \pm 0.22$	$0.94^{c} \pm 0.13$	$0.49^{d} \pm 0.020$
G6 Rats + peels (5%)	$2.18^{b} \pm 0.21$	$1.78^{b} \pm 0.001$	$0.53^{c} \pm 0.28$
G7 Rats+ mixture (2.5%)	$2.33^{bc} \pm 0.27$	$1.89^{b} \pm 0.018$	$0.67^{b} \pm 0.20$
G8 Rats+ mixture (5%)	$2.55^{ab} \pm 0.035$	$1.98^{b} \pm 0.13$	$0.78^{a} \pm .028$
LSD (P≤ 0.05)	**0.250**	**0.210**	**0.083**

Each value is shown as as mean ± standard deviation, Mean in the same column with different superscript letters differ significantly (P≤ 0.05).

Effect of red onions and their peel on Glucose level of diabetic male rats:

The data in Table (4**)** illustrate the effect of red onions and their peels on experimental rats' glucose. The results showed that the positive control rats had higher levels of glucose when compared to the negative control rats, with a significant difference (P<0.05) Diabetics have an impact on functions of hormones. Diabetes-related elevated can damage blood arteries as well as hormones over time, causing them to function less effectively. **(Mishriky *et al*., 2022)**. According to **(Caramori and Rossing, 2022)**. Diabetics are affected by high blood sugar, often known as hyperglycemia. Hyperglycemia in diabetics can be caused by a number of different circumstances, they include of diet and exercise, ailment, and diabetes-unrelated drugs. **(Ahmed *et al*., 2022)**. Furthermore, with a significant difference (P<0.05), the lowest values were reported for the group fed on a mix of 5% onions and their peels. These findings are consistent with a study that found a significant reduction in plasma levels of Glucose in diabetic rats fed onions **(Caramori and Rossing, 2022).** According to **(Erfanpoor *et al*., 2021).**

Table (4): Effect of red onions and their peel on Glucose of diabetic male rats

Groups	Glucose level (mg/dl)
Control negative (-)	84.33^{h} ± 1.528
Control positive (+)	210.33^{a} ± 1.507
G3 Rats + onions (2.5%)	198.100^{b}± 0.22
G4 Rats + onions (5%)	191^{c} ±1.07
G5 Rats + peels (2. 5%)	188.0^{b}± 1.01
G6 Rats + peels (5%)	115^{e}±2.00
G7 Rats+ mixture (2.5%)	100.76^{f} ± 2.082
G8 Rats+ mixture (5%)	92.67^{g}±2.517
LSD (P≤ 0.05)	**2.313**

Each value is shown as as mean ± standard deviation, Mean in the same column with different superscript letters differ significantly (P≤ 0.05).

Influence of red onions and their peel on lipid profile level of diabetic male rats:

Shows the effect of red onions and its peels on the serum total cholesterol and triglycerides of the experimental rats is shown in Table (5). The results showed that the positive control group had the greatest cholesterol and triglyceride levels (120.33and193.50 mg/dL, respectively) when compared to the negative control group (94.67and 126.00 mg/dL, respectively). This was anticipated because diabetes is associated with greater blood lipid and lipoprotein levels. Furthermore, diabetes and plasma triglycerides have a distinct association **Kim *et al*., (2015)**. While the several groups fed onions showed the lowest gradually measured cholesterol and triglyceride levels, the range of them was 101. 0 and 186.00 mg /dL in the group (3) fed on diet containing 2.5% red onions to 115.0 and 117.0 mg /dL to the group (8) fed on mix 5% red onions and peels powder. Numerous studies have found that red onions and their peels have the highest quantity of insoluble dietary fibre, which reduces TC and TG levels by reducing their absorption from the colon. **(Kim, *et al*., 2015)**. The same table shows how red onions and their peels alter the blood lipid profile (HDL-c, LDL-c, and VLDL-c) levels of infertile rats. The results showed that a lower HDL-c was recorded in the positive control group of rats compared to the negative control group of rats, and that this difference was significant ($P<0.05$). The group fed a mix of 5% red onions and their peels had the highest HDL-c of the treatment group, with a significant difference ($P<0.05$). The LDL-c and VLDL-c levels in the positive control rats group, on the other hand, were significantly higher as compared to the negative control group ($P<0.05$). On the other hand, onions have the ability to activate lecithincholesterol acyltransferase through enhancing insulin activity, which helps to

