



Journal of Home Economics

Volume 23, Number (1), 2013

<http://homeEcon.menofia.edu.eg>

Journal of Home  
Economics

ISSN 1110-2578

## ANTI INFLAMMATORY EFFECT OF SELECTED DIETARY ANTI OXIDANTS

Tarek Mohamed Abed El Rahman<sup>1</sup>, Mohamed Abdel Meged  
ElSaadany<sup>2</sup>, Shereen Mohamed Hassan Amer

Assistant Professor Nutrition and Food Science- Faculty of Home Economics-Minufiya  
University, Dr. of Nutrition and Food Science- Faculty of Home Economics-Minufiya University

### Abstract :

In this study forty five normal male albino rats of Sprague Dawley strain, Weighting (140+\_5g) were used to study paw edema . In order to carry out the study a formalin 1.0 mg/kg- induced the paw edema model in rats .The period continued 21 days from the date of injury .The regular intake of different concentrations (5,10 mg/kg) of 5or 10% tomatoes, spinach , Jew's mallow(*Corchorus olitorius* )and n-acetyl cysteine,(NAC) in diets has been associated with a reduced risk of paw edema . Inflammation was assessed by the measurement of paw volume after 0,1,2,4,5h and4,6,8,12,19,21 day, of injection , Complete Blood Count(CBC),some of liver function parameters and malondialhde (MDA) were deterrmind. Spinach at 10% showed significant reduction of paw edema after 6 days of formalin injection .Likewise poth of tomato at 5%and Jew's mallow at 10% showed significant reductions of paw edema after 8 days of formalin injection. Also spinach at 5% showed significant reduction of paw edema after 12 days of formalin till the end of experiment. NAC,tomato and spinach( 5%) induced significant decreases in glutamate pyruvate transaminase( GPT).All plants induced significant decreases in MDA level . Tomato and spinach at (5 and 10%) caused decreased in platelet cell (PLT) levels. Also tomato 5%, spinach10% and Jew's mallow 5% induced significant decreases in lymphocytes level. The present results showed that the mentioned plants has anti inflammatory activity on paw edema .It could be speculated that administration might be useful in the pharmacological modulation of inflammatory changes.

**Key words:** (inflammation ,paw edema, tomato, spinach, *corchorus olitorius*)

## INTRODUCTION:

Inflammation; the response of the host against infection and injury, may lead to several acute and chronic diseases such as atherosclerosis, rheumatoid arthritis, and even cancer. Chronic inflammatory diseases strike millions of people all over the world, and exercise is often prescribed for these patients to improve overall fitness and quality of life. Paw edema, is a convenient method for assessing inflammatory responses to antigenic challenges and irritants. Certain relatively uncommon antioxidants such as lycopene and phenolic compounds have not been extensively investigated from all above ailments, push us step forward to carry on to study the anti-inflammatory effect of selected dietary antioxidants. Cotran and Kumar, (1998).

## SUBJECTS AND METHOD:

**Subject:** Normal male albino rats of Sprague Dawley strain ,Weighting (140+\_5g).

**Materials:** Plants including tomato (*Solanum lycopersicum*),spinach (*Spinacia oleracea* )and molokhia” Jew’s mallow” (*Corchorus olitorius* ).

**Chemicals:** Formalin, and diethyl ether .N-acetyl cysteine ( NAC) .

**Method:** All plants were carefully washed then put it in vacuum oven at 45°C to be dried. Rats were fed on experimental diets for 21 days .All the groups of rats were fed on basal diet according to Campbell,(1961).Experimental diets contained 5or 10% of plants.

## Induction of paw edema and treatment protocol :

Forty five male albino rats were randomly divided into nine groups with five rats each as follows:

**Group 1:**The animals were subjected to injection into the rat left hind paw of 0.1m sterile saline and administered with saline (1 ml/kg, intraperitoneally ) .This group served as normal control without any treatment (Control-).The formalin-induced paw edema of the rat hind paw is a suitable model to study acute local inflammation . Agnel and Shobana,(2012). All other groups were injected with saline 10 micro liter of formalin (1 ml/kg) in left hind paw.

**Group 2:** Served without treatment as paw edema control (control +).

**Group 3:**Treated with N-acetyl cysteine added to water( 200mg /kg b.wt.).

**Group 4 and 5:**Treated with powder of tomato at two levels,(5and 10 mg/kg b.wt.) respectively.

**Group 6 and 7 :** Treated with powder of spinach at two levels,(5and 10 mg/kg b.wt.) respectively.

**Group 8 and 9** : : Treated with powder of molokhia”Jew’s mallow” at two levels,(5 and 10 mg/kg b.wt.) respectively

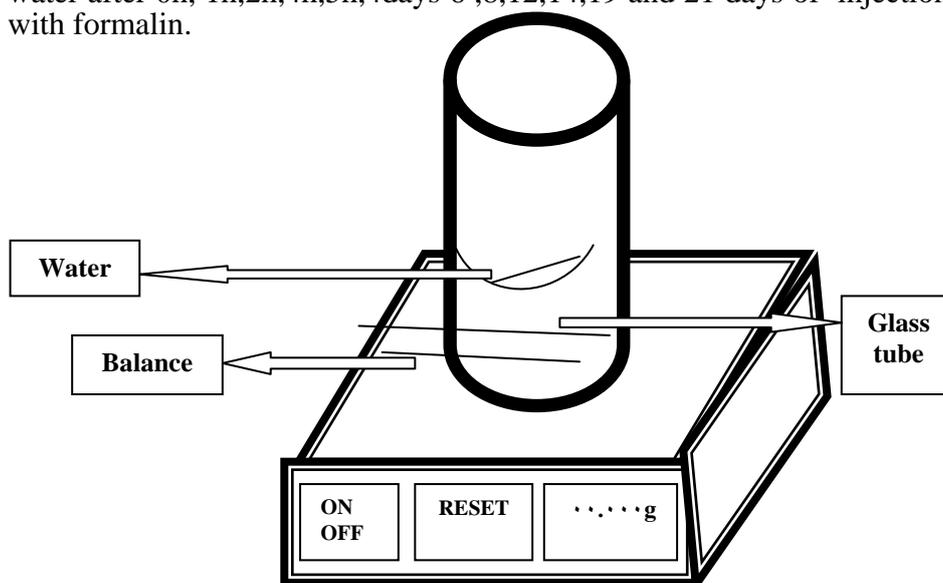
**Paw edema**

The formalin-induced paw edema of the rat hind paw is a suitable model to study acute local inflammation and widely considered to be one of the most useful models in the evaluation of anti-inflammatory activity of investigational compounds .( Agnel and Shobana,2012).

