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DIABETICS ENERGY SYSTEMS IMPROVED BY *ANASTATICA HIEROCHUNTICA* AND *CLEOME CHRYSANTHA*

BY

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ABSTRACT

Hypoglycemic effects of *Anastatica hierochuntica* and *Cleome chrysantha* were studied in streptozotocin rats. Ether and methanolic extracts of both plants were ingested into diabetic rats to evaluate their influences on energy metabolism and cytochrome-c system in brain, liver and kidney. For energy metabolism, ATP reduced but ADP and AMP levels were elevated at control of diabetic rats. In addition, myokinase activity was stimulated at diabetic control. Ingestion of both plants ether extracts insignificantly changed diabetes effect on (ATP, ADP, AMP) myokinase. Ingestion of methanolic extract of *Anastatica* and Cleome elevated ATP levels but ADP and AMP were reduced. Myokinase activity was inhibited of diabetic rats. Diabetes reduced cytochrome-c level but cytochrome-c-oxidase and succinate-c-reductase activity was stimulated. Ingestion of both plants ether extracts was insignificantly changed the diabetes effects on cytochrome-c system. Both plants methanolic extracts had antagonistic effects on diabetes influences. For that, cytochrome-c respiratory system was improved nearly normal control.

Keywords: *Anastatica hierochuntica*, *Cleome chrysantha*, diabetes, ATP, ADP, AMP, myokinase, cytochrome-c-oxidase, succinate-c-reductase.

Abbreviations: ATP: Adenosine-5-triphosphate; ADP: Adenosine-5-diphosphate; AMP: Adenosine mono phosphate; STZ; streptozotocin.

INTRODUCTION

The diabetes is a heterogeneous primary of carbohydrate metabolism with multiple etiologic factors that generally involves absolute or relative insulin deficiency, insulin resistance or the both. All causes of diabetes ultimately lead to hyperglycemia, which is the half mark of this disease (Foster, 1991 and Olefsky, 1992). It is usually accompanied with glycosurea and disturbance of animal metabolism in particular the energy and cytochrome systems (Murray *et al.*, 2006). The expenditure of energy in body is required for maintenance of ionic gradients across membranes, locomotion, synthesis of molecules, secretory processes, detoxification and heat generation. The central driving force which is the basis of all energy requiring biological processes is high energy phosphate in the form of ATP which can be generated by the oxidation of carbohydrate, fat and protein. These

sources of energy can be oxidized at different rates and in different proportions to each other, depending on the body's demand for energy and on the availability of these energy fuels to the body. The relationship between energy and cytochrome-c systems has been proved for many years (Elliott and Elliott, 2001). In diabetic animals, insulin secretion is probably backing to meet the different metabolic pathways.

Several natural medicinal agents, through of limited natural distribution have been used for the treatment of diabetes mellitus in amounts limited by tradition and personal taste. In general, no serious effects have been associated with this treatment, but it would be irrational to grant these materials exemption from modern safety testing when administrated to animals in a manner which produces any conscious control over their use by the consumer.

Anastatica hierochuntica and *Cleome chrysantha* which are grown wild in the Halal North Sinai are popularly known for its berrier to exhibit a variety of pharmacodynamic effects: diuretic, carminative, antiseptic and abortive among others (Gowenlock *et al.*, 1988 and Abdel-Rahim *et al.*, 1992). The plants ingestion into normal rats showed insignificant hypoglycemic effect in non-glycemic rats (El-Ridi, 2001 and Abdel-Rahim *et al.*, 1992). Although several investigations were done on for treating diabetes amongst, Abdel-Rahim *et al.*, (2005) found that *Anastatica hierochuntica* and *Cleome chrysantha* appear to have blood sugar lowering effect by improvement the carbohydrate metabolism which disturbed by diabetes in streptozotocin (STZ) diabetic rats. In the same manner, Rahmy and El-Ridi (2002) pointed out that *Anastatica hierochuntica* administration to STZ-diabetic rats also showed hypoglycemic effects.

The present work aims to evaluate the influence of *Anastatica hierochuntica* and *Cleome chrysantha* ingestion on energy system i.e. ATP, ADP and AMP (energy metabolites) content and myokinase activity as well as respiratory system (cytochrome-c content and the activity of cytochrome-c-oxidase and succinate-cytochrome-c-reductase) in brain, liver and kidneys tissues of STZ-diabetic mal adult albino rats.