promote the conversion of LDL to HDL. **(Ige & Akhigbe, 2013)**. On the other hand, onion can enhance bile acid excretion and block cholesterol absorption, hence lowering plasma cholesterol **(Guan *et al.*, 2010).** Furthermore, the antilipid activity of onion may be associated to lower levels of lipid hydroperoxide and lipoperoxide. Several research have recently explored the effects of onion on blood lipids, however the findings are conflicting. **Hadjiphilippou *et al.*, (2019**). found that treating healthy participants with 228 mg of onion skin extract for 10 weeks significantly increased TC, LDL, and HDL values, **Kim *et al.*, (2015)** found no significant difference in lipid profile after 12 weeks of administration of onion peel extract at 100 mg/day compared to placebo.**.** **Hadjiphilippou *et al.* (2019)**. Red onions are used as an anti-cholesterol and weight-loss supplement, including their peels and seeds. Red onion peels and seeds have been shown to have antioxidant, hypolipidemic, and hypoglycemic effects. **(Mattiuzzi *et al.*, 2020).**

Table (5): Effect of red onions and their peel on lipid profile level of diabetic male rats

Groups	Total cholesterol	Triglycerides	(HDL-C)	(LDL-C)	(VLDL-C)
Control negative (-)	94.67 ^{f}±2.08	126.0 ^{d}0±0.65	35.33 ^{b}±2. 64	34.13 ^{d} ±1.10	17.87^{b}±13.22
Control positive (+)	120.33^{b}±2.5	193.50 ^{a}±2.46	16.33 ^{e}±1.52	65.4 ^{a} ±2.42	38.60 ^{a} ±0.52
G3 Rats + onions(25%)	101 ^{e}. 0±2.64	186.00 ^{b}±2.01	16. 67 ^{e}±1.53	47.13 ^{c}±0.83	37.20 ^{a}±0.400
G4 Rats + onions (5%)	95.33 ^{f}±1.52	135.76±2.08^{c}	22.00 ^{d}±2.00	46.2 ^{c} ±1.80	27.67 ^{b}±1.416
G5 Rats + peels (2. 5%)	105. 0 ^{d}±2.64	128.33 ^{d}±1.58	32.00 ^{b}±2.60	47.33 ^{d} ±1.97	25.67 ^{b}±0.306
G6 Rats + peels (5%)	91.67 ^{f} ±1.52	122.00 ^{e}±2.08	34.33 ^{b}±1.52	32.93 ^{e}±1.70	24.40 ^{b}±0.401
G7Rats+mixture(2.5%)	134.67 ^{f} ±1.5	190.33 ^{e}±1.52	42.33 ^{a} ±2.52	54.27^{b} ±1.14	38.07 ^{a} ±0.306
G8 Rats+ mixture (5%)	115.0 ^{c}±1.00	117. 0 ^{f}±2.08	28.67 ^{c} ±1.51	63.0^{a} ±1.140	23.4^{b} ±0.408
LSD (P≤ 0.05)	3.46	3.88	2.843	2.92	2.21

Each value is shown as as mean ± standard deviation, Mean in the same column with different superscript letters differ significantly (P≤ 0.05).

