# Protective Effect of Beet Root and Rosemary against Hepatic Oxidative Stress Injury in Rats

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**Abstract:** Beet roots and rosemary are rich in bioactive food components has therapeutic properties in hepatic injury. The present study aimed to evaluate the effect of beet roots and rosemary on reduction and management of hepatic injury symptoms. This study was conducted on thirty albino male rats, weighting 135±5 g and randomly classified into six groups (6rats each). The first group kept as normal control fed standard diet only. The other four groups injected with injected subcutaneously by CIS to induce hepatic injury and reclassified into positive control, 10% beets, 10% rosemary and mixture treated groups. The treated groups with beet, rosemary and mixture showed a no significant difference in final weight, weight gain ,feed intake ,FER hemoglobin, packed cell volume ,RBCs ,ALT, AST and ALP enzymes activity, total protein, albumin, globulin in serum , A/G ratio and liver GSH,GPX ,MDA , glycogen ,cholesterol , total lipid and triglyceride, except rosemary group which showed a significant decrease in serum albumin and beet group showed a significant decreased in liver GSH but they showed significant increase in serum bilirubin when comparing with control (-ve) group. On the other side The treated groups with beet, and rosemary and mixture showed significant decrease in ALT, AST & alkaline phosphatase enzymes activity in serum bilirubin, A/G ratio, MDA ,cholesterol and total lipid in liver but showed significant increase in final weight, weight gain ,FER, hemoglobin, packed cell volume ,RBCs, ,serum albumin , total protein ,globulin and liver GSH , GPX ,glycogen and triglyceride except rosemary group showed a no significant difference in serum albumin and also beet rat group which showed no significant difference in liver GSH when compared with control (+ve) rats group. It is recommended to consume beet, and rosemary and mixture of them to maintain the efficacy of the liver**.**

**Keywords:** Liver functions, glutathione, malondialdehyde, antioxidant enzymes, rats

## Introduction

The beetroot *(Beta vulgaris L.*) has been used for centuries as a traditional natural coloring agent (**Govind *et al.*, 2013**). Beetroot contains red pigments (betacyanins) and yellow pigments (betaxanthins), known collectively as betalains. Medicinally, beetroot is employed as a popular folk remedy to stimulate the immune system and for the treatment of liver and kidney diseases. It is also employed as a special diet in the treatment of cancer (**Craig, 2017 and Jiratanan, and Liu, 2014**).

Rosemary (*Rosmarinus officinalis* Linn.*)* is a common household plant grown in many parts of the world. It is used for flavoring feed, as a beverage, and in cosmetics as well as in folk medicine for its choleretic, hepatoprotective and antitumorigenic activity. Rosemary and its constituents (carnosol, carnosic acid, ursolic acid, rosmarinic acid, caffeic acid) have been intensively studied during the last 10 years.Different effects of this spice important from thepoint of view of cancer prevention were observed **(Al-Sereiti et al., 2016 and Slamenova et al., 2012**). Rosemary contains polyphenolics substances that are useful for stimulating the

immune system, increasing circulation, and improving digestion. Rosemary also contains anti-inflammatory compounds that may make it useful for reducing the severity of asthma attacks. In addition, rosemary has been shown to increase the blood flow to the head and brain, improving concentration. Among these polyphenolics, carnosic acid (a phenolic diterpene compound), and carnosol are the most potent antioxidant constituents which about 90% of antioxidant activity (**Altinier *et al.*, 2017**).This work aimed to study the effect of beet root and rosemary consumption on experimental rats induced hepatic injury by CISplatin.

## Materials and Methods

### Materials

**Beet root** *(Beta vulgaris L.*) and **rosemary** (*Rosmarinus officinalis Linn.)* were obtained from local market. Then dried in dry freezer and crushed into powder then added to standards diet.

**CISplatin solution**© (Platinol AQ) was obtained from Sigma Chemical Co. (St Louis, Mo, USA).

**Experimental rats:** thirty rats were purchased from Helwan Farm of Laboratory Animals.

### Methods

Twenty four rats were weight 135±5 g purchased from Helwan Farm of Laboratory Animals. The animals were kept under observation for five days before experiment and fed on standard diet and water ad libitum. The standard diet comprised of casein (200g/kg), corn starch (497g/kg), sucrose (100g/kg) , cellulose (30 g/kg) ,corn oil (50g/kg), mineral mixture (100g/kg) , vitamin mixture (20g/kg) and DL-methionine (3g/kg) according to **Nelson,(2000).** The rats were randomly classified into four groups (6 rats each). The control (-ve) fed on standard diet all over the period of the experiment. The other six groups injected with injected intraperitoneally into rats with LD50 of CIS in a dose of 12 mg/kg body weight according to **Atssahin *et al.*, (2006)** and reclassified into the control (+ve), treated with beet, rosemary and mixture groups fed on standard diet only or with beet, rosemary and mixture of them for four weeks and after one day of that, the rats were sacrificed.