MATERIAL AND METHODS

Anastatica hierochuntica and *Cleome chrysantha* as hypoglycemic agents were extracted by successive extracts using ether and methanol respectively. Each fraction was concentrated under vacuum using a rotary evaporator at 40°C and stored at -20°C until used. All the fractions were suspended at different concentration of water or cotton seed oil before oral ingestion into the diabetic rats by daily doses of 150 mg/kg body weight for 6 weeks of each plant extracts.

A total of 36 adult male albino rats of Wister strain (three months old and weight average of 150 g) were kept separately in well aerated cages under hygienic condition. Rats were maintained with free access to water and a standard diet consisting of casein 15 %, cotton seed oil 10 %, salt mixture 4 %, vitamins mixture 1 % and starch 65 % (Lane-Petter and Pearson, 1971) for two weeks (adaptation

period). Diet and water were supplied *ad Libitum*. To induce diabetes, 30 rats were injected with a single dose of streptozotocin (60 mg/kg body weight) given intraperitoneally (i. p.) to rats according to the method described by Adeghate *et al.* (2001). Blood samples were withdrawn from orbital venous plexuses and blood glucose was determined. The diabetic rats were then randomly assigned and divided into 5 groups each of 6 rats and fed on the basal diet.

The first group (6 normal rats without injection of streptozotocin) was used as normal control. The 2nd group (6 of diabetic rats) was used as diabetic control. The 3rd group (6 of diabetic rats) was ingested daily with a dose of 150mg/kg body weight of ether extract of *Anastatica hierochuntica*. The 4th group (6 of diabetic rats) was ingested with 150mg/kg body weight of methanolic extract of *Anastatica hierochuntica*. The 5th group (6 of diabetic rats) was ingested with 150mg/kg body weight of ether extract of doum (*Cleome chrysantha*). The 6th group (6 of diabetic rats) was ingested with 150mg/kg body weight of methanolic extract of *Cleome chrysantha*. All the 6 groups animal were fed on the basal diet for 6 weeks (experimental period). Then all rats were killed by decapitation. Blood, brain, liver and kidneys of the experimental animals were removed and chilled up for analysis.

Enzymatic determination of rats plasma glucose was carried out according to Trinder method (1969). Determination of adenoins-5-triphosphate (ATP), adenosine-5-diphosphate (ADP) and adenosine-5-monophosphate (AMP) contents as well as the activity of myokinase in brain, liver and kidneys tissues were done as described by Bergmeyer (1974). The organs tissue mitochondria were isolated and purified then emulsified with 1% triton x-100 (3 ml) at 0°C for 30 min. The enzymes and metabolites of mitochondria were liberated and assayed (Wattiaux and de-Duve, 1956 and Astawrov, 1974). Cytochrome-c content of mitochondria was determined spectrophotometrically according to the method of Williams and Thorp (1969). Cytochrome-c-oxidase activity of spectrophotometrically according to Smith (1955) and succinate cytochrome-c-reductase activity of mitochondria was assayed spectrophotometrically as described by King (1963). Total soluble protein was determined as Lowary method (1951). Statistical analysis of the all biochemical analysis results were done by t-test ($p < 0.05$) according to Sendecor and Cochran (1967).

RESULTS AND DISCUSSION

It is well known that oxidative stress plays a major role in the etiology of diabetic complication and development of diabetes. ATP, ADP and AMP levels and the myokinase activity as affected by diabetes and the present hypoglycemic agents treatments of wild plant traditionally used in Egyptian folk medicine against diabetes (*Anastatica hierochuntica* and *Cleome chrysantha*) in liver, brain and kidneys tissues of male albino rats were determined and the results are given in table (1-2). The ATP levels were significantly elevated in the present study treatments of plants relative to diabetic control, these elevations due to ingestion of the both plant extracts into diabetic rats. The increased levels by ingestion of methanolic extracts of both plants were higher and significant than that recorded for the ether extracts which was significant alteration. The highest value of ATP was recorded for liver and brain

