Effect of Some Vegetable Seeds and Herbs on Hyperglycemic Rats

Fatma El-Zahraa Amin El-Sherif[1] Mohamed Samir El-Dashlouty[1] El-Sayed H. Bakr[1] Nadia Saleh El-Amoudi[2] Marwa Amer El – Sayed Ahmed[1]

[1]Department of Nutrition and Food Science, Faculty of Home Economics, Menoufya University, Shebin El-Kom, Egypt.
[2] Department of Nutrition and Food Science, King AbdulAziz , University, Jeddah Saudi Arabia.
drfatmazhraa@hotmail.com

ABSTRACT: Bakground: Diabetes mellitus is a metabolic disorder characterized by hyperglycemia and alterations in carbohydrate, fat and protein metabolism, associated with absolute or relative deficiencies in insulin secretion and / or insulin action. The symptoms of diabetes are polyuria, polydipsia, polyphagia, pruritus and unexpected weight loss. About 100 million people around the world have been diagnosed with diabetes by the year 2010, it is projected that soon 215 million people will have the disease. **Objective:** This study was carried out to investigate the probable benefit of certain herbs (*Cleome Sp*. & *Artimisia absinthium*) and seeds (*Allium sepa* seeds & *Portulaci oleracea* seeds) to correct hyperglycemia in rats. **Material and Methods:** Fifty mature male albino rats (Sprague Dawley strain) weighting 133±5g were obtained from Laboratory of Animal Colony, Helwan, Egypt. The animals were divided into 10 equal groups; one group was kept as a (C –ve) group, while the other 9 groups were injected via intra-peritoneal injection of alloxan 150 mg/kg body weight. Hyperglycemic rats were disparted into nine equal groups (n= 5 rats) using two doses (5 and 10 %) of wormwood, cleome, onion seeds and pusley seeds in diets. At the end of experimental period (28 days), blood samples were collected for serum separation to determine serum glucose, liver enzymes (ALT, AST, ALP), total cholesterol, triglycerides, lipoprotein fractions (HDLc, LDLc and VLDLc) and kidney function indicators (creatinine, urea and uric acid). **Results:** Data showed that the all tested seeds showed a significant improvement in glucose, liver enzymes (ALT, AST, ALP) total cholesterol, triglycerides, lipoprotein fractions (HDLc, LDLc and VLDLc) and kidney function (creatinine, urea and uric acid) in hyperglycemic rats. **Conclusion:** According to these results, wormwood, cleome, onion seeds and pusley seeds could be used for treatment hyperglycemia.

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Key words: Hyperglycemia, wormwood, cleome, onion seeds and pusley seeds

1.Introduction

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia and alterations in carbohydrate, fat and protein metabolism, associated with absolute or relative deficiencies in insulin secretion and / or insulin action. The symptoms of diabetes are poluria, polydipsia, polyphagia, pruritus and unexpected weight loss. About 100 million people around the world have been diagnosed with diabetes by the year 2010, it is projected that soon 215 million people will have the disease. Recently appropriate hypoglycemic agent have been focused on plants used in traditional medicine, because some natural products in traditional medicine may be better treatments than currently used drugs. However the compounds and precise antidiabetic mechanisms of most herbs remain to be indistinct **(Dawei *et al.*, 2010).**

Cleome herb is a genus of flowering plants in the family Cleomaceae which has been subjected to severe overexploitation to be used in folk medicine for diabetes. It has been eradicated from vast areas, especially in the Sinai and in the Eastern desert. However, in the far south of the Eastern desert, The plant is still flourishing and is growing in many Wadis (vallies) in hot desert areas **(Batanouny, 1999).** Also cleome is used in various disorders such diarrhea, fever, inflammation, liver diseases, bronchitis, skin diseases, and malaria fever **(ishant and Vinod, 2009).**

Artemisia Sp. With common name wormwood is one of the common species of the plants grown in Egypt in Sinai desert where animal graze on it. It is widely used in folk medicine and is recommended as a healer plant in traditional medicine by Bedouins there; volatile oil prepared from the flowering branches of *Artimisia judaica* has anthelmintic, anti – inflammatory, analgesic and anti – pyretic effects **(Nofal *et al.*, 2009).** The aqueous extract of *Artimisia herba* – alba produced initial hyperglycemia which was followed by hypoglycemia in normal and alloxan – treated rabbits and mice. Methanol extract of *Artimisia pallena* induced significant blood glucose lowering effect **(Subramoniam *et al.*, 1996).**

Onion (*Allium cepa*) has been reported to show hypolipidimic and antioxidant effects in rats fed a high – fat, sucrose diet. Dislipidemia is one characteristic of diabetes, and hyperglycemia in diabetes leads to increase oxidative stress, which plays an important role in the progression of diabetes **(Min – Jung *et al*., 2010).** Wide – ranging claims have been made for the effectiveness of onions against conditions ranging from the common cold to heart disease, diabetes, osteoporosis and other diseases **(Anon, 2009).**