During the study, the feed intake was calculated daily and the body weight gain was recorded daily. Part of blood from sacrificed rats was heparenized for estimation of hemoglobin and packed cell volume (**Drabkin, 1949 and Mc Inory, 1954**). The rest part of blood was left to coagulate then centrifuged at 3000 rpm for 15 minutes to obtain serum. Serum aminotransferase (ALT&AST), alkaline phosphates enzymes activity, total protein and albumin, were estimated according to **Reitman and Frankel, (1957), Kind and King, (1954), Weichselbaum, (1946) and Bartholomev and Delany ,(1966)** respectively. Serum globulin (G) value was determined by subtracting the albumin from the total proteins according to **Coles, (1974).** A/G ratio was calculated using albumin and globulin values for each individual sample. Livers of rats were rapidly removed and parts of them perfuse with 50 to 100 of ice cold 0.9%NaCL solution for estimation of glutathione (GSH) ,glutathione peroxidase (GPX) ,malondialdehyde (MDA), glycogen ,cholesterol , total lipids and triglyceride according to **Beuchamp and Fridovich,(1971) .,Beuther et al .,(1987) .,Habig et al.,(1974), Rerup and Lundquist, (1967),Abell et al., (1952)., Folch et al.,(1957) and Young and Pestaner ,(1975) ,**respectively.

**Statistical analysis**

Collected data were subjected to analysis according to SPSS program according **to Armitage and Berry (1987).**

**Results and Discussion**

**Effect of beets and rosemary on nutritional pattern of rats administrated CIS**

The statistical data in Table (1) presented that, control (+ve) group showed a significant decrease in body weight gain and feed efficiency ratio while beet, rosemary and a mixture treated groups showed non-significant difference in weight gain ,feed intake and FER compared with control (-ve) group. Beets, rosemary and mixture rats groups showed a significant increase in weight gain and FER compared with control (+ve) group. These results were in agreement with those obtained by **Govind *et al.*, (2013)** who found that, beets are teeming with folate and manganese and a good source of vitamin C, potassium and fiber. Beets are an excellent source of vitamins A and C, and the minerals potassium and magnesium, calcium, iron and copper beets are loaded with antioxidant phytonutrients like lycopene, anthocyanins and betaine. Betanin is, the extract of beetroot, used as a non-toxic, safe, natural feed colorant, and also be a potent cancer chemopreventive agent. **Schwartz *et al.*, (2012 ) and Lichtenthaler and Marx, (2015).** Rosemary is a good source of the minerals iron and calcium, as well as dietary fiber. Fresh has 25% more manganese and a 40% less calcium and iron, Rosemary is also contained many nutrients, including carbohydrates, sugar, soluble and insoluble fiber, sodium, vitamins, minerals, fatty acids and amino acids **Al-Sereiti *et al.*, (2016).**

**Table (1):** Mean values ± SD of body weight gain, feed intake and feed efficiency ratio (FER) of control and CIS treated rats groups

| Variables | Control (-ve) | CIS | | | |
|---|---|---|---|---|---|
| | | Control (+ve) | Beet | Rosemary | Mixture |
| Weight gain (g) | 115.77± 8.11 [a] | 66.89± 6.11 [b] | 106.33± 8.03 [a] | 105.77± 9.17 [a] | 108.14± 10.15 [a] |
| Feed intake (g/w) | 15.32± 2.14 [a] | 13.55± 2.55 [a] | 15.40± 2.33 [a] | 15.71± 2.71 [a] | 15.81± 2.14 [a] |
| FER | 0.125± 0.01 [a] | 0.082± 0.03 [b] | 0.115± 0.04 [a] | 0.112± 0.05 [a] | 0.113± 0.01 [a] |

Mean values in each raw having different superscript letters are significantly different at p≤0.05.