Measurement instruments of paw edema

Paw edema was determined according to Fereidonia *et al.*,(1999).As follow:

**Fig (1):** A line diagram of the apparatus used for determining edema. A 5-cm glass cylinder with 4 cm water content, and placed on an electronic balance. After immersing the animal paw into the water to a predetermined depth, a weight will appear on the balance. The paw volume will be this value divided by the specific gravity of water. Paw volume was measured by means of a volume displacement method using water after 0h, 1h,2h,4h,5h,4days 6 ,8,12,14,19 and 21 days of injection with formalin.



**Fig(1):** A line diagram of the apparatus used for determining edema. A 5-cm glass cylinder with 4 cm water content .

**Blood Samples:**

All experimental animals were kept as mentioned before for 21 days. At the end of experimental period ,rats were fasted for 12 hours and sacrificed under diethyl ether (anesthetized). Blood samples were collected in clean dry centrifuge tube from the hepatic portal vein. Apart

of blood was taken in heparinized plastic vial and analyzed immediately to determine a complete blood count (CBC).

**Separation of blood serum:**

At the end of experimental period, animals were sacrificed and blood samples were obtained from the hepatic portal veins then stored at room temperature for 15 minutes. After that samples were centrifuged at 4000/r.p.m, serum separated in clean glass well- Stoppard tubes and stored.

**Separation of organs :**

Rats were subjected to ether vapors inside desiccators for few seconds to be narcotized according to Baker (1958).Organs were separated at the end of the experiment by excising the animals with surgery, then transported by forceps to be weighted and put into Bouin solution for histological studies.

**Histopathological investigation:**

The obtained organs were fixed using of Bouin's solution according to method of Humanson (1962).The aqueous Bouin's solution was prepared as follow: Saturated aqueous solution of picric acid, formalin 25cm<sup>3</sup>, acetic acid 5 cm<sup>3</sup>.A microscopic section from organs was prepared according to the method of Kiernan (1981).

**Biochemical analysis**

Serum GPT was determined according to the method of (Tietz,1976).

Serum GOT was determined according to the method described by Henry,(1974); Young,(1975).and Murray,(1984).Creatinine formed a colored complex with picrate in alkaline medium which was measured Spectrophotometer (Patton and Crouch,1977).Serum high density lipoprotein Cholesterol (HDL-C)was determined according to the method described by Lopez(1977).Determination of serum malondialdehyde was determined according to Satoh (1978) using bio diagnosis at 534nm.

**Complete Blood Count (CBC)test:**

This test included WBC count, Hb. Platelet count (PLT), Lym, Mon. The results of CBC are generated by highly automated electronic and pneumatic multichannel analyzers based on aperture-impedances /or laser beam cell sizing and counting according to Jacobs et al., (2001).

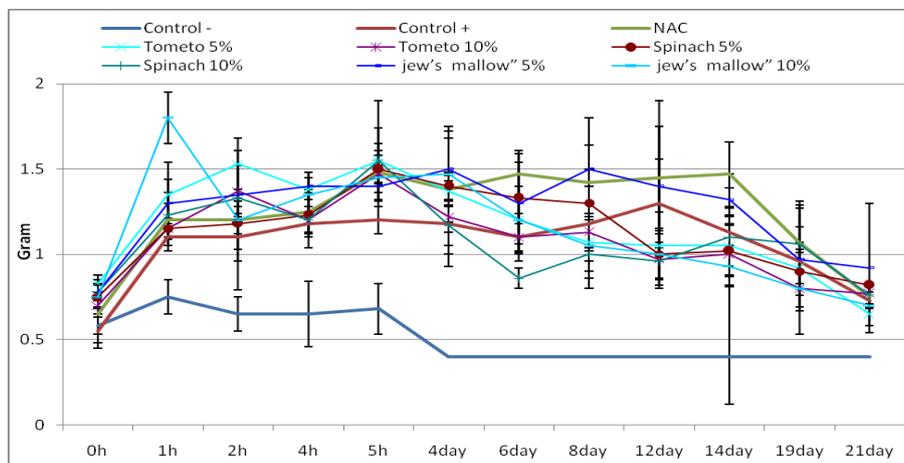
Statistical analysis: Statistical analyses were performed by IBM-PC computer hardware compact 1998,under Windows Microsoft Office 2000 compared with program using statistical package for social Science SPSS (1998),and compared with each other using the suitable test.All obtained results were tabulated and suitable recommendation were given.

## **Result And Discussion**

### **The effect of NAC and different plants on paw edema induced by formalin:**

Data concerning the effect of N-acetyl cysteine (NAC) and other plants on weight of paw edema induced in formalin in Fig(2).

