Egypt. J. Chem. Environ. Health, 4 (2):1-12 (2018)
On line ISSN: 2536-9164.

# Ameliorative effect of Celery( Apium gravealens) and Sweet Marjoram (Origanium marjoram) on some biochemical parameters of diabetic male rats

**Riham ,M.Raafat;.Hanan,M.Sobhy;.Amal,A.Zaki**
Biochemistry, Toxicology And Feed deficiency Depart. Animal Health Research Institute,Dokki.

## ABSTRACT

The goal of this study was to determine some biochemical activities of two medicinal plants Celery( **Apium gravealens) and** *Sweet marjoram* **(Origanium marjoram**) on normal and diabetic rats for 30 successive days . Twenty mature rats of an average body weight of (150-180 gm ) were divided into 4 groups 5 rats each.(G1) control ,(G2) diabetic control group injected intrapretonial by alloxan in a dose 150 mg/kg b.wt .(G3)diabetic rats fed on basal diet mixed with 1% dried *Celery*( ***Apium gravealens*)**,**(G**4) diabetic rats fed on basal diet mixed with 1% dried *SweetMarjoram* **(Origanium marjoram**) .At the end of the experiment ,serum blood samples were collected to determine some biochemical parameters , some oxidative markers and relative organs weights . Rats were sacrified and organs were weighed to determine relative organs weight

.Results revealed that there were a significant decrease of serum levels of AST,ALT,ALP,cholesterol, triglyceride ,urea and glucose as well as MDA than diabetic control groups at $P<0.05$.On the otherhand our result found no effect on albumin ,globulin and A/G ratio while catalase enzyme activity showed a significant increase than control diabetic one . the relative organs weight in (G3)and (G4) returned toward normal values.Conclusively ,fed *Celery* or *Sweet marjoram* to diets of diabetic male had a beneficial practical tool to minimize the effect of diabetes without any adverse effect on metabolic parameters and organs weight of rats.

## INTRODUCTION

Dietary factors play a key role in the development of various human diseases including diabetes and other metabolic diseases atherosclerosis, hyperlipedema **(Banerjee and Maulik 2002)**. Diabetes mellitus (DM) is a group of metabolic disorders resulting from defects in insulin secretion or reduced sensitivity of tissues to insulin action or both (**lanza et al., 1999**) Diabetes mellitus (DM) is characterized by absolute or relative deficiencies in insulin secretion and or insulin action associated with chronic hyperglycemia and disturbances of carbohydrate, lipid and protein metabolism. In addition, various biochemical disorders associated with vascular complications such as hyperlipidemia and oxidative stress frequently coexist with diabetes mellitus (DM) (**Mossaad and Abd Allah 2004**).Medicinal plants continue to provide valuable therapeutic agents, in both modern traditional and medicine system. The doubts about the efficacy and safety of the oral hypoglycemic agents have prompted a search for safer and more effective drugs in the treatment of

DM (**El- demerdash et al., 2005**). In spite of the fact that insulin has become one of the most important therapeutic agents known to medicine researchers. It have been making efforts to find insulin substitutes for synthetic or plant sources for the treatment of diabetes.

Many herbs have remained as an alternative to conventional therapy especially in poor areas where insulin is not readily available. (**Sanchez et al., 1994**).

*Celery* **(Apium gravealens)** is a herbal member of family Apiaceae. It is an annual or biennial plant native to mediterrenean regions (**Kapoor, 2001**). *Celery* has a potent antioxidant effect, it is an excellent source of vitamin C and dietary fiber, some vitamins and minerals.**Chu et al. (2002).** It has been extensively studied for its biological activities. *Celery* is a highly consumed vegetable with a high flavonoid as a epigenin, chryseoriol as ( phenolic acids, chologenic acid, cinnnamic acid, caumarin) and their glycosides. (**Khalid et al., 2013**).

*Celery* is characterized by its antiphyperglycemic, antitumer, antioxidant, dieuretic, antihypercholesteremic activities. **(Nehal, 2011**).