Portulaca oleracea L. grows widely in different areas of the world including north of China. The plant is known in folk medicine in some parts of China as hypotensive and antidiabetic, also, *oleracea* L. contains many compounds, including free oxalic acid, alkaloids, omeg 3 – fatty acids, coumarins, flavonoids, polysaccharide, cardiac glycosides, and anthaquinone glycosides **(Mohamed *et al*., 2004).** Polysaccharide extracted from *P. oleracea* L. can control blood glucose and modulate the metabolism of glucose and blood lipid in diabetes mellitus of mice **(Fenglin Li *et al*., 2009).**

Therefore, wormwood, cleome, onion seeds and pusley seeds at two doses were added to basal diet of alloxan diabetic rats in order to utilize as hypoglycemic agents.

2.Material And Methods

a- Material

The plants used in this study were:

1- *Cleome Sp*. (Cleome, Samwa herbs).

2- *Artemisia absinthium* (Wormwood, damsisa herbs).

3- *Portulaca oleracea* (Pusley, rigla seeds).

4- *Allium cepa* (onion seeds).

All herbs and seeds have been bought from local market of Egypt and prepared for experiments.

Methods:

1- Biological Investigation:

Male albino rats Sprague Dawley strain (50 rats) weighing 133±5g were obtained from Helwan Experimental Animal Station. All rats were housed individually in well-aerated cages and fed on basal diet for one week for adaptation, in animal house of Faculty of Home Economics, Menuofia University. The basal diet consists of casein (12%), Sunflower oil (10%), vitamins mixture (1%), cellulose (5%), salt mixture (4%), sucrose (22%) and corn starch (up to 100%), **(Hegested *et al.*, 1941)**.

2- Preparation of Diabetic Rats:

Diabetes was induced in normal healthy male albino rats via intra-peritoneal injection of alloxan 150 mg/kg body weight according to the method described by ***Desai and Bhide (1985)***. Twelve hours after the injection of alloxan, fasting blood samples were obtained by retro-orbital method to estimate fasting serum glucose. Rats having fasting serum glucose more than 192 mg/dl were considered diabetics **NDDG (1994)**.

3- Experimental Design:

The rats were divided into two main groups, the first main group (5 rats) fed on basal diet as a negative control. The second main group (45 diabetic rats) were divided into seven groups (n=5) according to the following scheme:

Group (A): Non diabetic control (control (-) rats fed on basal diet.

Group (B): Hyperglycemic main group:

1- Diabetic control group (control (+) fed on basal diet.

2- Diabetic rats fed on basal diet+ *Cleome Sp*.5 % for 28 consecutive days.

3- Diabetic rats fed on basal diet+ *Cleome Sp*.10 % for 28 consecutive days.

4- Diabetic rats fed on basal diet+ *Artemisia* absinthiun 5% for 28 consecutive days.

5- Diabetic rats fed on basal diet+ *Artemisia* absinthium 10% for 28 consecutive days.

6- Diabetic rats fed on basal diet+ *Portulaca oleracea* 5% for 28 consecutive days.

7- Diabetic rats fed on basal diet+ *Portulaca oleracea* 10% for 28 consecutive days.

8- Diabetic rats fed on basal diet+ Allium cepa seeds 5% for 28 consecutive days.

9- Diabetic rats fed on basal diet+ Allium cepa seeds 10 % for 28 consecutive days.

During the experimental period (28 days), the diet consumed was recorded every day, body weight was recorded every week. At the end of the experimental period, rats were fasted overnight before sacrificing. Blood sample were collected from aorta, in dry clean centrifuge tube, and left for 15 minutes to clot at room temperature, then centrifuged for a 15 minutes at 3000 rpm to separate serum. Liver, heart, kidneys, lungs and spleen were removed, cleaned and weighed for calculating relative weight and kept in buffered formalin solution (10%, V / V) according to methods described by **(Drury and Wallington, 1980)** for histopathological investigation.

4- Biological Evaluation:

All rats were weighted once weekly. At the end of the experiment, biological evaluation of the different diets was carried out by determination of body weight gain (BWG), feed efficiency ratio (FER) according to ***Chapman et al. (1959)*.** Using the following formulas .

$$\text{BWG} = \text{Final weight} - \text{Initial weight}$$

$$\text{FER} = \frac{\text{Gain in body weight (g)}}{\text{Food Intake (g)}}$$

5- Analytical methods:

Enzymatic colorimetric method used to determine blood glucose according to **Yound (1975) and Tietz (1967)**. Colorimetric method was used for the determination of total cholesterol according to **NIHP (1986).** Determination of HDLc was carried out according to the method of **Friedewald (1972) and Gordon and Amer**

(1977). Enzymatic colorimetric method used to determine triglycerides according to **Fassati and Prencipe (1982).** The determinations of VLDLc and LDLc were carried out according to the method of **Lee and Nieman (1996)** as follows: Very low density lipoprotein (VLDLc = triglycerides /5) and LDLc = (Total cholesterol – HDLc – VLDLc). Colorimetric method used to determine AST and ALT according to **Reitman and Frankel (1957);** while determination of alkaline phosphates ALP activity according to **Belfield and Goldberg (1971)**. Serum creatinine plasma was determined colorimetrically according to the method of **Bartles *et al*., (1972) and Larsen (1972)**. Serum uric acid was determined colorimetrically according to the method of **Barham and Trinder (1972)**. Urea content in serum was determined colorimetrically according to the method of **Fawcett and Soctt (1960)**.