**Effect of beets and Rosemary on hemoglobin, packed cell volume and RBCs pattern of rats administrated CIS**

In Table (2), the control (+ve) group showed a significant decrease in hemoglobin, packed cell volume and RBCs but beets, rosemary and mixture rat groups showed non-significant difference in compared with control (-ve) group. The beets and rosemary and mixture treated groups showed a significant increase in hemoglobin, packed cell volume and RBCs compared with control (+ve) group.Administration of CIS reduces hemoglobin concentration in the blood accompanied with erythrocytosis with an increase in the packed cell volume levels and lymphocytosis with neutropenia **Lee *et al.*, (2015**). Beets show hepatoprotective properties by acting as an antioxidant and probably are mild iron chelators **Lu *et al.*, (2009**). The nitrates found naturally in beets protect blood vessels and keep them healthy. Beet containing betaine, betanin, flavonoids, and other polyphenols has a beneficial effect on liver injury caused by ischemia-reperfusion (**László et al., 2014).**

Long-term daily intake of rosemary has an antithrombotic effect, which is probably due to inhibition of platelets and stimulation of endothelial cells. Flavonoid content of rosemary may be responsible for the antithrombotic effect.Flavone-8-acetic acid prolonged bleeding time .The mechanism of the antithrombotic effect may involve suppression of platelet reactivity and stimulation of the vascular endothelium (**Mruk *et al.*, 2018 and Aki *et al.*, 2008**).

**Table (2):** The Mean values ± SD of hemoglobin (HB), packed cell volume (PCV) and RBCs parameters in control and CIS treated rats groups

| Variables | Control (-ve) | *CIS* | | | |
|---|---|---|---|---|---|
| | | Control (+ve) | Beet | Rosemary | *Mixture* |
| HB (g/dl) | 14.34± 1.99 [a] | 10.41± 1.33 [b] | 13.99 ± 1.31 [a] | 13.89 ± 1.01 [a] | *14.11± 1.77 [a]* |
| PCV | 40.11± 4.77 [a] | 30.17± 3.33 [b] | 35.01± 4.17 [a] | 36.55 ± 4.11 [a] | 38. 71± 4.22 [a] |
| RBCs ($x10^6$/ µl) | 5.11± 0.99 [a] | 2.29± 0.82 [b c] | 4.37 ± 1.03 [a] | 4.92 ± 1.11 [a] | 5.21± 1.31 [a] |

Mean values in each raw having different superscript letters are significantly different at p≤0.05.

**Effect of beets and rosemary on liver function pattern of rats administrated CIS**

Table (3) showed that, control (+ve) group showed a significant increase in serum ALT, AST and alkaline phosphatase enzymes activity while the beets, rosemary and mixture groups showed non-significant difference in compared with control (-ve) group. The beet, rosemary and mixture treated groups showed significant decrease in ALT, AST and alkaline phosphatase enzymes activity compared with control (+ve) group. It is known that, the enzymatic activity depends upon the extent of inflammatory or necrobiotic damage to the hepatocytes, and residual parenchymal mass. Accordingly, subnormal, normal or differently increased values of ALT & AST are found. With the progressive loss of liver parenchyma, the transaminase values fall to the normal range, and occasionally even to subnormal levels (**Amodio et al., 2011**). Table beet ingestion can increase formaldehyde concentration which is the marker of increased biological methylation / demethylation and simultaneous positive change in the antioxidant parameters. The additive effect of endogenous transmethylation helped to improve liver function during hepatic ischemia reperfusion injury (**László et al., 2014).** Rosemary constituents are composed of vast numbers of polyphenolics, including carnosic acid, carnosol, rosemarinic acid, ursolic acid (**Ramirez *et al.*, 2016**).

**Table (3):** The Mean values ± SD of serum amino transferase (ALT and AST), and alkaline phophatase enzymes (Alk-phos), of control and CIS treated rats groups

| Variables | Control (-ve) | *CIS* | | | |
|---|---|---|---|---|---|
| | | Control (+ve) | Beet | Rosemary | *Mixture* |
| ALT (µ /ml) | 31.13± 4.51 [b] | 55.71± 8.14 [a] | 38.71± 4.89 [b] | 34.81± 4.01 [b] | 35.71± 3.11 [b] |
| AST (µ /ml) | 60.13± 6.10 [b] | 119.31± 13. 11 [a] | 70.33± 8.40 [b] | 65.91± 7.11 [b] | 66.77± 8.4 [b] |
| Alk-hos (µ /ml) | 42.71± 5.02 [b] | 60.78± 7.01 [a] | 45.41± 4.31 [b] | 43.33± 5.11 [b] | 44.77± 5.06 [b] |

Mean values in each raw having different superscript letters are significantly different at p≤0.05.