tissues. Kidneys tissue had the lowest value of the three organs tissues. In addition, the methanolic extract of *Anastatica hierochuntica* was more effective than that of *Cleome chrysantha* in the same conditions of diabetes. In connection, both ADP and AMP levels of the three organs tissues were reduced in contrary to ATP levels under the same effects of treatments in diabetic rats. The reductions of ADP levels was observed for methanolic extracts treated diabetic rats and was approximately similar to that of AMP levels relative to diabetic control. The high and significant influences of methanolic extract the both plants may be due to that extracts was rich in polyphenols which associated with increased with resistance of plasma constituents to oxidation and with an increase in plasma antioxidant capacity (Utsunomiya *et al.*, 2005). The improved values of energy metabolites were still lower than that of normal control for ATP but still higher than that of normal control for ADP and AMP levels of brain, liver and kidneys tissues. The present results of energy metabolites (ATP, ADP and AMP) may be to either the high rate of ATP synthesis or the energy liberation during the metabolic processes through trapping phosphate with AMP and ADP (Murray *et al.*, 2006), these findings were in parallel with these of the carbohydrate metabolism (previous study) (Abdel-Rahim *et al.*, 2005) and respiratory system (in the present study). They found that alcoholic extracts of the both plants (rich in polyphenols) ingestion stimulated glycolytic processes in diabetic rats. These were not observed under the treatments of ether extracts ingestion (rich in lipid fractions). The obtained results led to the suggestion that at any circumstance associated with diminished availability of the prime dietary source of energy, namely carbohydrate, would accentuate the utilization of fatty acid for this purpose. In this respect, the stimulation of glycolytic metabolism and respiratory systems led to the accumulation of ATP that is rapidly utilized in protein biosynthesis processes by stimulation of adenylated cyclease activity to form cAMP (Elliott and Elliott, 2001).

Results showed stimulation in myokinase activity of brain, liver and kidneys tissues of diabetic rats (table 2). The ingestion of the present plants extract (ether and methanol) inhibited the activity relative to diabetic control. The inhibition of myokinase activity by ether extracts was low and insignificant, but that for methanolic extracts was high and significant. Generally, the increase in ATP contents due to the methanolic extracts ingestion into diabetic rats was mainly attributed to the influence of these rich polyphenol nutrients on the respiratory system (results of the present study).

The maintenance of organs tissue is likely accomplished through stimulation the glycolytic processes. The inhibition of myokinase activity in diabetic rats induced by methanolic extracts of the both plants may be due to ample ATP (Murry *et al.*, 2006). Myokinase catalyzed as the following reaction :

$$2\ ADP \longrightarrow ATP + AMP$$

The reaction was stimulated after the complete utilization of ATP. Also, the amount of AMP might be due to the cyclic AMP which was formed from ATP to catalyze the adenylate cyclase reaction as follows:

$$ATP \longrightarrow cAMP + pyrophosphate$$

Table (1): Plant extracts influences on the energy metabolites in albino rats organs tissues:

Treatment	ATP (µmol/g.tissue)						ADP (µmol/g.tissue)						AMP (µmol/g.tissue)					
	Brain		Liver		Kidneys		Brain		Liver		Kidneys		Brain		Liver		Kidneys	
	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%
Normal control	7.60 ± 0.20	100	11.01 ± 0.90	100	2.01 ± 0.09	100	0.61 ± 0.036	100	0.17 ± 0.011	100	0.16 ± 0.009	100	0.31 ± 0.014	100	0.69 ± 0.031	100	0.25 ± 0.016	100
Diabetic control	4.00 ± 0.27*	52.6	6.70 ± 0.34*	60.9	1.22 ± 0.05*	60.7	0.85 ± 0.041*	139.3	0.21 ± 0.013*	123.5	0.20 ± 0.010*	125	0.41 ± 0.020*	132.2	0.76 ± 0.016*	110	0.29 ± 0.015*	116
Ether extract of *Anastatica*	4.11 ± 0.27*	54.1	6.66 ± 0.32*	60.5	1.20 ± 0.06*	59.7	0.83 ± 0.050*	136.1	0.20 ± 0.012*	117.7	0.21 ± 0.011*	131.3	0.40 ± 0.019*	129	0.76 ± 0.020*	110	0.30 ± 0.014*	120
Methanol extract of *Anastatica*	5.50 ± 0.22*	72.4	9.00 ± 0.47*	81.7	1.70 ± 0.08	84.6	0.68 ± 0.032	111.5	0.17 ± 0.012	100	0.16 ± 0.008	100	0.34 ± 0.017	119.6	0.72 ± 0.016	104	0.26 ± 0.013	104
Ether extract of *Cleome*	4.50 ± 0.26*	59.2	6.71 ± 0.34*	60.9	1.20 ± 0.05*	59.7	0.84 ± 0.041*	137.7	0.21 ± 0.013*	123.5	0.19 ± 0.010*	118.8	0.41 ± 0.020*	132.2	0.77 ± 0.018*	112	0.28 ± 0.015*	112
Methanol extract of *Cleome*	5.00 ± 0.29*	65.8	8.80 ± 0.41*	79.9	1.50 ± 0.04*	74.6	0.72 ± 0.036*	118	0.17 ± 0.011	100	0.16 ± 0.007	100	0.36 ± 0.014	116.1	0.70 ± 0.017	101	0.25 ± 0.020	100