6- Histopathological study

Specimens from (liver, kidney) were collected from studied rats by the end of experimental period, fixed in 15 % neutral buffered formalin (pH 7.0), dehydrated in ethyl alcohol, cleared in xylol and embedded in paraffin, 4.6 mm sections were prepared and stained with sections hematoxylin and eosin **(Carleton, 1976)**.

7-Statistical Analysis

Statistical analysis were performed by using computer program statistical package for social science **(SPSS, 2008)**, and values compared with each other using the suitable tests .

3.Results and Discussion:

1- Biological Evaluation

1.1. Effect on FI, FER and BWG(%) for hyperglycemic rats:

Data present in table (1) show the effect of wormwood, cleome, onion seeds and pusley seeds on body weight gain (BWG), feed intake (FI) and feed efficiency ratio (FER) in hyperglycemic rats.

Table (1): Effect of wormwood, cleome, onion seeds and pusley seeds on BWG, FI and FER of hyperglycemic rats.

Parameters Animal group	Mean of BWG (g/28day)	Feed intake (g/28day)	feed efficiency ratio Mean ±SD
Control (-ve)	59.7b ± 5.69	606.25e ± 4.80	0.097b ± 0.008
Control (+ve)	20.80g ± 4.69	852.50 a ± 11.11	0.024 b ± 0.003
Wormwood 5%	46.47d ± 3.58	649.25 b ± 7.66	0.077 b ± 0.005
Wormwood 10%	21.32g ± 3.68	618.50 d ± 3.31	0.034 b ± 0.006
Cleome 5 %	50.10c ± 3.55	600.25 f ± 9.01	0.080 b ± 0.004
Cleome 10 %	18.92g ± 2.96	627.00 c ± 3.70	0.029 a ± 0.002
Onion seeds 5 %	80.83a ± 6.00	632.75 c ± 5.41	0.130 b ± 0.002
Onion seeds 10 %	26.52f ± 3.08	643.75 c ± 9.57	0.039 a ± 0.003
Pusley seeds 5 %	38.02 e ± 4.10	617.50 ^{d} ± 4.23	0.060b ± 0.007
Pusley seeds 10 %	38.30 f ± 5.01	613.50d ± 4.10	0.062b ± 0.005
LSD	2.92	5.95	0.15

Mean values which don't share the same letter in each column are significantly different at $P < 0.05$.

It could be observed for hyperglycemic rats (C +ve group) that that the mean value of BWG of control (+ve) was lower than that of the control (–ve) group. The values of all treatments were higher while the Cleome 10% group was lower than the control (+ve) group. The best treatment was observed when hyperglycemic fed on diet contained onion seed 5 %.

Concerning FI the results showed that the mean value of control (+ve), all experimental diets groups showed significant decrease in FI when compared to control positive group. Regarding FER the results revealed that the value of control (+ve) was lower than that of the control (–ve). Experimental diets raised the FER and the best treatment was that of Onion seeds 5%.

1.2. Effect on organs weights of hyperglycemic rats:

Data listed in table (2) show biological effect of wormwood, cleome, onion seeds and pusley seeds on liver, kidney and spleen weights (g) for rats suffering from hyperglycemia.

The mean value of liver weight (g) of control (+ve) group was higher than that of the control (–ve) group, which were 8.33 ± 0.24 and 6.22 ± 0.13g respectively.

Values in all treatments were lower than that of the control (+ ve) group and showed nonsignificant differences when compared to control (– ve) group. Most of the mean values showed significant differences when compared to control (+ ve) group.

As for kidney weight, the mean values of control (+ ve) was higher than that of the control (–ve) group being, 1.87 ± 0.26 g and 1.71 ± 0.16 g respectively. All the mean values of groups wormwood 5 %, 10 %, cleome 5 %, 10 %, onion seeds 5 %, 10 % and pusley seeds 5 %, 10 % showed nonsignificant differences when compared to control (+ ve) or control (– ve) group at (P < 0.05).

Spleen weight (g) for control (+ ve) was higher than that of control (– ve) group, and showed non significant differences at ($P < 0.05$). The mean value of treatment (onion seeds 10 %) showed the lowest value and indicated significant differences when compared to control (+ ve) group.

2. Biochemical changes

2.1. Effect on glucose, total cholesterol and triglycerides for hyperglycemic rats:

Effect of wormwood, cleome, onion seeds and pusley seeds for hyperglycemic rats are recorded in table (3).