*Sweet marjoram* **(Origanium marjoram**) is one a member of family lamiaceae is widly used in Egypt and Middle Eas . **Kapoor(2001**). It is promising source of hepatoprotective , antioxidant activities and hypoglycaemic effects. It has been found to have a variety of pharmacological and antioxidant effects. Phytochemical constituents of sweet Marjoram such as flavonoids, tanins, sterols, triterpens and volatile oils had been previously isolated and identified. (**Ali, 2011**). The phytochemical of sweet Marjoram is related to its total phenolic content and antioxidant activities and controlling oxidative damage of pancreas and testis tissues **El-Ashmawy et al.(2005).** The goal of this study was to evaluate the ameliorative effect of celery and sweet Marjoram on some biochemical parameters and antioxidant activities on diabetes induced by alloxan in male rats .

## MATERIALS AND METHODS

### Materials

**Plants:**

*Celery* **(Apium gravealens)** and *Sweet marjoram* **(Origanum marjoram)** were obtained from Faculty of Agriculture farm. Plants were identified by Faculty of Pharmacy, department of Pharmacognosy, Cairo University, Egypt. The plants were air dried then ground and kept in a glass bottles till mixed with ration.

**Experimental animals:**

Twenty apparently healthy male albino rats of an average body weight 150-180g were obtained from the laboratory of animal colony, Helwan, Cairo, Egypt. Rats were fed on standard ration and water supply was given *ad-libtum*.

**Preparation of diabetic rats:**

Alloxan tetrahydrate pure (99% ) was obtained from Sigma Company (Germany) was dissolved in sterile distilled water and injected to fifteen rats intrapretoneally at a dose of 150 mg/Kg b wt according to (**Desai and Bhide, 1985**).

**Experimental design:**

Twenty rats were divided into 4 equal groups. All groups were fed the experimental basal diet with or without the tested plants for 30 days as follows:

Group (1) : Control group was fed on basal diet. Group (2) : Diabetic rats were fed on basal diet.

Group (3): Diabetic rats were fed on basal diets mixed with *Celery* in Concentration of 10g/kg ration (1%).

Group (4): Diabetic rats were fed on basal diets mixed with *Sweet marjoram* in concentration of 10 g/kg ration (1%).

**Sampling:**

**Blood samples:** were collected from each rats at the end of the experiment. Blood samples were taken from retro-orbital venous plexus into clean, sterile and labeled centrifuge tubes to separate serum to determine some biochemical parameters as follows Serum aspartate aminotransferase (AST) and serum alanine transferase (ALT) were determined according to **Reitman and Frankel (1957)** and alkaline phosphatase was measured according to the method described by **Tietz (1986**). Total cholesterol (T.chol.) and triglycerides (Trigs) were estimated

according to the method described by **Watson** (**1960**) and **Whalerfeld (1974**) respectively. Urea and glucose were measured spectrophotometrically according to the method described by **Reises et al., 1965** and **Trinder, 1969** respectively. Total protein (TP) and albumin (ALb) were determined according to method described by **Weichselbaum** (**1946)** and **Doumas et al., (1971)** respectively.

while globulin (glob) was calculated by substracting of albumin levels from total protein levels and A/G ratio was calculated mathematically. Lipid peroxide activity were assayed (Malondialdehyde MDA) according to **(Ohkawa et al., 1979**) and catalase as recorded by (**Aebi, 1974**).

**b-Tissue sample**: at the end of the experiment rats of all groups were weighed then sacrified. Organs (liver, kidney, heart and spleen) were taken and weighed to calculate the relative organs weights.

**Statistical analysis:**

Parametric data were statistically analyzed by using Anova tests and comparison between means were preformed using Duncan Multiple range test for comparative of means using SPSS ver 14 (2006). Results were represented as (Mean $\pm$ S.E.).