% Relative to normal control

* Values are significantly different with normal control $P < 0.05$

- Each value represents the mean of 6 rats (Mean ± SD)

Table (2): Plant extracts influences on myokinase activity in mitochondrial and cytoplasmic fractions of albino rats organs tissues:

Treatment	Mitochondrial myokinase activity (µmol ADP/mg protein)						Cytoplasmic myokinase activity (µmol ADP/mg protein)					
	Brain		Liver		Kidneys		Brain		Liver		Kidneys	
	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%
Normal control	0.41 ± 0.023	100	0.34 ± 0.016	100	0.26 ± 0.014	100	0.51 ± 0.020	100	0.44 ± 0.025	100	0.21 ± 0.012	100
Diabetic control	0.46 ± 0.023*	112.2	0.41 ± 0.019*	120.6	0.29 ± 0.017*	111.5	0.60 ± 0.027*	117.6	0.53 ± 0.023*	120.5	0.31 ± 0.015*	147.6
Ether extract of *Anastatica*	0.45 ± 0.020*	109.8	0.40 ± 0.018*	117.6	0.30 ± 0.013*	115.4	0.61 ± 0.030*	119.6	0.53 ± 0.022*	120.5	0.30 ± 0.020*	142.9
Methanol extract of *Anastatica*	0.43 ± 0.021	104.9	0.37 ± 0.018	108.8	0.27 ± 0.012	103.8	0.55 ± 0.024	107.8	0.48 ± 0.025	109.1	0.24 ± 0.012	114.3
Ether extract of *Cleome*	0.46 ± 0.020*	112.2	0.41 ± 0.020*	120.6	0.28 ± 0.015*	107.7	0.60 ± 0.024*	117.6	0.52 ± 0.026*	118.2	0.31 ± 0.012*	147.6
Methanol extract of *Cleome*	0.44 ± 0.027	107.3	0.39 ± 0.020*	114.7	0.28 ± 0.016	107.7	0.57 ± 0.027	111.8	0.50 ± 0.024	113.6	0.28 ± 0.013*	133.3

% Relative to normal control

* Values are significantly different with normal control $P < 0.05$

- Each value represents the mean of 6 rats (Mean ± SD).

The extent of coupling oxidation to phosphorylation, evident in mitochondria provided a means by which the role of oxidation of foodstuffs by respiratory oxygen was regulated by high requirement of the cell for useful energy. The utilization of ATP to drive the energy requiring processes of the cell automatically increased the available supply of ADP and inorganic phosphate, which in turn became available to react in the coupling mechanism and permitted respiration to proceed (Chatterjea and Shinde, 2002). At the effect of methanolic extracts of the plants ingestion, the oxidative phosphorylation was stimulated due to the respiratory oxygen and inorganic phosphate that was increased by stimulation of phosphatases activity under the same conditions these were paralleled with the increase of ATP formation (Abdel-Rahim *et al.*, 2005).