Table (2): Biological effects of wormwood, cleome, onion seeds and pusley seeds on organs weights of hyperglycemic rats

Parameters Animal group	Liver (g)	Kidneys (g)	Spleen (g)
Control (-ve)	6.22ab ± 0.13	1.71a ± 0.16	1.12abc ± 0.13
Control (+ve)	8.33a ± 0.24	1.87a ± 0.26	1.42a ± 0.29
Wormwood 5%	6.43ab ± 0.22	1.72 a ± 0.09	1.12 abc ± 0.18
Wormwood 10%	5.25 b ± 0.72	1.47 a ± 0.14	0.87 bc ± 0.19
Cleome 5 %	6.54 b ± 0.78	1.77 a ± 0.18	1.22 ab ± 0.25
Cleome 10 %	4.82 b ± 0.79	1.28 a ± 0.19	0.87 bc ± 0.13
Onion seeds 5 %	7.03 ab ± 0.26	1.76 a ± 0.08	1.25 ab ± 0.18
Onion seeds 10 %	5.01 b ± 0.43	1.44 a ± 0.21	0.64 c ± 0.20
Pusley seeds 5 %	6.59ab ± 0.24	1.69a ± 0.20	0.82bc ± 0.09
Pusley seeds 10 %	6.79ab ± 0.55	1.51a ± 0.14	0.82bc ± 0.08
LSD	2.52	0.616	0.43

Mean values which don't share the same letter in each column are significantly different at $P < 0.05$.

Table (3):Effect of wormwood, cleome, onion seeds and pusley seeds on glucose, total cholesterol and triglycerides for hyperglycemic rats

Parameters Animal group	Glucose mg/dl	Total cholesterol mg/dl	Triglyceride mg/dl
Control (-)	124.30cd ± 4.07	139.40 bc± 2.26	48.13f ± 2.01
Control (+)	180.68a ± 4.38	187.93a ± 6.62	142.95a ± 2.76
Wormwood 5%	127.15 c ± 2.75	128.15 f ± 2.25	113.25 c ± 2.84
Wormwood 10%	119.70 de ± 3.34	130.36 ef ± 4.69	67.17 e ± 2.46
Cleome 5 %	109.62 f ± 2.66	140.16 b ± 3.77	127.05 b ± 3.33
Cleome 10 %	102.43 g ± 3.00	135.80 cd ± 5.68	109.12 c ± 2.64
Onion seeds 5 %	142.50 b ± 4.20	130.11 ef ± 3.39	127.09 b ± 5.11
Onion seeds 10 %	120.17 de ± 3.62	132.24 de ± 3.23	111.14 c ± 8.14
Pusley seeds 5 %	115.40e ± 4.42	124.30b ± 6.17	113.40c ± 5.89
Pusley seeds 10 %	75.84h ± 3.95	128.01f ± 5.16	103.24 d ± 5.95
LSD	4.95	3.69	4.17

Mean values which don't share the same letter in each column are significantly different at $P < 0.05$.

It could be noticed for serum glucose that the mean value of control (+ ve) group was higher than that of the control (– ve) group. The treatment with wormwood 10 % and onion seeds 10 % showed nonsignificant difference. The lowest value of serum glucose was observed for Pusley 10% group. It could be concluded that most of the plants or seeds under investigation especially Pusley seeds 10 % concentration lowered serum glucose g/dl even less than indicated that of the control (– ve) group. These results were in agreement with **El–Shenawy et al. (2006)** who reported that the cleome reduced the blood glucose in hyperglycemic rats. **Anon (2011)** found that cleome (Aqucocus and chloroformic extract of the herb) reduction of blood glucose in diabetic rats and mentioned the beneficial of onion (Allium cepa) was to reduced blood glucose. **Lachenmeier and Walch (2011)** used the thujone, amonoterpene keten often present in wormwood for treatment of diabetes mellitus. **Motaal *et al.* (2011)** reported that the antihyperglycemic activity of *Cleome* droserifolia was attributed to significant insulin – like effect in peripheral tissues. **Mathew and Augusti (1975)** found that the onion was lowering the fasting blood glucose of alloxan – diabetic (hypoglycemic) rabbits. **Sheela *et al.* (1995)** used the onion and garlic sulfoxide amino acid in rats to decrease blood glucose in diabetic rats. **Min – jung *et al.* (2010)** reported that the fibrous root of Welsh onion is effective in controlling hyperglycemia in animal models of diabetes mellitus.

With regard to total cholesterol the data revealed that the mean value of control (– ve) group was lower than that of the control (+ ve) group. All the treatment showing mean values lower than that of the control (+ ve) group. The lowest mean value observed for lowering total cholesterol of diabetic rats recorded for group fed on diet contained Pusley 10 %.

For triglycerides data it could be noticed that the mean values of (T.G) of control (– ve) was lower than control (+ ve) group. All the investigated treatment were lower than that of the control (+ ve) group. The lowest mean value was observed for rats fed on diet contained wormwood 10 %.