## RESULTS AND DISCUSSION

Diabetes mellitus (DM) is a chronic, systemic and metabolic disease manifested by hyperglycemia. It is characterized by alteration in the metabolism of carbohydrate, protein and lipids. The cumulative effects of these metabolic derangement lead to cell damage and circulatory changes. Other clinical consequences of diabetes include ne nephropathy, retinopathy and liver dysfunction (**Wild et al., 2004**). Herbal and natural products represents the most common forms of complementary and alternative medicine (**Graham et al., 2005**). They are readily available and can

be obtained from supermarkets and pharmacies. As these products are usually used without medical prescription, they must be safe for human (**Ernst, 2006**). Numereous studies have reported the antioxidant properties of many natural products against many toxic materials (**Shati and Alamri 2010**). Antihyperglycemic effects of these plants are attributed to their ability to restore the function of pancreatic tissues by causing an increase in insulin output or inhibit the intestinal absorption of glucose or to the facilitation of metabolites in insulin dependent processes (**Oliver – Bever, 1986**). Most plants contain glucoside, alkaloids, terpenoids, flavonoids, and carotenoid which may be implicated as having antidiabetic and antioxidant effect (**Loew and Kaszkin, 2002**).

The present study was carried out to investigate the ameliorative effect of available herbs as *Celery* and *Sweet marjoram* on some biochemical parameters and antioxidant markers in normal and diabetic rats.The obtained results in (table 1) showed that feeding rats a ration mixed on *Celery* 1% *and Sweet marjoram* 1% of produced a significant decrease in AST, ALT and Alp levels at $P<0.05$. This finding are in agreement with **Ahmed et al. ( 2002)** and **Amnah (2013)** who studied the effects of methanolic extracts of *Celery* against liver damage induced by paracetamol in rats.They reported that methanolic extract of C*elery* seeds showed a significant hepatoprotective effect due to its antioxidant effect.It contains large amount of vitamin C which has the ability to improve liver dysfunction due to its antiperoxiditive property . Moreover, **El -Ashmawy et al.(2005)** found that administration of *Sweet marjoram* extraction to rats intoxicated with lead acetate for one month induced significant decrease in serum transeaminases and improved liver and kidney histology in comparison to lead acetate treated group .

Data in table (1) also indicate that diabetic rats showed a significant elevation in total cholesterol and triglyceride levels comparing with control group while rats fed *Celery* and *Sweet marjoram* showed significant reduction in total cholesterol and triglyceride concentrations compared to diabetic control group at $P < 0.05$. Similar observations on *Celery* were reported with **Jelodar et al.( 2007**) and **Khan** and **Balish (2001**) and who found that *Celery* on some biochemical parameters of decreased serum levels of total cholesterol and triglyceride of diabetic rats . Also **Dhanapakiam et al. (2008**) and **Ahmed et al. (2009**) reported that oral administration of *Marjoram* and Chicory or Their extracts at 5% and 10% lowered total cholesterol and triglyceride concentrations.

Also Table (1) presented the effect of feeding 1% of *Celery* and *Sweet Marjoram* to normal and diabetic rats. The results showed that significant $P < 0.05$ reduction in urea level (table 1) in groups fed1% *Celery* and 1% *Sweet marjoram* than diabetic rats.These results are consistent with **El shabrawy** and **Nada (1996**) and **Aissaoui et al. (2008**) who recorded that *Celery* seeds and stalks are effective in reducing urea and uric acid levels and have the ability to decrease inflammation and oxidative stress they are also rich in vitamins B complex, A and C .

Concerning glucose level (table 1) it was reduced significantly in *Celery*, and *Sweet Marjoram* treated rats as compared to diabetic group rats at $P < 0.05$ these finding was in agreement with **khalid et al. (2013**).

This effect may be attributed to their phenolic content which are Known to be involved in the healing process of free radical mediated diseases Moreover their flavonoids which are the active principles ,it also possess an inhibitory effect on the aldose reductase enzyme. This enzyme played a role in catalyzing the reduction of glucose to sorbitol which cannot diffuse out of cell membrane. **Bafeel and Ali (2009)** and **Jain et al. (2009).**

Data tabulated in table (2) indicated that feeding *Celery* and *Sweet marjoram* to diabetic rats at concentration 1% for 30 successive days exhibited no changes in the level of total protein, albumin, globulin and A/G. Our finding are inagreement with **Ibrabim et al., (2000)** and **Sreelatha et al. (2009).**