In case of respiratory system of cytochrome-c which connected with respiratory system of mitochondria and its enzymes which considered one of important markers of mitochondrial biosynthesis and turnover (Murry *et al.*, 2006). Table (3) observed the results of cytochrome-c contents and the activities of cytochrome-c-oxidase and succinate-cytochrome-c-reductase in mitochondrial fractions of brain, liver and kidneys tissues. The levels of cytochrome-c of three organs tissues were reduced relative to normal control in diabetic rats. These values were returned to about normal level by ingestion of the both plants methanolic extracts, but still lower than those of normal control. These were not observed by treatments of plants ether extracts. Table (3) also, showed the activity of oxidative enzymes related to cytochrome-c in mitochondria. From these data, the diabetes stimulated the activities of mitochondrial cytochrome-c-oxidase. The present stimulated values were returned to about that of normal control animals by the ingestion of methanolic extracts of the both medicinal plants but not by their ether extracts. Ether extracts ingestion the present plants slightly but insignificant inhibited the enzyme activity of diabetic rats. The same trend was observed in case of succinate-cytochrome-c-reductase activity, but the effects of diabetes on the activity of succinate- cytochrome-c-reductase were more than that on cytochrome-c-oxidase. The activity values of the both enzyme were still more than that of the normal control in diabetic rats treated by the both extracts either of *Anastatica hierochuntica* or of *Cleome chrysantha.* The present finding suggested that diabetes damaged cytochrome-c in mitochondria, which is synthesized in extra-membrane of mitochondria and can be used as an important maker to evaluate the inner membrane of mitochondrial turnover (Murry *et al.*, 2006).

The results concluded that diabetes caused a damage in mitochondria structure, however the influences of methanolic extracts on diabetes was as antagonistic agent (antioxidant). In addition, the stimulation of cytochrome-c-oxidase and succinate-cytochrome-c-reductase activities of diabetic animals may be due to not only elevation of respiratory system activity but also stimulation in the oxidative enzymes activity which used succinate and cytochrome-c as metabolites. The present results are in agreement with that reported by Utsunomiya *et al.* (2005) and Ismail *et al.* (2007) and, they found that the polyphenol extracts (by methanol) reduced the toxic and stress of diabetes on mitochondrial respiratory system.

Table (3): Plant extracts influences on cytochrome-c respiratory system in albino rats organs tissues:

Treatment	Cytochrome-c-oxidase activity (µmol/min/g tissue)						Succinate-cytochrome-c-reductase activity (µmol/min/g tissue)						Cytochrome-c contents (µmol/g tissue)					
	Brain		Liver		Kidneys		Brain		Liver		Kidneys		Brain		Liver		Kidneys	
	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%	Value ± SD	%
Normal control	51.00 ± 3.33	100	16.06 ± 1.00	100	15.00 ± 0.88	100	30.12 ± 1.55	100	2.22 ± 0.12	100	3.27 ± 0.16	100	9.11 ± 0.06	100	23.00 ± 1.12	100	27.19 ± 1.78	100
Diabetic control	61.00 ± 3.47*	120	18.06 ± 0.92*	113	16.12 ± 0.91*	108	54.11 ± 2.22*	179.6	4.10 ± 0.21*	185	4.61 ± 0.20*	141	7.00 ± 0.31*	76.84	18.22 ± 0.82*	79.22	17.89 ± 1.11*	65.8
Ether extract of *Anastatica*	60.11 ± 3.21*	118	18.00 ± 0.84*	112	16.00 ± 0.82*	107	54.20 ± 3.00*	179.9	4.00 ± 0.19*	180	4.42 ± 0.21*	135	7.11 ± 0.41*	78.04	18.01 ± 0.90*	78.30	17.70 ± 1.00*	65.1
Methanol extract of *Anastatica*	53.11 ± 3.00	104	16.87 ± 0.77	105	15.16 ± 0.80	101	37.21 ± 1.61*	123.5	2.97 ± 0.19	134	4.00 ± 0.17	122	8.00 ± 0.40	87.82	20.13 ± 0.99	87.52	22.22 ± 1.21	81.7
Ether extract of *Cleome*	59.89 ± 3.01*	117	18.10 ± 0.81*	113	16.01 ± 0.74*	107	54.00 ± 3.00*	179.3	3.98 ± 0.20*	179	4.50 ± 0.22*	138	7.02 ± 0.31*	77.06	18.20 ± 0.97*	79.13	17.60 ± 1.00*	64.7
Methanol extract of *Cleome*	54.61 ± 3.04	107	17.11 ± 0.90	107	15.60 ± 0.76	104	40.00 ± 1.88*	132.8	3.04 ± 0.17	137	4.22 ± 0.22*	129	7.89 ± 0.30*	86.61	20.00 ± 0.95	86.96	20.11 ± 0.99	74.0

% Relative to normal control

* Values are significantly different with normal control $P < 0.05$

- Each value represents the mean of 6 rats (Mean ± SD)..