2.2. Effect on lipids profile for hyperglycemic rats:

Data illustrated in table (4) show the effect of of wormwood, cleome, onion seeds and pusley seeds on lipoprotein fractions (HDL, LDL and VLDL) in hyperglycemic rats.

Table (4): Biological effect of wormwood, cleome, onion seeds and pusley seeds on HDL, LDL and VLDL (mg/dl) for hyperglycemic rats.

Parameters Animal group	HDL mg/dl	LDL mg/dl	VLDL mg/dl
Control (-)	100.87c ± 4.46	28.90b ± 1.91	9.63e ± 2.01
Control (+)	68.05e ± 4.50	91.29a ± 3.53	28.59a ± 3.00
Wormwood 5%	95.73 d ± 4.62	9.77 e ± 1.72	22.65 c ± 2.35
Wormwood 10%	114.64 a ± 4.18	2.29 f ± 0.83	13.43 d ± 3.27
Cleome 5 %	95.80 d ± 4.05	18.95 c ± 2.77	25.41 b ± 3.23
Cleome 10 %	100.30 c ± 2.74	13.68 d ± 3.10	21.82 c ± 3.05
Onion seeds 5 %	101.44 c ± 3.52	3.95 f± 1.63	25.42 b ± 2.75
Onion seeds 10 %	105.75 b ± 4.91	4.26 f ± 0.32	22.23 c ± 3.11
Pusley seeds 5 %	94.32d ± 4.50	7.30e ± 0.62	22.68c ± 2.21
Pusley seeds 10 %	99.51c ± 6.06	7.85e ± 0.95	20.65c ± 3.13
LSD	2.71	2.49	2.1

Mean values which don't share the same letter in each column are significantly different at $P < 0.05$.

It could be noticed for HDL that the mean value of control (– ve) group was higher than that of the control (+ ve) group. All groups showed significant increase when compared with control positive group. The best treatment was recorded for rats fed on diet contained wormwood 10 %.

As regards the LDL the mean values of control (– **ve**) group was lower than that of the control (+ **ve**) group. It could be noticed that group of rats fed on diet contained wormwood 10 %) recorded the lowest value for LDLc.

As for VLDLc, it could be noticed that the mean values of control (– **ve**) group lower than that of the control (+ ve) group. The lowest mean value of VLDL was recorded for the group of rats fed on diet contained wormwood 10%).

These data confirmed by **Loai *et al*., (2002)** who found that the wormwood reduced the blood glucose level, prevent elevation of glycosylaled haemoglobin level and possessed a hypoliposis effect for diabetic rats. **Nofal, Salwa *et al*., (2009)** found that the extract of *Artimisia judaica* produced insignificant effect on serum cholesterol level but there was significant decrease in serum triglyceride. **Nicola *et al*., (1996)** suggested that the *Cleome droseriforlia* had hypocholesterolemic effect more specifically on low density lipoprotein cholesterol (LDL – c) which consequently raised the HDL – c / LDL – c ratio. This adds to its value as a protective and antiatherogenic agent for hyperglycemic. **Anon (2011)** reported that the onion is beneficial in lowering cholesterol, also the onion (*Allium cepa*) could be used as anticholesterolemic. **An Sook lee *et al*. (2010)** reported that the pusley lowered blood glucose, plasma T.G, plasma level of LDL – c and increased plasma level of HDL – c and insulin in diabetic mice. **Shen and Lu (2003)**, suggested that the *Portulaca oleracea* improved lipid metabolism and was decreasing free fatty acids of hyperglycemic rats. Dawei (2010) indicated that the use of *Portulaca oleracea L.* lowered the T.C and T.G in diabetic rats. **El – Sayed (2011)**, showed a significant decrease in serum levels T.G, T.C, LDL – c, while a significant increase in HDL – c when he used *Portulaca oleracea L.* seeds in treatment of type 2 – diabetic patients.

2.3. Effect on GOT, GPT and ALP for hyperglycemic rats:

Table (5) reveals the mean values of GOT (or AST), GPT (or ALT) and ALP serum of hyperglycemic rats which effected by feeding wormwood, cleome, onion seeds & pusley seeds in diets of diabetic rats.