There was significant difference between control negative and control positive after one hour of formalin injection till the end of experiment. Paw edema volume of control (-) group increased gradually with the time till 12 day after that paw edema was decreased. These data agreed with Lee and Jeong (2002), who found similar observation. Injection of formalin elicits significant inflammation (i.e. edema) in the center of the sole of the hind paw. Different concentrations of formalin effect on paw edema and pain behaviors in rats. Rats were injected with 100 micro liter of formalin 10% (F10) group. The diameters of the paw in the F 10 group were significantly larger than those in the control group ( $p < 0.05$ ). This suggests that there may be some dissociation of nociception from the edema formation. On other hand NAC and "Jew's mallow" 5% didn't show any improvement on paw edema during the experiment. Where spinach 10% showed a significant reduction of paw edema after 6 days of formalin injection compared with positive group. Likewise both tomato 5% and "Jew's mallow" 10% showed significant reductions on paw edema after 8 days of formalin injection compared with control positive group. Also spinach 5% showed significant reduction on paw edema after 12 days of formalin till the end of experiment. Mean while the obtained data treated with NAC did not show any improvement on paw edema during the experiment. These data were in contrast with Farshid et al., (2010) who found that n-acetylcysteine and diclofenac decreased paw thickness, and neutrophil infiltration in the paw tissues. Inhibition of cyclooxygenase products such as prostaglandins may be involved in the anti-inflammatory effects induced by n-acetylcysteine.

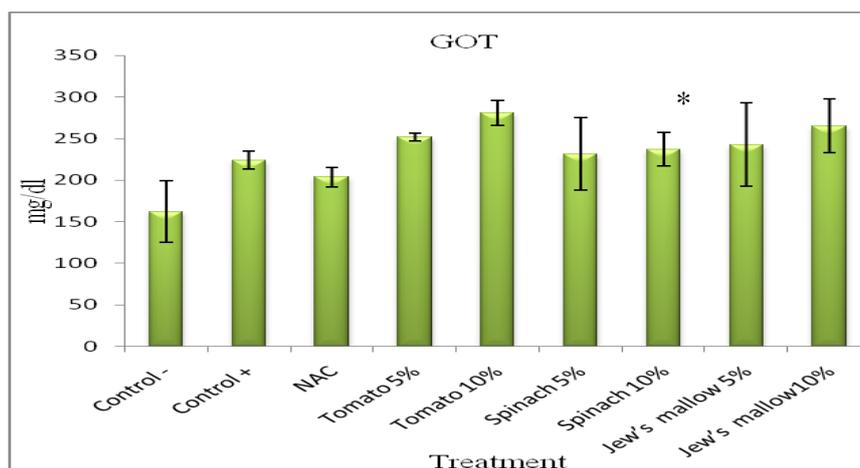


**Figure (2) :The effect of N-acetyl cysteine (NAC )and different plants on weight of paw edema induced by formalin .**

**The effect of NAC and different plants on GOT of formalin induced inflammation on in rats inflicted with paw edema.**

Data of significant differences in GOT levels of control( -) compared with control (+) group ( $p \leq 0.05$ ) these data were in link with Agnel and Shobana(2012) who found that formalin induced significant increase in GOT level . There is increasing evidence that lysosomal enzymes play an important role in the development of acute and chronic inflammation (Anderson *et al.*, 1971).In present work (Fig.3) there was non significant difference in GOT level between all treatments and positive group except of tomato 10%.Our results were in agreement with Parvin and Akhter(2008 ).who found that tomato induced significant rise in serum GOT level and different grades of necrotic changes in myocardium. On the contrary , Mazumder *et al.*, (2003) found that low dose of *Corchorus olitorius Linn.* seed which contain steroids and cardenolide glycosides, did not exhibit any significant change of serum GOT level. In addition ,Bignotto. Let'cia *et al.*,(2009). found that daily administration of lycopene during 14 d at two doses of 25 and 50 mg/kg by oral administration did not exhibit any significant differences in GOT serum levels when compared with the control negative ,these results may due to desires effect of lycopene treatment on liver injury. In addition both concentration (5and10%)of spinach did not exhibit any significant change in serum GOT level. Similar observation also found within impaired liver function. Also (Silva *et al.*,2012). Who found that daily administration of NAC increase

Aspartate aminotransferase . NAC preserved the remnant liver in mice and stimulates regeneration even after IR injury.



**Figure (3 ):**The effect of N-acetyl cysteine (NAC) and other plants on GOT for all studied groups.

**The effect of NAC and different plants on GPT of formalin induced inflammation in rats are shown in figure (4) .**

Data represented in Fig.(4) revealed significant difference in GPT level observed for control(-) compared with control (+) ( $p \leq 0.05$ ). These data were parallel with Agnel and Shobana (2012) who found that formalin induced significant increase in GPT level. There is increasing evidence that lysosomal enzymes play an important role in the development of acute and chronic inflammation (Anderson *et al.*, 1971). Also both of concentration of "Jew's mallow" (5 and 10%) induced significant increase in GPT level compared to control (+) ( $p \leq 0.05$ ) these data were in agreement with Mazumder *et al.*, (2003), who found that *Corchorus olitorius* Linn seeds which contain steroids and cardenolide glycosides in medium and high dose levels, induce significant increase in GPT. Elevation level of GPT activity in moderate and high dose level of weekly treated mice may be due to improper liver function following the treatment. On the contrary NAC, tomato 5% and spinach 5% induced significant decrease in GPT level compared with control positive ( $p \leq 0.05$ ); these data were in line with that of bigotto, Letícia *et al.*, (2009) who studied that effect of lycopene on GPT levels in the serum. When compared with sham-operated animals, there was a significant rise in the serum level of GPT. Daily administration of

lycopene during the 14 days that preceded the experiments significantly reduced this increase. This suggests that the beneficial effect of lycopene on the reduction of liver injury, might be related to its antioxidant properties. In addition Silva *et al.*,(2012) found that N-Acetylcysteine decreased ALT activity in ischemia reperfusion significantly ( $P < .05$ ), reflecting a modulation of the injury. Necrosis resulting from IR was mitigated by NAC. N-Acetylcysteine (NAC) exerts beneficial effects on livers undergoing ischemia reperfusion. There are authors of present work sought to evaluate NAC modulation on reduced livers associated with IR injury.