In addition, the previous study (Abdel-Rahim *et al.*, 2005) found that the oxido-reductase enzymes could enhance the metabolites oxidations such as pyruvate and succinate in which via cytochrome-c mechanism, overcome the initial lack of oxygen and provided the animal with energy requirement. This stimulation in the animal tissues could be due to the physiological status of animals (Yin *et al.*, 2006). On the other hands, Utsunomiya *et al.* (2005) and Ismail *et al.* (2007) added that the polyphenol extracts increased plasma adiponictin content, these observation suggest that improvement of insulin sensitivity with polyphenol extracts may be mediated partly through increased adiponictin.

REFERENCES

Abdel-Rahim, E.A.; El-Saadany, S.S.; Abo-Eytta, A.M., and Wasif, M.M. (1992): The effects of Sammo administration on some fundamental enzymes of pentose phosphate pathway and energy metabolites of alloxznized rats. *Nahrung*, 36(1), 8 – 14.

Abdel-Rahim, E.A.; Hanaa, F.M.; Mahmoud, M.A., and Faten, Abo-El-Alaa (2005): Biochemical studies on the effects of *Anastatica hierochuntica* and *Cleome chrysantha* plants on hypoglycemic treatment on carbohydrate metabolism of diabetic rats. *J. Gene. Engin. Biotech*, 3(2), 1152-1163.

Adechate, E..; Ponery, A. S.; Pallat, D. J., and Singh, J. (2001): Distribution of vasoactive intestinal polypeptide, neuro peptide-Y and substance P their effects on insulin secretion from the in vitro pancreas of normal and diabetic rats. *Peptides*, 22(1), 99 – 107.

Astaworv, B.L. (1974): Methods in biological development. *Preparation of mitochondria and Cytoplasm.* 336 (pp. 363 – 367). Nauka, Moscow.

Bergmeyer, H. U. (1974): *Methods of enzymatic analysis* (2nd English ed.) Academic press Inc. New York, San Francisco, London.

Chatterjea, M.N., and Shinde, R. (2002): *Text book of medical biochemistry.* (5th ed), Jaypee Brothers, Medical publishers (P) LTD, New Delhi.

Elliott, W.H., and Elliott, D.C. (2001): *Biochemistry and Molecular Biology.* (2nd ed.), Oxford Univ. Press. Published in U. S. A. Inc. New York.

El-Ridi, M.R. (2001): A possible hypoglycemic effect of some medicinal plants used in United Arab Emirates. *Bull. Egypt Soc. Physiol. Sci*, 21(1), 9 – 16.

Foster, O.W. (1991): Diabetes mellitus *In: Harrison's principles of Internal Medicine*, Braunwald, E., Isselbacher, K. J., Petersdorf, R. G., Wilson, J. D., Marten, J. B., Fayci, A. S. & Root, R. K. (eds). Mc-Graw, Hill Book, (pp. 1739-1758). New York

Gowenlock, A.H.; Mc Muraray, J.R., and Mc Lauchian, A. (1988): *Practical Clinical Biochemistry.* (6th ed), Heinemann Medical Books, London.

Ismail, S.A.; Ahmed, S.H.; Fayed, S.A., and Mahmoud, G.I. (2007): Adiponectin, insulin and nitric oxide levels in hyperlipidemia and hyperchloestrolemia in addition to streptozotocin induced diabetes mellitus and normal rats intraperitonially injected with anthocyanin and epicatchine extracts. *New Egyptian J. Medicine.* 36(3), 135 – 143.

King, T.E. (1963): Reconstitution of respiratory chain enzyme system. *J. Biol. chem*, 238: 4032 - 4036.

Lane-Petter, W., and Pearson, A.E. (1971): Dietary requirements *In: the laboratory animal principles and practice.* (pp. 142) London and New York.

Lowry, O.H.; Rosebrought, N.J.,; Farr, A.L., and Randoll, R.J. (1951): Protein measurement with the follin phenol reagent. J. Biol. Chem, 193, 265 – 275.

Murry, R.K.; Granner, D.K., and Rodwell, V.W. (2006): *Harper's illustrated biochemistry* (27th ed), Mc-Graw Hill, Education Casia.

Olefsky, J.M. (1992): Diabetes mellitus In: *Cecil text book of medicine.* Wyngaarden, J. B., Smith, L. H. and Philadelphia, W. B. (eds), (19th ed), Saunders Co, (pp: 1291 – 1310).