**Effect of beets and rosemary on serum bilirubin, total protein, albumin, globulin and albumin/globulin ratio (A/G) pattern of rats administrated CIS**

Table (4) showed that, control (+ve) group showed a significant increase in serum bilirubin and A/G ratio and significant decrease in serum total protein, albumin and globulin in compared with control (-ve) group. Beets, rosemary and mixture treated groups showed significant increase in serum bilirubin and non-significant difference in serum total protein, albumin, globulin and A/G ratio except rosemary group which showed significant decrease in albumin comparing with control (-ve) group. The beets, rosemary and mixture rat groups showed significant decrease in bilirubin and A/G ratio and significant increase in total protein , globulin and albumin except rosemary group which showed no significant difference in albumin when compared with control (+ve) group. The protein and amino-acid metabolism of liver is characterized by production and breakdown of proteins, production and breakdown of amino acids as well as regulation of their concentrations in the blood, and detoxification of ammonium via the synthesis of urea (excretory form) and glutamine with simultaneous regulation of the acid-base balance. The breakdown of branched-chain amino acids occurs exclusively in the muscular system by way of deamination (**Gjoen *et al.*, 2016**). The hypoproteinemia is mostly associated with a reduction in albumin synthesis as found in liver disease or with excessive loss. The alteration in serum albumin is found more commonly in chronic liver disease. Therapeutic or prophylactic administration of an antioxidant leads to an increase in the level of albumin in the serum (**Yokogawa *et al.*, 2006**). Beet is a potent methyl donor in transmethylation help in liver protection. The cellular mechanisms of apoptosis and cell proliferation are affected by formaldehyde that plays a key role in protection against oxidative stress **Kahlon *et al.*, (2012**). Rosemary leaves contain carnosic acid which has antimicrobial activity, can inhibit lipid absorption in humans and is a free radical scavenger, due to its phenolic skeleton **Ninomiya *et al.*, (2014) and Moreno *et al.*, (2016).**

**Table (4):** The Mean values ± SD of serum bilirubin, total protein, albumin, globulin and albumin/globulin ratio (A/G) of control and CIS treated rats groups

| Variables | Control (-ve) | *CIS* | | | |
|---|---|---|---|---|---|
| | | Control (+ve) | Beet | Rosemary | *Mixture* |
| Bilirubin (mg/dl) | 0.29± 0.01$^{c}$ | 1.12± 0.12$^{a}$ | 0.37± 0.03$^{b}$ | 0.34± 0.04$^{b*}$ | 0.30± 0.01$^{b*}$ |
| T. protein (g/dl) | 7.55± 1.51$^{a}$ | 4.01± 0.91$^{b}$ | 6.31± 1.31$^{a}$ | 6.77± 1.21$^{a}$ | 7.21± 1.49$^{a}$ |
| Albumin (g/dl) | 3.71± 0.81$^{a}$ | 2.99± 0.91$^{b}$ | 3.64± 0.81$^{a}$ | 2.98± 0.95$^{b*}$ | 3.61± 0.95$^{a}$ |
| Globulin (g/dl) | 3.84± 0.87$^{a}$ | 1.02± 0.97$^{b}$ | 3.97± 0.65$^{a}$ | 3.89± 0.55$^{a}$ | 3.80± 0.45$^{a}$ |
| *A/G ratio* | *0.96± 0.01$^{b}$* | 2.93± 0.33$^{a}$ | 0.92 ± 0.04$^{b}$ | 0.77 ± 0.05$^{b}$ | 0.95 ± 0.04$^{b}$ |

Mean values in each raw having different superscript letters are significantly different at p≤0.05.

**Effect of beets and rosemary on serum of serum antioxidant pattern of rats administrated CIS**

The data in table (5) demonstrated that, control (+ve) group showed significant decrease in the values of liver GSH and GPX were and significant increase in the values of liver MDA compared with control (-ve) group. On the other side, the beet, rosemary and mixture treated groups showed non-significant difference in liver GSH,GPX and MDA except beet treated group showed a significant decreased in GSH compared with control (-ve) group. The beet, rosemary and mixture treated groups showed significant increase in the values of GSH and GPX, while was and significantly decrease in the values of liver MDA except beets group showed no significant difference in GSH in comparison with control (+ve) group. It is well known that cisplatin is metabolized by mixed function oxidase system in the endoplasmic reticulum of the liver. Hepatic lipid peroxidation was significantly correlated with GPX activity and related to an increase in free radical production.Glutathione reduces both hydrogen peroxide and organic peroxides, in reactions catalyzed by glutathione peroxidase and glutathioneS-transferase **Cabre *et al.*, (2010) and Szymonik *et al.*, (2013)**.The consumption of table beet has numerous beneficial physiologic effects, some of which may be appropriate for the protection of the liver of presurgical patients. Because beet contains a great number of different components, it may be able to modulate various cellular pathways. The beneficial medical effect is due to bioactive components, such as betaine, betanin, betaxanthins, flavonoids, polyphenols, vitamins (thiamine, riboflavine, pyridoxine, ascorbic acid), folic acid, and biotin, and soluble fiber and pectin. Mainly betanin, flavonoids as quercetin, and other polyphenols have extremely effective antioxidant properties (**Craig, 2017**). The antioxidant and pro-oxidant properties of active rosemary constituents are powerful inhibitors of lipid peroxidation in microsomal and liposomal systems, and good scavengers of peroxyl radicals generated by pulse radiolysis. Four diterpenoids, carnosicacid, carnosol, rosmanol, and epirosmanol, isolatedas antioxidative agents isolated from the leaves of rosmary. These diterpenoids protected biological systems against oxidative stresses **Keith, (2015).**