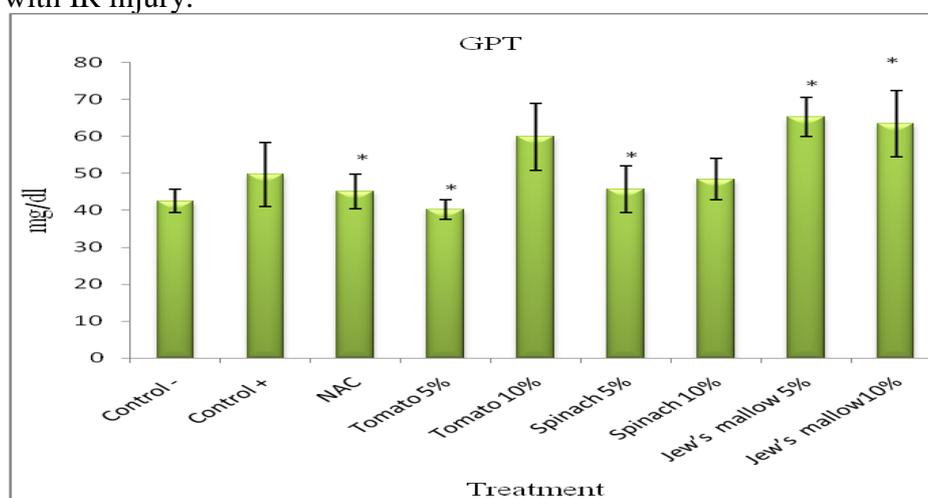


Figure ( 4):The effect of N-acetyl cysteine (NAC) and different plants on GPT of formalin induced inflammation in rat.

**The effect of NAC and different plants on MDA of formalin induced inflammation on rats are shown in figure ( 5 ).**

As represented in the Fig. there was significant decrease observed in control positive compared to negative control. These data agreed with that of Duan (2011). who found similar observation in MDA contents in human bronchial epithelium group increased with formaldehyde. These results may be due to formaldehyde-induced damages in human bronchial epithelium cells in vitro. With exception of NAC which showed non significant effect on MDA, all plants induced significant decreases compared with control positive group. Groups could be arranged descending as follow: NAC, tomato 5%, spinach10%, " Jew's mallow" 5%, spinach5%, " Jew's mallow" 10% and tomato 10%.These data were in consistence with Aydın *et al.*,(2012).who found that lycopene significantly recovered the parameters of liver functions in plasma and reduced malondialdehyde. It was suggested that the

reduction in MDA level induced by tomato might be due to the carotenoids have been well described able to scavenge reactive oxygen species. Lycopene, a carotenoid present in tomatoes and tomato products, have been suggested to have antioxidant activity, so may play a role in certain diseases related to the oxidative stress. In addition Otari *et al.*,(2012) found the protective effect of aqueous extract of *Spinacia oleracea leaves* (AESO) in experimental paradigms of inflammatory bowel disease. AESO significantly decrease colon malondialdehyde content . The most prominent effects were evident for AESO 1,000 mg/kg. This effect might be due to the antioxidant activity of the flavonoids present in the AESO. Also Das *et al.*,(2010). found that treatment with of aqueous extract of *C.olitorius* (AECO) significantly increased ( $p<0.01$ ) malondialdehyde and protein carbonyl content in myocardial tissue. Such results concluded that the treatment with AECO prior to arsenic intoxication has significant protecting effect against arsenic-induced myocardial injury .The obtained data showed no effect of N-Acetylcysteine on MDA being in contrast with that of Ucar *et al.*,(2013). who examined the potential protective effects of N-acetyl cysteine (NAC) and NAC + ozone therapy (OT) combination against APAP-induced nephrotoxicity. Also ,they found that NAC and NAC + OT significantly decreased MDA .These findings suggest that combination of NAC and OT might improve renal damages because of both oxidative stress and inflammation.

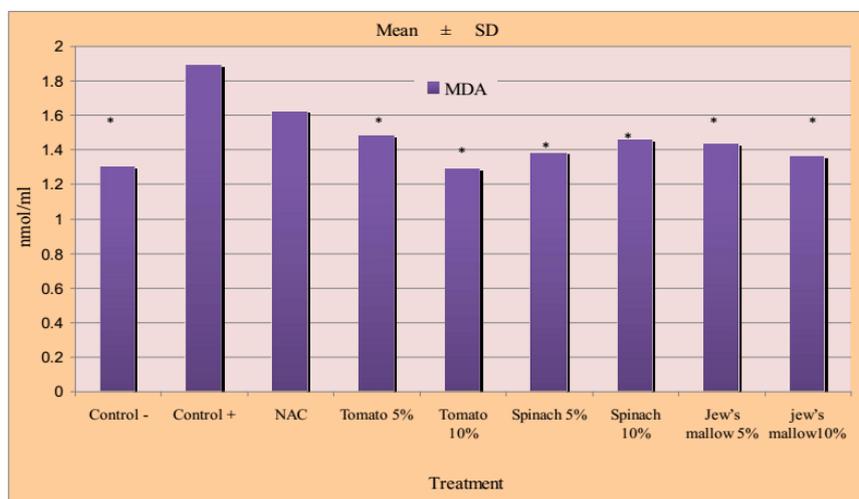
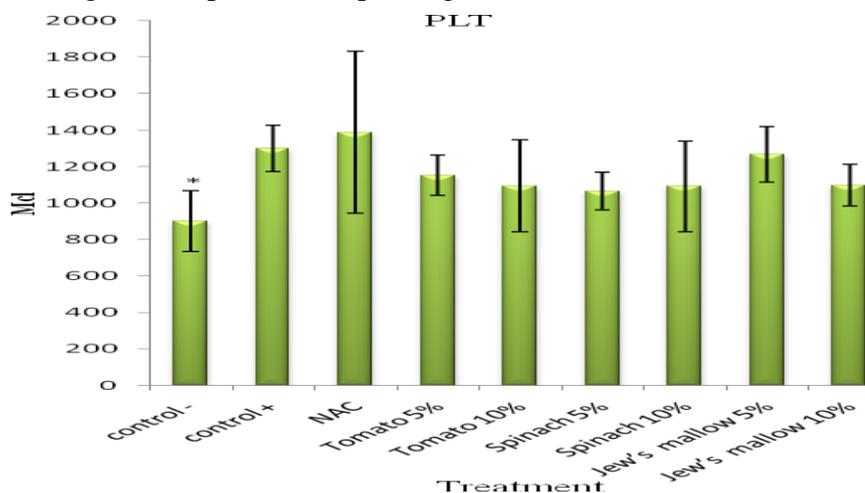