Rahmy, T.R., and El-Ridi, M.R. (2002): Action of *Anastatica hierochuntica* plant extract on islets of langerhans in normal and diabetic rats. *Egyptian J. Biology,* 4, 87 – 94.

Sendercor, G. and Cocharn, W. (1967): *Statistical methods* (7th ed), Iowa state Univ. Press Ames, (pp. 393), Iowa, USA.

Smith, L. (1955): Spectrophotometric assay of cytochrome-c-oxidase. *Methods in Biochem. Analy,* 2, 427 – 434.

Trinder, P. (1969): Determination of blood glucose using an oxidative-peroxidase system: a non carcinogenic chromagen. *Am. Clin. Biochem,* 6, 24 – 30.

Utsunomiya, H.; Yamakew, T.; Kamei, J.; Kadonosone, K., and Tanaka, S. (2005): Anti-hyperglycemic effects of plum in a rat model of obesity and type 2 diabetes, Wistar fatty rats, *Biochemical Research,* 26(5), 193 – 200.

Wattiaux, R., and de-Duve, C. (1956): Tissue fractionation studies. Release of found hydrolysis by means of Triton-X-100. *Biochem. J,* 62: 606 – 608.

Williams, J., and Thorp, S. (1969): Re-evaluation of cytochrome-c concentration in rat organs using a new method for cytochrome-c. *Biochem. Biophys. Acta,* 189, 25 – 28.

Yin, X.; Zhang, Y.; Yu, J. Zhang, P.; Shen, J.; Qiu, J.; Wu, H. and Zhu, X. (2006): The antioxidative effect of *Astragalus* saponin I protect against development of early nephropathy. *J. Pharmacol Sci,* 101, 166 – 173.

تحسين أنظمة الطاقة لفئران مصابة بمرض السكر باستخدام نباتى كف مريم والسموة

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** قسم الخلية الحيوية – المركز القومى للبحوث – القاهرة – مصر

تم دراسة التأثير الخافض لسكر الدم لكلا من نباتى كف مريم والسموة على الذكور الفئران البالغة والمصابة بمرض السكر نتيجة المعاملة بمادة الستربتوزيتوسين. هذا وقد تم حقن كلا من المستخلص الكحولى والإيثيرى لكلا النباتين لحيوانات التجارب المصابة بمرض السكر لدراسة تأثيرهم على أنظمة تمثيل الطاقة والسيتوكروم جـ فى كل من المخ، الكبد والكليتين. وقد لوحظ فى تمثيل الطاقة للمجموعة الكنترول للفئران المصابة بمرض السكر انخفاض فى محتوى الأدينين ثلاثى الفوسفات وزيادة فى محتوى كلا من الأدينين أحادى وثنائى الفوسفات. كما لوحظ بالإضافة لذلك حدوث

ارتفاع فى نشاط انزيم الميوكينيز. هذا وقد سببت التغذية على المستخلص الأيثيرى لكلا النباتين تغيرات غير معنوية فى تأثير مرض السكر على محتوى كلا من (الأدينين أحادى، ثنائى، ثلاثى الفوسفات) ونشاط انزيم الميوكينيز.

هذا وقد أحدثت تغذية الفئران المصابة على المستخلص الكحولى لكلا من كف مريم والسموة ارتفاع معنوى فى مستوى الأدينين ثلاثى الفوسفات وانخفاض فى كلا من الأدينين أحادى وثنائى الفوسفات. بينما حدث انخفاض فى نشاط انزيم الميوكينيز.

بالإضافة لحدوث انخفاض فى محتوى السيتوكروم جـ وزيادة معنوية فى نشاط انزيمى السيتوكروم جـ أوكسيديز والسكسنات جـ ريدكتيز. وقد أثبتت نتائج هذه الدراسة ان تغذية الفئران على المستخلص الأيثيرى لكلا النباتين قد أحدثت تغيرات غير معنوية فى تأثيرات مرض السكر على نظام السيتوكروم جـ. على النقيض فالتغذية بالمستخلص الكحولى لكلا من نباتى كف مريم والسموة قد احدثت تأثيرات معنوية كبيرة فى نظام السيتوكروم جـ الخاص بالفئران المصابة بمرض السكر وساهمت فى تحسين أنظمة التنفس وجعلتها مماثلة للفئران السليمة.