**Table (5):** The Mean values ± SD of some liver glutathione (GSH), glutathione peroxidase (GPX) and malondialdehyde (MDA) in control and CIS treated rats groups

| Variables | Control (-ve) | CIS | | | |
|---|---|---|---|---|---|
| | | Control (+ve) | Beet | Rosemary | Mixture |
| GSH (mg/g) | 4.56± 0.91$^{a}$ | 2.01± 0.51$^{b}$ | 3.76± 0.41$^{bc}$ | 3.91± 0.29 $^{a}$ | 4.24± 0.28$^{a}$ |
| GPX (µg /mg) | 55.34 ± 9.41$^{a}$ | 39.17± 6.71 $^{b}$ | 49.71± 6.91 $^{a}$ | 50.71± 7.35$^{a}$ | 54.31± 7.14 $^{a}$ |
| MDA (nmol/g) | 39.46± 5.71 $^{b}$ | 89.31± 10.33$^{a}$ | 45.22± 7.11 $^{b}$ | 43.13± 8.29 $^{b}$ | 40.18± 7.10 $^{b}$ |

Mean values in each raw having different superscript letters are significantly different at p≤0.05.

**Effect of beets and rosemary on serum of some liver glycogen, cholesterol, total lipids and triglyceride pattern of rats administrated CIS**

The data in Table (6) demonstrated that, control (+ve) group showed significant decrease in the values of liver glycogen and triglyceride and significant increase in the values of liver cholesterol and total lipid when compared with control (-ve) group. On the other side, the beet, rosemary and mixture groups showed non-significant difference in the liver glycogen ,cholesterol , total lipid and triglyceride compared with control (-ve) group. Treated with beet, rosemary and mixture groups showed significant increase in the values of glycogen and triglyceride and significant decrease in the values of liver cholesterol and total lipid in comparison with control (+ve) group. In liver cirrhosis, the glycogen content of the liver and glycogenolysis are reduced to 20-30% of the normal level. The clearly decreased glycogenolysis is compensated by increased gluconeogenesis (three or four times above normal). Absorption of glucose in the liver is reduced, while the release of glucose is unaffected. These operate through a reduction in de novo cholesterol synthesis, an increase in cholesterol elimination in bile secretions, and an inhibition of LDL oxidation **Keith, (2015).** Red beet contains natural red pigments such as betalein, which considered with potential antioxidative properties. Red beet showed antioxidant ability against LD L oxidation and ROS production in human mononuclear cells **Sugihara *et al.*, (2009).** The most important constituents of rosemary are caffeic acid and its derivatives such as rosmarinic acid and carnosic acid, which have antioxidant effects and therapeutic potential in the treatment or prevention inflammatory diseases, hepatotoxicity, atherosclerosis **Al-Sereiti *et al.*, (2016) and Mruk *et al.*, (2018)**

**Table (6):** The Mean values ± SD of some liver glycogen, cholesterol, total lipids and triglycerides in control and CIS treated rats groups

| Variables | Control (-ve) | *CIS* | | | |
|---|---|---|---|---|---|
| | | Control (+ve) | Beet | Rose-mary | Mixture |
| Glycogen (mg/100g) | 5.44± 1.14[a] | 2.99± 0.33[b**] | 4.04± 1.22 [a] | 4.55± 1.31 [a] | 5.01± 1.55 [a] |
| Cholesterol (mg/dl) | 3.77± 1.30 [b] | 7.11± 2.14[a] | 4.71± 1.17 [b] | 4.33± 1.31 [b] | 4.53± 1.35 [b] |
| Total lipids (mg/dl)) | 37.63± 3.36 [b] | 49.33± 4.11 [a] | 38.54± 3.20 [b] | 38.45± 4.18 [b] | 39.44± 4.19 [b] |
| Triglyceride (mg/dl) | 2.33± 0.41 [a] | 1.77± 0.01 [b] | 2.07± 0.22 [a] | 2.11± 0.11 [a] | 2.23± 0.44[a] |

Mean values in each raw having different superscript letters are significantly different at p≤0.05.