Figure (7): The effect of N-acetyl cysteine (NAC) and other plants on MDA for all studied groups.

Figure ( 5 ):The effect of N-acetyl cysteine (NAC) and different plants on MDA of formalin induced inflammation rats.

**The effect of NAC and different plants on PLT of formalin induced inflammation of rats is shown in figure( 6)**

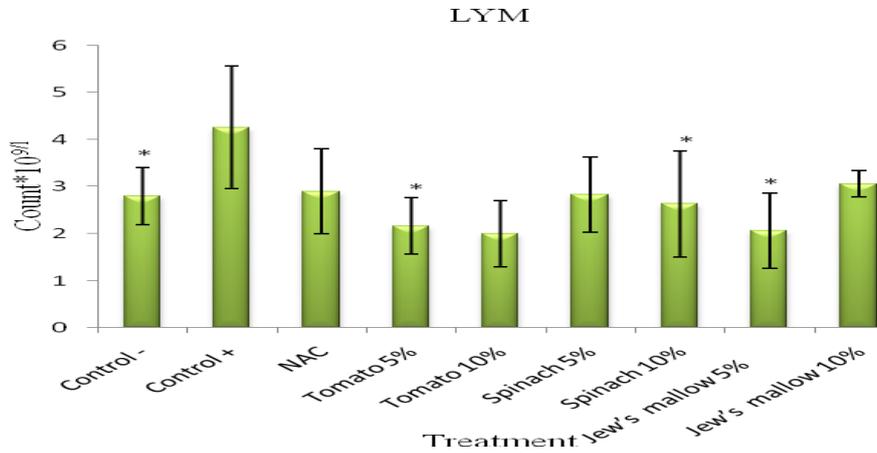
As represented in Fig (6) there were significance different between positive and negative control groups ( $p \leq 0.05$ ). These data are in agreement with that of Kilic *et al.*, (2002). who found that in all animals with paw edema induced by formalin, platelet count was increased. In addition Sivan *et al.*, (2010) found that the inflammatory response induced by *S. argus venom* in the mice hind paw was significantly increased considering platelet count. Also Henriques *et al.*, (1987). found higher increased in the number of circulating platelets in paw edema model. These data might due to in inflammation induced by formalin injection revealed a diffuse cellular infiltrate with predominance of polymorph nuclear neutrophils. As shown in Fig.(6) all treatments revealed non significant difference of PLT levels compared with positive group. In addition, there were decreases in both concentration (5 and 10%) of tomato and spinach compared with positive control group. On the contrary NAC and both concentrations of "Jew's mallow" (5 and 10%) induced increases in PLT level compared with positive group. These data are in line with that of Xu *et al.*, (2011) found that lycopene decreased platelet count. This effect of lycopene on protecting blood cell, promoting fibrinolytic activity and reducing aortic lesions in hyperlipidemic rats might be the result of reducing blood lipids and improving anti oxidation.



**Figure (6): The effect of NAC and other plants on PLT for all studied groups.**

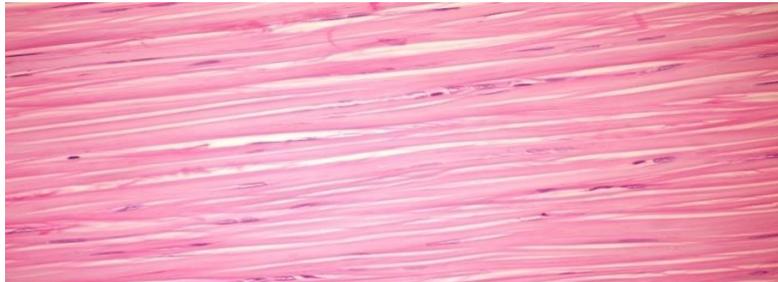
**The effect of NAC and different plants on LYM of formalin induced inflammation of rats is shown in figure (7).**