Effect of red onions and their peel on liver functions of diabetic male rats:

Data are given in Table (6) show the effect of red onions and its peels on liver functions (AST and ALT) of the experimental rats. The results showed that the AST and ALT enzymes in the male stimulated male rats group had the highest values (98.00 and 73.00 U/L). confirmed by **(Udoka *et al.*, 2009).** According to the study, diabetes boosts the hepatic and cardiac markers levels such as AST and ALT. Researchers discovered a decrease in hepatic ALT, aspartate transaminase (AST), and alkaline phosphatase activities, as well as an increase in ALT and AST plasma activities. Onion extracts significantly mitigated these harmful effects. Onion extract provided dose-dependent hepatoprotection. Our data suggest that high dosages of onion extract and low doses of extract can minimise Cd-induced oxidative damage in the rat liver, possibly through reduced lipid peroxidation **(Kim *et al.*,2016)**. Onions were demonstrated to reduce AST and ALT levels when added to the basal diet. The lowest value was found in the group (8) that used the maximum concentration of mixed red onions and peels (5%). These results showed that increased levels of these enzymes in diabetic control rats make them more vulnerable to hepatic and cardiac problems. At varied doses, red onions and their peels successfully reduced ALT and AST levels. Also, **(Udoka *et al,* 2009)**. According to a study on the advantages of morin, a bioflavonoid present in many plants and fruits, including onion, flavonoids can treat ethanol-induced liver fibrosis as shown by a drop in hepatic enzyme levels, as well as a hepatoprotective effect, with a regain of near normal architecture. Previous research has shown that onions have a hepatoprotective effect on liver morphology. Several studies have

confirmed the positive effects of onion flavonoid components on liver functioning **(Kim *et al.*, 2016)**.

Table (6): Effect of red onions and their peel on liver functions level of diabetic male rats

Groups	AST (U/L)	ALT (U/L)
Control negative (-)	72.67^{d} ±2.52	41.67^{f}±1.33
Control positive (+)	98.00^{a}±2.65	73.00^{a} ±2.65
G3 Rats + onions (25%)	90.33^{b} ±2.52	62.67^{b} ±2.51
G4 Rats + onions (5%)	92.0^{b} ±2. 03	57.00^{c}±2.64
G5 Rats + peels (2. 5%)	89.0^{b} ±1.00	53.33^{cd} ±1.52
G6 Rats + peels (5%)	78.0^{c} ±2.64	50.00^{de} ±2.65
G7 Rats+ mixture (2.5%)	78.00^{c} ±1.05	49.00^{de} ±1.00
G8 Rats+ mixture (5%)	74.00^{cd} ±1.01	46.33^{e} ±2.08
LSD (P≤ 0.05)	**3.72**	**3.698**

Each value is shown as as mean ± standard deviation, Mean in the same column with different superscript letters differ significantly (P≤ 0.05).

Effect of red onions and their peel on kidney functions level of diabetic male rats:

The data in Table (7**)** Illustrate the effect of red onions and their peels on experimental rats' kidney functions (uric acid, urea, and creatinine). The results showed that the positive control rats had higher levels of creatinine, uric acid, and urea when compared to the negative control rats, with a significant difference (P<0.05). Diabetics have an impact on renal function. Diabetes-related elevated blood sugar can damage blood arteries in the kidneys as well as the nephrons over time, causing them to function less effectively. Many diabetics develop excessive blood pressure, which can also harm the kidneys. These factors lead to ectopic lipid accumulation in the renal tissue, which results in glomerular hypertension as well as albuminuria, glomerulomegaly, increased glomerular permeability, hyperfiltration, and even localised glomerular hypertension. **(Jamshid, 2014)**. Furthermore, with a significant difference (P<0.05), the lowest values were reported for the

group fed on a mix of 5% onions and their peels. These findings are consistent with a study that found a significant reduction in plasma levels of kidney functioning indicators such as uric acid, urea, and creatinine in diabetic rats fed onions **(Al Hamedan *et al.*, 2011).** According to **(Jamshid, 2014).** Onions may reduce the incidence of renal dysfunction by preventing structural/cellular foundation damage because renal dysfunction is associated with aberrant kidney morphology.