## References

**Abell L.L., Levy, B.B., Brodie, B.B and Kendal, R. (1952):** A simplified method for the estimation of total cholesterol in serum and demonstration of its specificity. J .Biol .Chem, 357-366.

**Atssahin, A., Karrant, I., and Turk, G. (2006):** Protective role of lycopene on cisplatin induced changes in spern characteristics, testicular damage and oxidative stressinrats. Roperod Toxical,21:42-47.

**Aki, N., Mayumi, U., Tsutomu, Y., Ryo A., and Junichiro, Y. (2008):** Long-term intake of rosemary and common thyme herbs inhibits experimental thrombosis without prolongation of bleeding time. Thrombosis Research, 122, 517–522.

**Al-Sereiti, M.R., Abu-Amer , K.M. and Sen, P.(2016):** Pharmacology of rosemary (Rosmarinus officinalis Linn.) and its therapeutic potentials. Indian J. Exp. Biol. 124–130.

**Altinier, G., Sosa, S., Aquino, R.P., Menderini, T., Della Loggia, R., and Tubaro, A. (2017):** Characterization of topical antiinflammatory compounds in Rosmarinus officinalis L. J. Agric. Feed Chem. 55, 1718–1723.

**Amodio, P., Caregarol, L., Pettenbl, E., Marcon, M., Del Piccolo, F. and Gatta, A. (2011):** Vegetarian diets in hepatic encephalopathy; facts or fantasies? .Digest Liver Dis. 33:492-500.

**Artimage G.Y and Berry W.G (1987):** Statistical Methods 7th Ed. Ames, Iowa Stata University Press, 39-63.

**Bartholomev, R.J. and Delany, A. (1966):** Proc Aust. Assoc. Biochemists. 1: 214-220

**Beuther, E. Duron, O and Kelly, B. (1987):** Improved method for the determination of total blood glutathione. J Lab.Clin.24:221-230.

**Beuchamp, C and Fridovich, J. (1971):** Superoxide dismutase. Improved an assay applicable to acrylamide gels. Anal Biochem.44:276-287.

**Cabre, M., Camps, J., Paternain, J.L., Ferre, N., and Joven, J. (2010):** Time-course of changes in hepatic lipid peroxidation and glutathione metabolism in rats with carbon tetrachloride-induced cirrhosis. Clin. Exp. Pharmacol. Physiol. Sep; 27(9):694-699.

**Craig, S.A. (2017):** Betaine in human nutrition. Am. J. Clin. Nutr.80:539–49.

**Drabkin, D.I. (1949):** The standardization of hemoglobin measurements. Am. J. Med. Sci 21 (7): 710.

**Folch J; lees, M. Yloane, and Stanley, G.H. (1957):** A simple method for isolation and purification of total lipid from animal tissue. J Biol Chem 266: 497-509.

**Gjoen, T., Bjerkelund, T., Blomhoff, H. K., Norum, K. R., Berg, T and Blomhoff, R. (2016):** Liver takes up retinol-binding protein from plasma. J. Biol. Chem. 262: 10926-10930.

**Govind, J., Magnus, A., Rajagopalan, S., Yoko, O., Atsushi, T., Eiichiro, I., Teruo M., Midori T., Takao K., Hoyoku,N. and Harukuni, T(2013):** Chemoprevention of DMBA-induced UV-B promoted, NOR-1-induced TPA promoted skin carcinogenesis, and DEN-induced Phenobarbital promoted liver tumors in mice by extract of beetroot .Pharmacological Research. 47 , 141–148.

**Habig, W.H., Pabst, M .J. and Takob, W.B. (1974):** Glutathione S-transferase. The first enzymatic step in meracapturic acid formation .J, Biol. Chem .249(22):7130-7139.

**Jiratanan, T., and Liu, R. H. (2014):** Antioxidant activity of processed table beets (Beta vulgaris var, conditiva) and green beans (Phaseolus vulgaris L.). J. of Agri. and Feed Chem. , 52, 2659–2670.

**Kahlon, T.S., Chapman, M.H and Smith, G.E. (2012):** In vitro binding of bile acids by okra, beets, asparagus, eggplant, turnips, green beans, carrots, and cauliflower. Feed Chemistry 103, 676–680.