Moreover table (3) demonstrated the antioxidant parameters after feeding 1% *Celery* or 1% *Sweet marjoram* to diabetic rats . The results revealed significant decrease MDA levels while catalase activity was significant increased in groups fed the tested plants compared to diabetic control one at $P<0.05$. our results consistent withand **Yae et al., (2010)** and **Amnah 2013** who said that *Celery* is an excellent source of vitamin C and flavonoids which have a protective effect in minimizing the oxidative stress .Concerning *Sweet marjoram* is a potent antioxidant as it has the ability to trap free radicals. These free radicals may oxidize nucleic acids , protein or DNA and can lead to degenerative disease **Nehal et al .(2014).** Antioxidant compounds like phenolic acids,polyphones ,terpenoids and flavenoids scavenge the free radicals and thus inhibit the oxidative mechanisms **kintzios et al.(2010).**

Table (4): illustrated the effect of feeding tested plant ( *Celery* or *Sweet marjoram*)in concentration 1% for 30 successive days on relative organ weight (kidney, heart, liver and spleen) of normal and diabetic rats. Diabetic rats which received *Celery* or *Sweet marjoram* did not show changes in the body weight and liver weight while kidney ,heart and spleen relative weights significantly decreased at $P<0.05$ comparing with diabetic rats . *Celery* and *Sweet marjoram* improved significantly kidney kidney relative weight of diabetic rats which could be due to antioxidant effect (**Nehal,2011**). Conclusively ,fed *Celery* or *Sweet marjoram* to diets of diabetic male had a beneficial practical tool to minimize the effect of diabetes without any adverse effect on metabolic parameters and organs weight of the rats.

Table (1): Effect feeding 1% of *Celery* or 1% *Sweet marjoram* for 30 successive days on some biochemical parameters in normal and diabetic rats (n = 5).

| Parameters / Groups | AST (U/L) | ALT (U/L) | ALP. (U/L) | T.chol. (mg/dl) | Trig. (mg/dl) | Urea (mg/dl) | Glucose (mg/dl) |
|---|---|---|---|---|---|---|---|
| control | 25.26 ±0.24$^{a}$ | 12.5 ± 0.596$^{a}$ | 40.38 ±0.618$^{a}$ | 62.23 ±2.7$^{a}$ | 76.56 ±0.62$^{a}$ | 36.23 ±0.046$^{a}$ | 104.7 ±2.92$^{a}$ |
| Diabetic | 49.4 | 25.65 | 80.49 | 90.77 | 166.4 | 39.05 | 211.13 |
| Diabetic rats fed 1% *Celery* | 43.268 ±0.219$^{c}$ | 15.4 ±0.416$^{c}$ | 45.58 ±0.163$^{c}$ | 87.6 ±2.55$^{b}$ | 162.3 ±0.21$^{c}$ | 36.212 ±0.189$^{a}$ | 140.6 ±0.134$^{c}$ |
| Diabetic rats fed 1% Sweet | 45.942 ±0.278c | 20.65 ±0.426b | 63.38 ±0.516d | 58.6 ±3.39a | 162.454 ±0.143c | 31.596 ±0.145c | 179.68$^{d}$ ±0.314 |

Mean±SE . Means with different superscripts in the same column are significantly different . (P<0.05)

Table (2): Effect of feeding 1% *Celery* or 1% *Sweet marjoram* for 30 successive days on some Protein profile Aspects in normal and diabetic rats (n = 5).

| Parameters / Groups | T.P (g/dl)) | Alb (g/dl) | Globulin (g/dl) |
|---|---|---|---|
| control | 6.44 ± 0.13$^{a}$ | 3.55 ± 0.098$^{a}$ | 2.89 ± 0.125$^{a}$ |
| Diabetic control | 6.5 ± 0.245$^{a}$ | 4.79 ± 0.17$^{b}$ | 1.7 ± 0.156$^{b}$ |
| Diabetic rats fed 1% *Celery* | 6.36 ± 0.175$^{a}$ | 3.812 ± 0.134$^{bc}$ | 1.92 ± 0.29$^{b}$ |
| Diabetic rats fed 1% *Sweet marjoram* | 5.796 ± 0.407$^{ab}$ | 4.22 ± 0.094$^{ac}$ | 1.98 ± 0.34$^{b}$ |

Mean±SE . Means with different superscripts in the same column are significantly (P<0.05) different.