As represented in Fig.(7) there was significant difference between control positive and negative groups ( $p \leq 0.05$ ). Agnel and Shobana *et al.*,(2012) found that administration of formalin in rats resulted in a significant increase in the levels of lymphocytes which are predominant cells in chronic inflammation. This may cause permanent distortion of the tissue, interfering its function. Also inflammation might induce infiltration. On other hand tomato 5%, spinach 10% and “Jew’s mallow” 5% induced significant decreases in lymphocytes level compared with control positive group ( $p \leq 0.05$ ). These results are in agreement with Porrini *et al.*, (2002). who found that lycopene decreased significantly lymphocytes, and this reduction was due to the consumption of carotenoid-rich foods which even for a short period of time gives protection against oxidative stress. The results obtained, however seem to suggest that this protective role is not specifically related to carotenoids. In addition Pool, Zobel *et al.*,(1997) found that the supplementation of the diet with spinach products resulted in a significant decrease in endogenous levels of strand breaks in lymphocyte DNA. Oxidative base damage was significantly reduced during the carrot juice intervention. These findings support the hypothesis that carotenoid containing plant products exert a cancer-protective effect via a decrease in oxidative and other damage to DNA in humans. Also Chew *et al.*,(2012) found that A 14 immune-gene signature, which identifies molecular cues driving tumor infiltration by lymphocytes, accurately predicts survival of patients with hepatocellular carcinoma especially in early disease. In addition Li *et al.*,(2012) investigated the effects of ethanol extract of *C. olitorius* (ECO) on the growth of human hepatocellular carcinoma (HepG2) cells, and gained some insights into the underlying mechanisms of its action. This action might induce the decrease of lymphocyte. Although the obtained data showed no effect of N-Acetyl cysteine on lymphocyte count, they were in contrast with that Zhuang *et al.*,(2012) found that the infiltration of lymphocytes and formation of pseudolobuli in liver alleviated in three acetyl cysteine magnesium treatment groups was significantly lower than for control group. It was suggested that Acetylcysteine magnesium is probably a distinctive antioxidant which can remove various free radical in body and modulate ligand-dependent signal transduction and the growth of cell. It also have protection from the liver cirrhosis and portal hypertension of rats induced by dimethylnitrosamine.

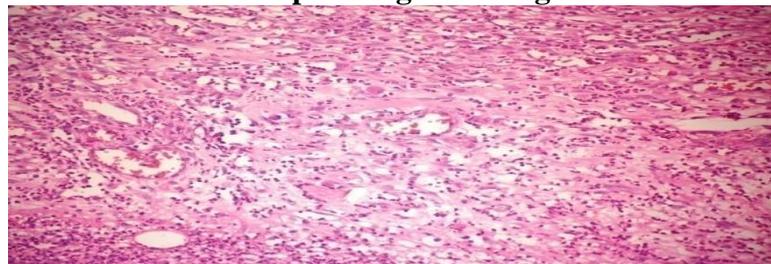


**Figure (7):**The effect of NAC and other plants on LYM for all studied groups.

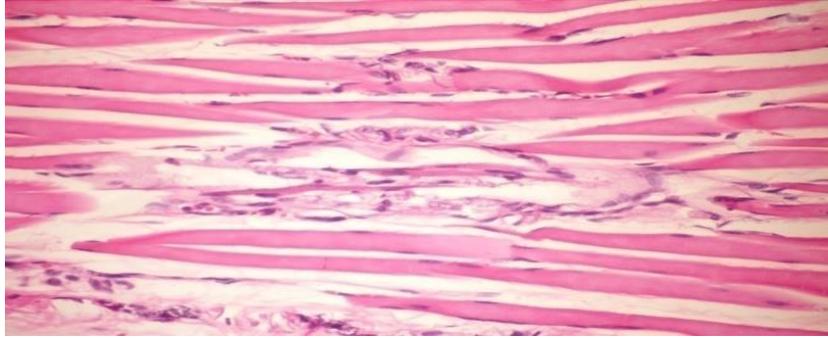
**Histopathological investigation:**



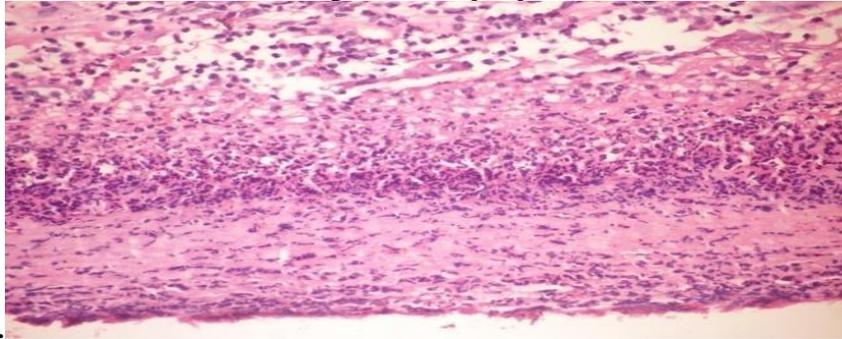
**Photo ( 1 ):** Muscles of rat from (control -) group showing no histopathological change



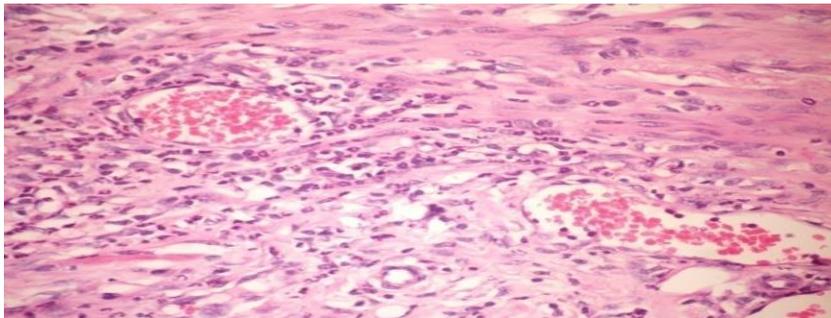
**Photo( 2 ):** Muscles of rat from (control +) group showing massive inflammatory cells infiltration, fibroblasts proliferation with formation of new blood capillaries.