Table (5): Effect of wormwood, cleome, onion seeds and pusley seeds on GOT, GPT and ALP (U/L) for hyperglycemic rats

Parameters Animal group	GOT U/L	GPT U/L	ALP U/L
Control (-ve)	11.26g ± 1.25	4.30f ± 0.56	115.30f ± 3.92
Control (+ve)	48.78a ± 2.87	20.61a ± 2.21	280.68 a ± 6.02
Wormwood 5%	41.05 b ± 2.42	8.01 c ± 1.77	261.15 b ± 5.40
Wormwood 10%	32.17 d ± 1.21	6.35 cde ± 1.29	259.34 b ± 3.48
Cleome 5 %	50.23 a ± 2.11	10.14 b ± 1.73	200.60 c ± 5.31
Cleome 10 %	36.41 c ± 2.00	7.25 cd ± 1.85	180.25 d ± 4.00
Onion seeds 5 %	31.50 d ± 1.78	6.17 de ± 2.00	171.33 e ± 5.11
Onion seeds 10 %	22.01 e ± 2.06	4.60 ef ± 1.54	142.41 g ± 3.16
Pusley seeds 5 %	33.24d ± 1.03	6.15de ± 1.64	134.05h ± 5.13
Pusley seeds 10 %	17.15f ± 2.87	3.40f ± 2.05	94.70i ± 3.71
LSD	2.97	1.66	4.39

Mean values which don't share the same letter in each column are significantly different at $P < 0.05$.

From the GOT data in the table (5), it could be noticed that the mean value of control (+ ve) group was higher than that of the control (– ve) group. All the variable treatments were lowered than that of control (+ ve) group and showed significant differences expect the mean value of rats fed on diet contained cleome 5 %. Group of rats fed on Pusley seeds showed the best treatment for AST (GOT).

The mean value of control (– ve) group was lower than that of the control (+ ve) group for GPT. It could be noticed that nonsignificant difference found between group fed on Pusley seed 10% and control (–ve) group (healthy rats) and represented the best treatment.

Concerning ALP the data revealed that the mean value of control (+ ve) was higher than that of the control (–ve) group. All the variable treatment lowered the mean values than that of the control (+ ve). The mean value of rats fed on diet contained pusley 10 %) was the best treatment for serum ALP. These results supported by **Nofal *et al.* (2009)** who found that the wormwood sp. (*Artemisia judaica*) extract showed significant improvement in the activities of transaminases (AST, ALT) and ALP in the 2 nd month after treatment of hyperglycemic rats, when compared to the control. Also, **Nishant and Vinod (2009)** reported that the *Cleome Viscosa linn.* extract had a hepatoprotective activity. El – Sayed (2011) studied the effect of *Portulaca oleracea L.* (pusley) in treatment of type – 2 – diabetes mellitus patient. He reported that the pusley showed a significant decrease in serum levels of liver ALT, AST and gamma glutamyl transaminase but a non – significant change of alkaline phosphate (ALP) for pusley seeds treated subjects. **Anon (2011)** reported that the *Cleome sp.* had a hepatoprotective effect and used in traditional medicine.

2.4. Effect on Creatinine, Urea and Uric acid for hyperglycemic rats:

Table (6) results show the mean values of creatinine, urea and uric acid of hyperglycemic rats as effected by diets containing wormwood, cleome, onion seeds & pusley seeds.

Table (6): Biological effect of wormwood, cleome, onion seeds and pusley seeds on creatinine, urea and uric acid (mg/dl) for hyperglycemic rats

Parameters Animal group	Creatinine mg/dl	Urea U/L	Uric acid U/L
Control (- ve)	0.32 bc ± 0.09	21.08 g ± 2.43	1.11 c ± 0.28
Control (+ve)	0.98 c ± 0.18	72.45 a ± 3.63	2.95 a ± 0.39
wormwood 5%	0.71 ab ± 0.04	41.13 cd ± 2.72	1.62 bc ± 0.19
wormwood 10%	0.64 ab ± 0.08	40.05 de ± 3.92	1.50 bc ± 0.09
cleome 5 %	0.73 ab ± 0.07	44.26 c ± 2.96	2.52 a ± 0.13
cleome 10 %	0.62 ab ± 0.07	37.40 e ± 2.95	2.34 ab ± 0.08
onion seeds 5 %	0.80 ab ± 0.06	44.15 c ± 3.45	1.56 bc ± 0.07
onion seeds 10 %	0.73 abc ± 0.05	38.40 de ± 4.58	1.27 c ± 0.10
pusley seeds 5 %	0.81 [a] ± 0.06	58.36 [b] ± 6.27	1.60 [bc] ±0.17
pusley seeds 10 %	0.62 [abc] ±0.04	33.50 [f] ± 5.30	1.51 [bc] ± 0.15
LSD	0.45	3.39	0.80

Mean values which don't share the same letter in each column are significantly different at $P < 0.05$.

It could be noticed that the mean value of creatinine for control (–ve) group was lower than control (+ ve) group. Mostly the mean values of various treatments showed significant differences when compared to control (+ ve) group and control (– ve) group. The lowest value of serum creatinine being 0.62mg/dl recorded for cleome 10 % and pusley seeds 10 % treatments.

Regarding urea all treatments decreased the mean values of serum urea, the treatment of rats fed on pusley 10% recorded the best mean value. Also, for uric acid the mean values of control (+ ve) group (hyperglycemic rats) was higher than that of the control (– ve) group (healthy rats). The best treatment was illustrated for groups of rats fed on diet contained 10 % onion seeds.