**Keith, W. S. (2015):** Rosemary extract and carnosol stimulate rat liver glutathione-S-transferase and quinone reductase activities Cancer Letters 100, 139-144.

**Kind, P.R and King, E.J. (1954):** Estimation of alkaline phosphatase activity by determination of hydrolyzed phenol with aminoantipyrene. J. Clin.Path.7, 322-330.

**László, V., Éva ,S., Klára, S., Hedvig, F., Éva, S., Andrea, L., Ibolya, K and Anna,B. (2014):** Liver-protecting effects of table beet (Beta vulgaris var. rubra) during ischemia-reperfusion .Nutrition 23 172–178.

**Lee, G.P., Jeong, W.I., Jeong, D.H., Do, S.H., Kim, T.H and Jeong, K.S.(2015):** Diagnostic evaluation of carbon tetrachloride-induced rat hepatic cirrhosis model. Anticancer Res. Mar-Apr; 25(2A):1029-1038.

**Lichtenthaler, R and Marx, F (2015):** Total oxidant scavenging capacities of common European fruit and vegetable juices. J .Agr. Feed Chem. 53:103–110.

**Lu X., Wang Y., and Zhang Z. (2009):** Radioprotective activity of betalains from red beets in mice exposed to gamma irradiation. Eur. J. Pharmacol.; 615:223–227.

**Mc Inory, R.A. (1954):** A micro heamatocrit for determining the packed cell and hemoglobin concentration on capillary blood. J. Clin. Path. (7): 32-38.

**Moreno, S., Scheyer, T., Romano, C.S., and Vpjnov, A.A. (2016):** Antioxidant and antimicrobial activities of rosemary extracts linked to their polyphenol composition. Free Radic. Res. 40, 223–231.

**Mruk, J.S., Webster, M.W., Heras, M., Reid, J.M., Grill, D.E., and Chesebro, J.H. (2018):** Flavone-8-acetic acid (Flavonoid) profoundly reduces platelet-dependent thrombosis and vasoconstriction after deep arterial injury in vivo. Circulation, 101:324-328.

**Nelson, F. (2000):** A Periodic Table of the Element from Mineral Institute, Google.

**Ninomiya, K., Matsuda, H., Shimoda, H., Nishida, N., Kasajima, N., Yoshino, T., Morikawa, T and Yoshikawa, M., (2014):** Carnosic acid, a new class of lipid absorption inhibitor from sage. Bioorg. Med. Chem. Lett. 14, 1943–1946.

**Posadas, S.J., Caz, V., Largo, C., Matallanas, B., Reglero ,G. and De Miguel,E.(2009):** Protective effect of supercritical fluid rosemary extract, Rosmarinus officinalis,on antioxidants of major organs of aged rats. Experimental Gerontology .44, 383–389.

**Ramirez, P., Garcia-Risco, M.R., Santoyo, S., Seronans, F.J., Ibaٌez, E and Reglero, G. (2016):** Isolation of functional ingredients from rosemary by preparative supercritical fluid (Prep-SFC). J. Pharm. Biomed. Anal. 41, 1606–1613.

**Reitman S. and Frankel S. (1957):** Clin .Path. Am. J. 28: 57-63.

**Rerup,E. and Lundquist, S. (1967):** Precipitation and purification of liver glycogen in rats .Acta Pharmmic. Tox. 25:47-51.

**Schwartz, S.J., Elbe, J.H., Pariza, M.W., Goldsworthy, T and Pitot, H.C (2012):** Inability of red beet betalain pigments to initiate or promote hepatocarcinogenesis. Feed Chem Toxicol, 21:531–535.

**Slamenova, D., Kuboskova, K., Eva, H and Sona, R. (2012):** Rosemary-stimulated reduction of DNA strand breaks and FPGsensitive sites in mammalian cells treated with H2O2 or visible light-excited Methylene Blue. Cancer Letters 177, 145–153.

**Sugihara1, N., Kishimoto1, Y., Iizuka1, M., Saita1, E., Suzuki1, K., Toyozaki1, M., Nagai1, M., Murakami1, K., Takenaka1, K., Tani1, M., and Kondo, K. (2009):** Effects of red beet on LDL oxidation and reactive oxygen species (ROS) production. Atherosclerosis Supplement, 10 (2): 1431-1438.