Egypt. J. Chem. Environ. Health, 4 (2):1-12 (2018)
On line ISSN: 2536-9164.

Table (3):Effect of feeding 1% *Celery* or1% *Sweet marjoram* for 30 successive days on some oxidative markers in normal and diabetic rats (n =5)

| Parameters / Groups | MDA (nmol) | Catalase (mmol) |
|---|---|---|
| control | $7.83 \pm 0.28^{a}$ | $196 \pm 1^{a}$ |
| Diabetic control | $10.4 \pm 0.37^{b}$ | $110.8 \pm 3.2^{b}$ |
| Diabetic rats fed 1% *Celery* | $8.8 \pm 0.32^{b}$ | $124.8 \pm 2.35^{c}$ |
| Diabetic rats fed 1% *Sweet marjoram* | $8.6 \pm 0.31^{b}$ | $134 \pm 4.84^{abc}$ |

Mean±SE .Means with different superscripts in the same different.are sigicanniftly column P<0.05)

Table (4): Effect of *feeding 1% Celery* or1% *Sweet marjoram* for 30 successive days on relative organs weight in normal and diabetic rats (n=5).

| Parameters / Groups | Body weight (g) | Kidney (g) | Heart (g) | Liver (g) | Spleen (g) |
|---|---|---|---|---|---|
| control | $206.6 \pm 3.06^{a}$ | $0.71 \pm 0.007^{a}$ | $0.33 \pm 0.01^{a}$ | $2.74 \pm 0.04^{a}$ | $0.192 \pm 0.007^{a}$ |
| Diabetic control | $195 \pm 4.28^{b}$ | $0.85 \pm 0.022^{b}$ | $0.391 \pm 0.019^{b}$ | $2.51 \pm 0.092^{a}$ | $0.364 \pm 0.02^{b}$ |
| Diabetic rats fed 1% *Celery* | $199.17 \pm 2.01^{ab}$ | $0.783 \pm 0.031^{c}$ | $0.352 \pm 0.0154^{a}$ | $2.76 \pm 0.168^{a}$ | $0.255 \pm 0.017^{c}$ |
| Diabetic rats fed 1% *Sweet marjoram* | $198.33 \pm 1.67^{ab}$ | $0.793 \pm 0.031^{c}$ | $0.338 \pm 0.014^{a}$ | $2.83 \pm 0.154^{a}$ | $0.268 \pm 0.008^{c}$ |

Mean±SE , Means with different superscripts in the same column are significantly($P<0.05$)

Egypt. J. Chem. Environ. Health, 4 (2):1-12 (2018)
On line ISSN: 2536-9164.

## REFERENCES

**Aebi, H. (1974):** Catalase. In methods of enzymatic analysis (Bergemeeyer, H.U. and Ulrich, H., Eds). Vol. 2pp 673-684, Academic Press, New York.

**Ahmed,B.;Alam,T.;Varshney,M.andKhan,S.A.(2002):** hepatoprotective activity of two plants belonging to Apiaceae and Euphorbiaceae family .J. Ethnopharmacology ;79(3):313-6.

**Ahmed,L.A.;Ramadan,R.S.and Mohamed,R.S.(2009):** Biochemical and histopathological studies on the water extracts of Marjoram and chicory herbs and their mixtures in obese rats.Pakistan journals of Nutrition ;8(10):1581-1587.

**Aissaoui,A.;El-hilaly,J.;Israil,Z.H.and Lyoussi,B.(2008):**Acute diuretic effect of continous intravenous infusion of aquous extract of coriandrum sativum L.in anatheasized rats.J.Ethnopharmacology 115(1):89-95.