Table (7): red onions and their peel on kidney functions of diabetic male rats

Groups	Creatinine (mg/dl)	Urea (mg/dl)	Uric acid (mg/dl)
Control negative (-)	0.67 ^{cd} ±.021	61.91 ^{f} ±1.64	2.21 ^{d} ±0.03
Control positive (+)	0.84 ^{a} ±0.040	97.33 ^{a} ±2. 02	3.19 ^{a} ±0.02
G4 Rats + onions (25%)	0.84 ^{a} ±0.011	92.67 ^{b}±2.52	3.10 ^{b} ±0.26
G4 Rats + onions (5%)	0.77 ^{b}±0.025	82.79 ^{c}±2.39	2.75 ^{b}±0.025
G5 Rats + peels (2. 5%)	0.70 ^{b} ±0.020	77.33 ^{d}±1.53	2.73 ^{d} ±0.022
G6 Rats + peels (5%)	0.68 ^{cd} ±0.015	70.67 ^{e}±2.08	2.53 ^{c}±0.026
G7 Rats+ mixture (2.5%)	0.67 ^{cd}±0.028	64.36 ^{f}±0.92	2.22 ^{d}±0.028
G8 Rats+ mixture (5%)	0.64 ^{d}±0.018	62.61 ^{f}±1.55	2.12 ^{a}±0.02
LSD (P ≤ 0.05)	0.041	3. 01	0.154

Each value is shown as as mean ± standard deviation, Mean in the same column with different superscript letters differ significantly (P≤ 0.05).

CONCLUSION:

The results of this study show that red onions and their peels can significantly reduce the male infertility that diabetes causes in rats. This is accomplished by treating the effects of diabetes, which include lowering blood sugar and lipid levels and increasing LH, FSH, and testosterone levels. The use of red onions and their peels due to the highest concentrations of quercetin acid, which scavenges the blood from free radicals, and the presence of soluble and insoluble dietary fibre, which improved the liver and kidney functions and lipid profile. This enhanced liver and kidney functions led to an improvement in overall health.

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تأثير البصل الأحمر ومسحوق قشوره كعلاج واعد لعقم ذكور الفئران الناجم عن مرض السكري

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الملخص العربى

العقم عند الذكور هو حالة طبية تنتج في بعض الأحيان عن مرض السكري. تهدف هذه الدراسة إلى تحديد تأثير البصل ومسحوق قشوره بجرعات مختلفة على ذكور الجرذان البيضاء المصابة بالعقم والمسببة لمرض السكري. تم تقسيم ثمانية ذكور واثنان وثلاثون أنثى من الجرذان البيضاء البيضاء إلى ثماني مجموعات (تتكون كل مجموعة من خمسة فئران، ذكر واحد وأربعة إناث) وتم إعطاء خلطاتهم المسحوقة إلى النظام الغذائي الرئيسي. وتم حقن سبع مجموعات بمادة الألوكسان (١٥٠ ملغم / كغم) لتحفيز مرض السكري، تم فحص العينات للعلامات البيوكيميائية بعد ٢٨ يوما من انتهاء التجربة، وتم تحديد وظائف الدهون والجلوكوز والكبد والكلى، وتم قياس الهرمونات (LH، FSH، وتستوستيرون)، وذلك عن طريق حساب عدد الإناث القادرة على الحياة بعد التزاوج.

ومن خلال إحصاء عدد الإناث الحوامل، وإحصاء عدد النسل، أمكن تحديد تأثير البصل ومسحوق قشره على خصوبة ذكور الجرذان المصابة بمرض السكري، ووجدت الدراسة أن البصل ومسحوق قشوره يحسن الصحة بشكل كبير ومرض السكري الخصوبة - العقم الناجم.المجموعة ٨ التي تحتوي على أعلى خليط ٥٪ لديها أعلى مستويات LH وFSH والتستوستيرون بالإضافة إلى أفضل صورة للدهون ووظائف الكلى والكبد.

الكلمات المفتاحية: ،العقم الناجم عن مرض السكر ، مسحوق البصل والقشر ، الجلوكوز ، وظائف الكلى