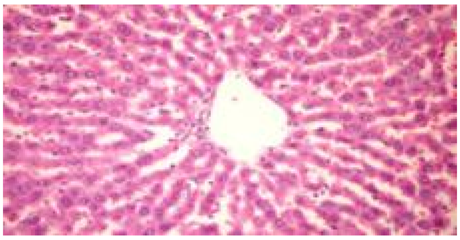
3. Histopathological investigation

3.1. Liver

Microscopically, liver of rat from healtgy group (control " –ve ") revealed the normal histological structure of hepatic lobule (Photo 1). Meanwhile, liver of rat from diabetic group (control " +ve ") showed sinusoidal leucocytosis, focal hepatic haemorrhage, pyknosis of hepatic nuclei and portal infiltration with leucocytes (Photo 2). Vacuolization of centrolobular hepatocytes was noticed in liver of rat from group 3 (wormwood 5% group (Photo 3). However, liver of rats from wormwood 10% revealed kupffer cells activation, cytoplasmic vacuolization of centrobular hepatocytes and portal infiltration with leucocytes (Photo 4). Liver of rat from group cleome 5 % group revealed perivascular leucocytes infiltration (Photo 5). However , liver of rat from cleome 10% group reveled kupffer cells activation and sinusoidal leucocytosis (Photo 6). No histopathological changes were noticed in liver of rat from onion seeds 5% group (Photo 7). Meanwhile, liver of rat from onion seeds 10% group revealed congestion of central veins and focal hepatic necrosis associated with inflammatory cells infiltration (Photo 8). However, liver of rats from pusley seeds groups (pusley 5 %) & (pusley 10 %) showed no histopathological changes (Photos 9 & 10).