**Ali, A. Shari (2011):** Effects of origanummajoramal on caolmium induced hepato toxicity and nephrotoxicity in albino rats. Vol. 32 (8): 797-805.

**Amnah,M.A.Alsuhaibani (2013):**antioxidant activity of celery in vitro and vivo .J.American Sci.;9(6).

**Bafeel,S.O.and Ali,S.S.(2009):** Potential liver toxicity of lepidium sativum seeds in albino rats.Research J. of biological Science 4(12):1250-1258.

**Banerjee, S.K., Maulik, S.K. (2002):** Effect of garlic on cardio vascular disorders: a review Nutrition Journal 1 (4), 1-14.

**Chu, Y.F.;Sun, J.;Wu,X.Z and .Liu,R.H.(2002):**Antioxidant and antiprolifererative activities of common vegetables .J of Agricultural and Food Chemistry;50(23):6910-6916.

**Desai, A. and Bhide, M. (1985):** Hypoglycaemic effect of Hanitonia Suavecolens. Indian J. Med., 81: 86-91.

**Dhnapakiam,P.;Joseph,J.M.;Ramaswamy,V.K.;Moorthi,M.and**
**Kumar,A.S.(2008):**The cholesterol lowering property of coriandrum seeds mechanism of action . J.Enviromental biol. 29(1):53-56.

**Doumas ,B.,T.;Watson,W.A.and Biggs,H.,G.(1971):**Albumin standard and the the measurment of serum albumin with bromocresol green. Clin.Acta. ,3:87-96.

**El Ashmawy,I.M.;El-Nahas,A.F.and Salama,O.M.(2005):**protective effect of volatile oil,alcoholic,and aqueous extacts of Origanum majaram on lead acetate toxicity in mice. Basic clin.pharmacol.toxicol.;97(4):238-243.

**El- Demerdash,F.M.;Yousef,M.I.and Abou El Naga , N. I.(2005):**alloxan induced diabetic rats. Food and chemical toxicology 43,57-63.

**Ernst E. (2006):** when natural is not harmless. Inr. J. clin. Pract 60: 380.

Evaluation of antioxidant activity Marjoram (Origanium marjoram) in Ccl4 intoxicated rats. Spatula DD,4(1):33-40.

**El Shabraw,O.A**.and **Nada,S.A.(1996):** Biological evaluation of multicomponent tea used as hypoglyceamic in rats .Fitoterapia ;67(2):99-102.

**Graham, R.E. Ahn, A.C., Davis, RB and Eisenberg D.M. (2005):** use of complementary and apreinative medical therapies among racial and Ethnic minority aduts results from the 2002 National health interview survey J. Natl Med Assoc. 97: 535-455.

**Ibrahim,S.A.M.;El Ghamry,A.A.and El Mallah ,G.M.(2000):**Effects of some medicinal plants of labiatae family as feed additives on growth and metabolic changes of rabbits .Egypt J.of rabbits sciences ;10(1)105-120.

**Jain,G.C.;Pareek,H.;Khajja,B.S.;Jain,K.;Jhalani,S.;Agrawal,S.and Sharma ,S.(2009):** Modulation of di-(2 Ethyl hexyl )phthalate induced hepatic toxicity by Apium graveolens L. seeds extracts in rats .African J.of biochemistry Research .3(5):222-225.

**Jelodar,G.;Mohsen,M. and Shahram,S.(2007):** Effect of walnut leaf ,coriander and pomegranate on blood glucose and histopathology of pancreas of alloxan induced diabetic rats .Afri.J.Tradit. complement Altern. Med .;4(3)299-305.

**Kapoor,L.D.(2001):**Handbook of ayurvedic medicinal plants .CRC press llc,USA.Pp.283.

**Khalid Niaz, Seemi Gull, M. Azam Zia (2013**): Hypoglycemic effect of celery seeds in streptoZotocin induced diabetic Rats. Journal of Raw alpindi Medical college. 17 (1): 134-137.

**Khan,S.and Balick,M.J.(2001):** Therapeutic plants of ayurveda :a review of selected clinical and other studies for 166 species .J.Alterrn. complement. Med.;7(5):405-515.