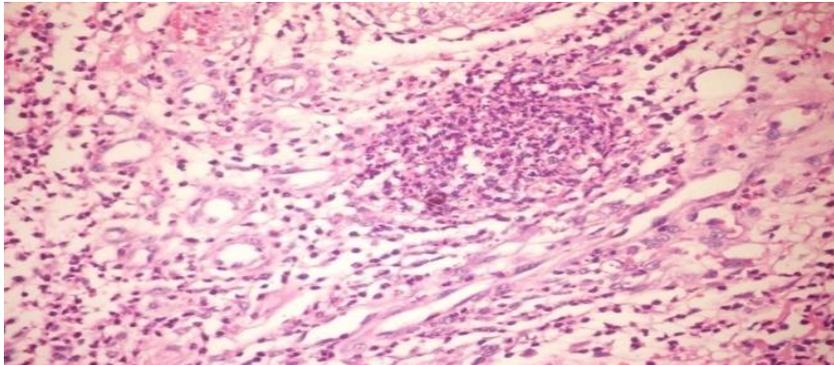
**Photo(3): Muscles of rat from (NAC) group showing local myolysis of sporadic myocytes**



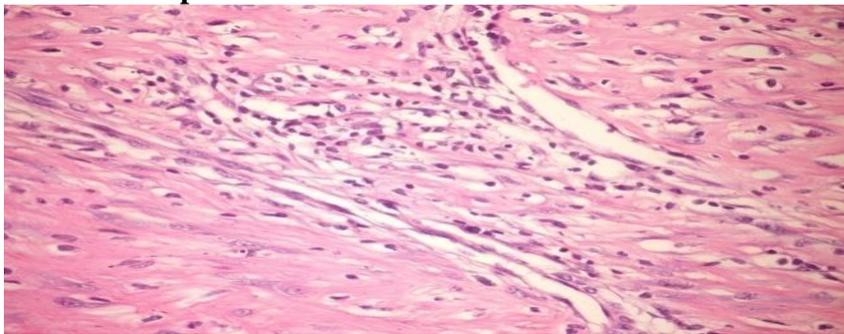
**Photo(4): Muscles of rat from (Tomato5%) group showing slighted liquifactive necrosis associated with some neutrophilic cells infiltration.**



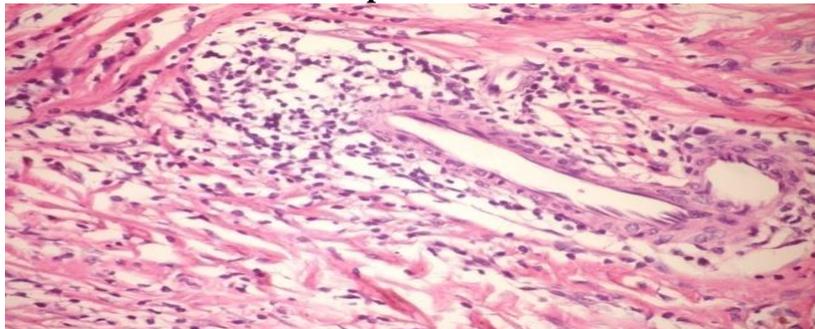
**Photo(5) :Muscles of rat from (Tomato10%) group showing local myositis . Notice the slight congested blood vessels and some infiltration with neutrophiles.**



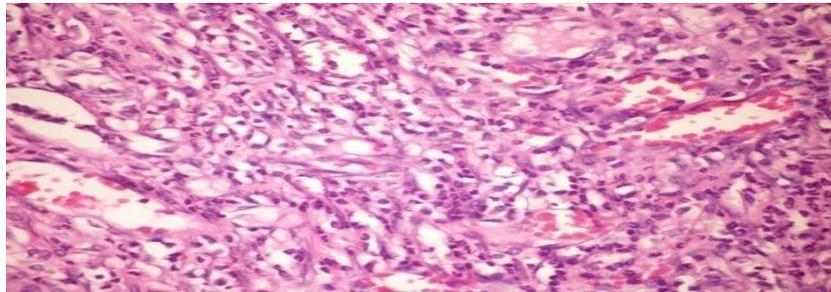
**Photo(6) :Muscles of rat from (Spinach 5%) group showing local neutrophilic cells aggregation associated with formation of newly formed blood capillaries**



**Photo( 7): Muscles of rat from(Spinach 10%) group showing local myositis associated with appearance of newly formed blood capillaries .**



**Photo( 8) : Muscles of rat from (mellow5%) group showing local myositis .**



**Photo( 9 ): Muscles of rat from(mellow 10%) group showing massive inflammatory cells infiltration, fibroblasts proliferation and congested blood capillaries.**

**References:**

- Agnel ,J. and Shobana, G.(2012): Anti-inflammatory activity of *Talinum fruticosum* L. on formalin induced paw edema in albino rats. *Journal of Applied Pharmaceutical Science*, 2 (1): 123-127.
- Anderson,A.J.;Bocklehurst,W.E. and Wills,A.L.(1971):Evidence for the role of lysosomes in the formation of prostaglandins during carraginin induced inflammation in rat.*Pharmacol.Res.*,3:13-1.
- Aydın,S.;Tokaç, M.; Taner , G.; Arıkök , A.T.; Dündar, H. Z.; Ozkardeş, A. B.; Taşlıpınar, M.Y.; Kılıç, M.; Başaran ,A.A. and Başaran,N.(2012): Antioxidant and antigenotoxic effects of lycopene in obstructive jaundice. *J. Surg .Res.*,(12)954-957.
- Baker,(1958):*Methods of Animales. tsia the Anes Press.USA*
- Bignotto , Letí'cia .; Rocha, J.; Sepodes, B.; Eduardo,F. M.;Pinto, R.; Chaud, M.; de Carvalho, J.; Moreno, H. Jr. and Mota-F.H.(2009): Anti-inflammatory effect of lycopene on carrageenan-induced paw oedema and hepatic ischaemia-reperfusion in the rat. *Br. J. Nutr.*,102(1):126-33.
- Campbell,J.(1961):*Methodologyofproteinevaluation.RAG.Nutr.Docume nt R.10 Ledo.37Jone mething..New York,Toronto.*
- Chew,V. ; Chen,J. ; Lee,D. ; Loh,E. ; Lee,J. ; Lim,K.H .; Weber,A.; Slankamenac, K.; Poon ,R.T.; Yang, H.; Ooi ,L.L.; Toh ,H.C.; Heikenwalder, M.; Ng, I.O.; Nardin, A. and Abastado, J.P.(2012): Chemokine-driven lymphocyte infiltration: an early intratumoural event determining long-