**Szymonik-Lesiuk, S., Czechowska, G., Stryjecka-Zimmer, M., Slomka, M., Madro A., Celinski, K and Wielosz ,M (2013):** Catalase, superoxide dismutase, and glutathione peroxidase activities in various rat tissues after carbon tetrachloride intoxication. J Hepatobiliary Pancreat Surg. 10(4):309-315.

**Weichselbaum, T.F (1946):** An accurate and rapid method for the determination of protein in small amount of blood serum and plasma .Am .J. Clin .Path. (16):40.

**Yokogawa, K.., Ido, A., Kurihara, T., Mano, Y., Nomura, M., Ishizaki, J and Miyamoto, K (2006):** Serum aminotransferase activity as a predictor for estimation of total clearance of hepatically metabolized drugs in rats with acute hepatic failure. Biol. Pharm. Bull. Jan; 29(1):141-5.

**Young, A. and Pestaner, D.L. (1975):** Determination of triglycerides in serum .Clin.Chem. 21:5-7.

**Zhu, X. F., Zhang, H. X., and Lo, R. (2005):** Antifungal activity of Cynara scolymus L. extracts. Fitoterapia, 76, 108–111.

# التأثير الوقائي لجذور البنجر وحصالبان ضد الإصابة بالإجهاد التأكسدى الكبدي في فئران

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**الملخص** : تحتوى كلا من جذور البنجر وإكليل الجبل على المكونات الغذائية النشطة بيولوجيا التى لها العديد من خصائص علاجية في الإصابة الكبدية. تهدف هذه الدراسة إلى تقييم تأثير كلا من جذور البنجر وإكليل الجبل على الحد من أعراض الاصابة الكبدية. وأجريت هذه الدراسة علي 30 من الفئران يتراوح أوزانهم بين 125±5 جرام وتم تقسيمهم إلى 6 مجموعات المجموعة الضابطة السالبة التى تغذت على الوجبة القياسية . وتم حقن المجموعات الأربعة الأخرى تحت الجلد بواسطة السيسبيلاتين للحث على إصابة الكبدية ثم قسمت الى المجموعة الموجبة والمجموعات المعالجة ب10% جذور البنجر و10% من حصالبان والمخلوط منهما . وقد أسفرت النتائج المتحصل عليها فيما يلي ان المجموعة الضابطة الموجبة اظهرت انخفاض معنوي في الوزن النهائي و المكتسب و نسبة كفاءة الطعام و الهيموجلوبين و (PCV) وكرات الدم الحمراء و البروتين الكلي والالبيومين والجلوبيلين في السيرم ونسبة الالبيومين الى الجلوبيلين وايضا (GSH ,GPX) والجليكوجين و الجلسيريدات الثلاثية في الكبد، وارتفاع معنوي في MDA و الكولسترول والدهون الكلية في الكبد و (ALT, AST, ALP) والبيلروبين في السيرم بالمقارنة بالمجموعة الضابطة السالبة إما مجموعة حصالبان فقد أظهرت انخفاض معنوي في الالبيومين بينما مجموعة البنجر التي اظهرت انخفاض معنوي في GSH و ارتفاع معنوي في البيلروبين في السيرم بالمقارنة بالمجموعة الضابطة السالبة. وعلى الجانب الاخر ، فمجموعات البنجر وحصالبان والمخلوط منهما اظهرت انخفاض معنوي في ALT, AST and ALP enzymes activity في السيرم ونسبة الالبيومين الى الجلوبيلين و البيلروبين و MDAو الكولسترول والدهون الكلية في الكبد كما اظهرت ارتفاع معنوي في الوزن النهائي و المكتسب و نسبة كفاءة الطعام و الهيموجلوبين و (PCV) و كرات الدم الحمراء و البروتين الكلي والالبيومين والجلوبيلين في السيرم وايضا (GSH ,GPX) والجليكوجين و الجلسيريدات الثلاثية في الكبد ما عدا مجموعة حصالبان فقد اظهرت عدم تواجد اختلاف معنوي في الالبيومين بينما مجموعة البنجر اظهرت عدم تواجد اختلاف معنوي في GSH بالمقارنة بالمجموعة الضابطة الموجبة.كما أظهرت النتائج الباثولوجية لأنسجة الكبد وجود تغيرات مرضيه واضحة في المجموعة الضابطة الموجبة و انخفضت هذه التغيرات في باقي مجموعات الدراسة. وتوصى الدراسة بضرورة تناول البنجر وحصالبان للوقاية و المحافظة على كفاءة الكبد مما ينعكس على الصحة العامة.

**الكلمات المفاتحية:** وظائف الكبد، الجلوتاثيون، المالونالدهيد، الانزيمات المضادة للأكسدة، الفئران.