**Kintzios,S.;Papageorgiou,k.;Yiakoumettis,I. and Baricevic,D.(2010**):
Evaluation of antioxidant activities of four Slovene medicinal plant spicies by traditional and novel biosensory assay .J.pharm.Biomed.Anal.53(3):773-6.

**Lanza, R.P.; Ecker, D.M.; Kuhtreiber, W.M.; Marsh, J.P. and Chink**, **W.L. (1999**): Transplantation of islets using microen capsulation studies in diabetic rodents and dogs. J. Mol. Med.; 77: 206-210.

**Loew, D. and Kaszkin, M. (2002):** Approaching the problem of bioequivalence of herbal medicinal products Phytother. Res., 16: 705-711.

**Mosaad, A.A. and Abd – AllAH Youssef (2004):** Evaluation of some biochemical changes in diabetic patients. ClinicachimicaActa 346: 161-170.

**Nehal, M Belal (2011**): Hepato protective effect of feeding celery leaves Mixed with chicory leaves and Barley Grains to hypercholesterolemic Rats. Asian Journal of clinical Nutrition 1 : 11.

**Nehal,A.A.;Mostafa,A.S.;Hosney,A.E.and Shimaa,E.R.(2014):**
Evaluation of antioxidant activity of marjoram plant (Origanium majarana L.)in $CCl_4$ in toxicated rats .Spatula DD.4(1):33-40.

**Ohkawa, H. ohish, W. and Yagi, K. (1979):** Assay for lipid peroxide in animal by Thiobarbituricacid reaction. Anal. Biochem., 95: 351-353.

**Oliver – Bever, B (1986):** oral hypoglyceamic action of medicinal plants in tropical west Africa. Cambridge university Press, London, pp. 245-267.

**Reises,D.;Murain,Z. and Dainciart,A.(1965):**Determination of serum urea .Bull.Soc. pharm. Brodeaux,104:173.

**Reitman**, **S.and Frankel, S. (1957):** Determination of serum glutamic oxaloacetic and gluramic pyruvic trans aminase. Amer. J. clin. Path.; 28:56-63.

**Sanchez, F.D., Game, MJ. Jimenez, I., and Zarzuelo, A. (1994):** Hypoglycemic activity of Juniperus (Berries). Plant medicine 60, 197-200.

**Shati, A.A. and Alamri, S.A. (2010):** Role of Saffron and honey syrup on Aluminum – induced hepato toxicity. Saudi Med. J. 31: 1106-1113.

**SPSS 14 (2006):** Statistical Package for Social Science for windows release 14.0.0, 12 June, 2006 Standard version copyright.

**Sreelatha,S.;Padma,P.P.and Umadei,M.(2009):**protective effects of coriandrum sativum L. extracts on carbon tetrachloride induced hepatotoxicity in rats . food chemistry toxicology;47(4):702-8.

**Tietz, N.W. (1986):** Fundamentals of clinical chemistry Edited by N.W. Tietz, Saunders. Company, 3rd Ed. Vol. Philadelphia, USA.

**Trinder,P.(1969):**Enzymatic determination of glucose .Ann.Clin. Biochem.,6:26.

**Wahlerfeld, A.W. (1974):** Methods of enzymatic analysis value size Hupergmeyer, Ed. Academic press, New York Pages 1831-31835.

**Watson, D. (1960):** Determination of serum cholesterol. clin. Chem. Acta 5 : 637.

**Weichselbaum, T.E. (1946):** an accurate and rapid method for determination of protein in serum and plasma. Am. J. clin. Path. Tech. Sec. 10 : 40.

**Wild, S.; roglic, G.; Green, A.; Sicree, r. and King, H. (2004):** Global prevalence of diabetes: estimates for the year 2000 and Projection for 2030 Diabetes Care 27 (5): 1047-53.

**Yae,Y.,Sang,W.,Zhou,M.and Ren,G.(2010**): phenolic composition and antioxidant activities of 11 celery cultivars .J food Sci.,75(1): c9-13.