3.2. Kidney

Microscopically, kidney of rat from healthy group (control " –ve ") revealed the normal histological structure of renal parenchyma (Photo, 11). Meanwhile, kidneys of rat from group control (+ve) revealed vacuolationa of endothelial liming glomerular tuft, vacuolations of epithelial liming renal tubules, tubulo – interstitial nephritis and perivasculitis (Photo 12). However, kidneys of rat from wormwood 5 % group showed vacuolations of epithelial liming some renal tubules (Photo 13). Kidneys of rat from wormwood 10 % group revealed no histopathological changes (Photo 14). Moreover, kidneys of rat from group cleome 5 % group revealed vacuolations of epithelial liming some renal tubules (Photo 15). However, kidneys of rat from group cleome 10 % group showed also no histopathological changes (Photo 16). Examined sections from group onion seeds 5 % group revealed congestion of renal blood vessels and vaculoations of epithelial liming renal tubules (Photo 17). Moreover, kidneys of rat from onion seeds 10 % group showed vacuolations of endothelial liming glomerular tuft and epithelial liming renal tubules (Photo 18). Also, kidneys of rat from pusley seeds 5 % group revealed vacuolations and congestion of glomerular tufts (Photo 19). No histopathological changes were noticed in kidneys of rat from group pusley seeds 10%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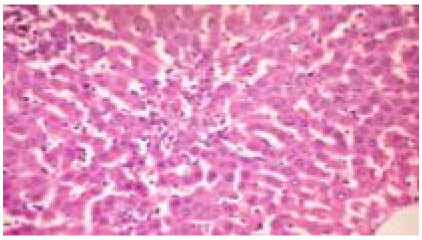
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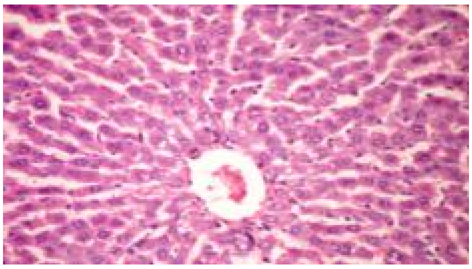
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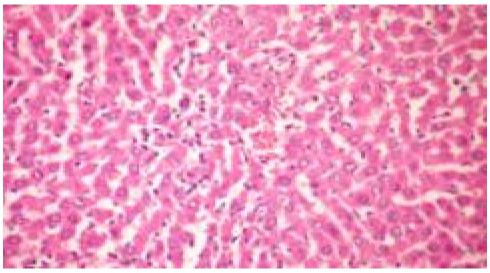
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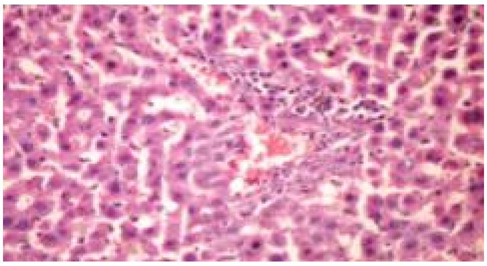
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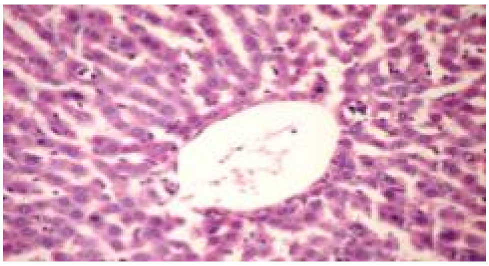
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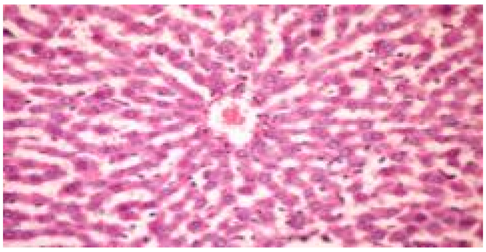
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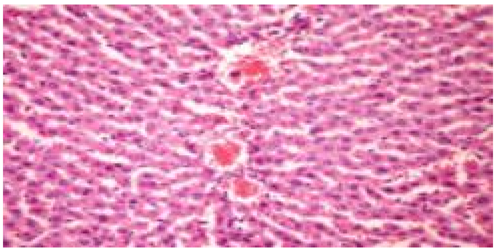
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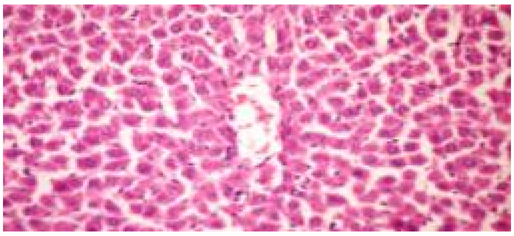
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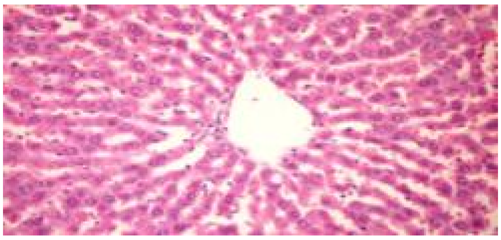
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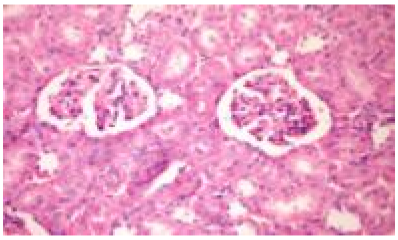
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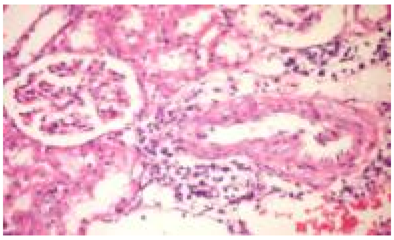
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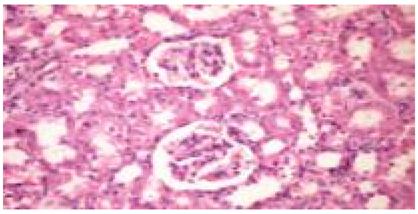
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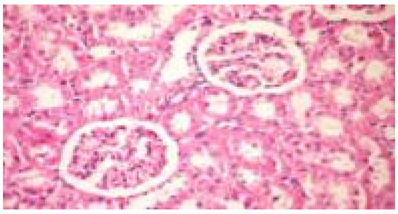
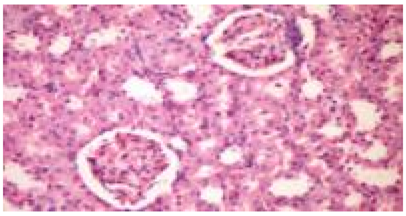


Photo (14)


Photo (15)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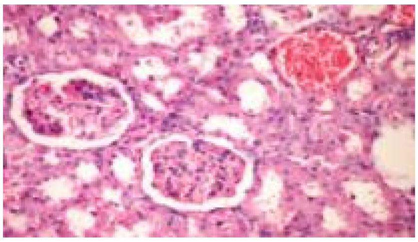
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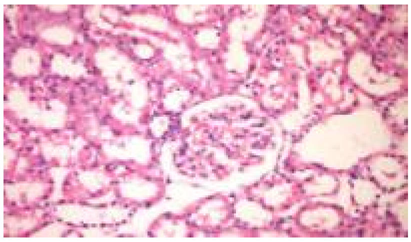
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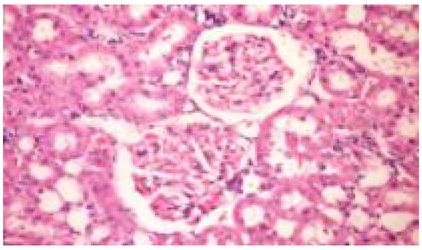
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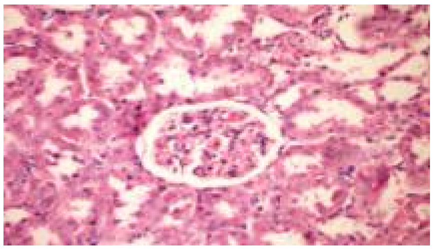
Photo (20)

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