- term survival in respectable hepatic cellular carcinoma. *Gut*,61(3):427-38.
- Cotran and Kumar, C., (1998): Robbins Pathologic Basis of Disease. Philadelphia: W.B Saunders Company. ISBN 0-7216-7335-X
- Das, A.K.; Sahu ,R.; Dua ,T.K. ;Bag, S.; Gangopadhyay, M. ;Sinha ,M.K.and Dewanjee, S.(2010): Arsenic-induced myocardial injury: Protective role of *Corchorus olitorius leaves*..*Food Chem. Toxicol.*,48(5):1210-7.
- Duan ,Y.Y.(2011): Effects of overexpression of heat shock protein 70 on the damage induced by formaldehyde in vitro. *Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi.*,29(5):349-52.
- Farshid ,A.A.; Tamaddonfard, E.and Yahyae, F.(2010): Effects of histidine and N-acetylcysteine on diclofenac-induced anti-inflammatory response in acute inflammation in rats. *Indian .J .Exp. Biol.*,48(11):1136-42.
- Fereidoni,M.; A, Ahmadiani.; S, Semnianian.and M, Javan.(1999): An accurate and simple method for measurement of paw edema. *Journal of Pharmacological and Toxicological Methods.*, 43 (2) :11 - 14.
- Henriques, M.G.; Silva, P.M.; Martins, M.A.; Flores, C.A.; Cunha, F.Q.; Assreuy-Filho, J.and Cordeiro, R.S.(1987): Mouse paw edema: A new model for inflammation? *Braz J .Med .Biol. Res.*,20(2):243-9.
- Henry,R.J.(1974):*ClinicalChemist:PrinciplesandTechnics*.2<sup>nd</sup>Edition.He gestown (MD),Harcer,Row.,P.882.
- Humanso,G.L.(1962):*Animal Tissue Techniques*.W.H.Freem and Company,Sanfrancisco,U.S.A.
- Jacobs,D.S.;Oxley,D.K.and Demott,W,R.(2001):*Laboratory Test book Hand .Lexi.Comp.,Inc.*
- Kiernan,J.A.(1981):*Histological and Histochemical Methods :Theory and Practice*.Pernanein Press, New York,U.S.A.
- Kilic, F.S.; Erol, K.; Batu, O.; Yildirim, E.and Usluer ,G.(2002): The effects of fusidic acid on the inflammatory response in rats. *Pharmacol. Res.*,45(4):265-7.

- Lee, I.O.and Jeong, Y.S. (2002): Effects of different concentrations of formalin on paw edema and pain behaviors in rats. *J. Korean Med .Sci.*,17(1):81-85.
- Li ,C.J.; Huang ,S.Y.; Wu, M.Y.; Chen ,Y.C.; Tsang, S.F.; Chyuan, J.H.and Hsu, H.Y.(2012): Induction of apoptosis by ethanolic extract of *Corchorus olitorius* leaf in human hepatocellular carcinoma (HepG2) cells via a mitochondria-dependent pathway. *Molecules.*,17(8):9348-60.
- Lopez , M. F. (1977):HDL\_Cholesterol Colorimetric Method.*J.of Clin\_Chem.*,23:882.
- Mazumder ,U.K.; Gupta ,M.; Pal ,D.and Bhattacharya,S.(2003): Chemical and toxicological evaluation of methanol extract of *Cuscuta reflexa Roxb.* stem and *Corchorus olitorius Linn.* seed on hematological parameters and hepatorenal functions in mice. *Acta Pol Pharm.*,60(4):317-23.
- Murray,(1984): Determination of Serum Glutamate Oxalate Transaminase.,*Clin .Mosby Co. St Louis.Toretonto.Princon* P.P.1112-116.
- Otari, K.V.; Gaikwad, P.S.; Shete ,R.V.and Upasani, C.D.(2012): Protective effect of aqueous extract of *Spinacia oleracea* leaves in experimental paradigms of inflammatory bowel disease. *Inflammopharmacology* ,20(5):277-87.
- Parvin ,R. and Akhter, N.(2008): Protective effect of tomato against adrenaline-induced myocardial infarction in rats. *Bangladesh Med. Res .Counc. Bull.*,34(3):104-8.
- Patton,C.J.and Crouch, S.R.(1977):Determination of serum creatinine enzymatically *Anal.Chem.*,49:464:469.
- Pool-Zobel, B.L.; Bub ,A.; Müller, H.; Wollowski ,I.and Rechkemmer, G.(1997): Consumption of vegetables reduces genetic damage in humans: first results of a human intervention trial with carotenoid-rich foods. *Carcinogenesis.*,18(9):1847-50.
- Porrini, M.; Riso, P.and Oriani ,G.(2002): Spinach and tomato consumption increases lymphocyte DNA resistance to

- oxidative stress but this is not related to cell carotenoid concentrations. *Eur J Nutr.*,41(3):95-100.
- Satoh, K.,(1978): Serum lipid peroxide in cerebrovascular disorders determined by a new colorimetric method. *Clin. Chem. Acta.*,(90): 37-43.
- Silva, S.M.; Carbonel ,A.A.; Taha, M.O.; Simões, M.J.and Montero,E.F.(2012):Proliferativeactivityin ischemia/reperfusion injury in hepatectomized mice: Effect of N-acetylcysteine. *Transplant Proc.*,44(8):2321-5.
- Sivan, G.; Venketasvaran, K. and Radhakrishnan ,C.K.( 2010): Characterization of biological activity of *Scatophagus argus* venom. *Toxicon.*, 56(6):914-25.
- SPSS,(1998):Statistical Package for Soial Science Computer Soft ware,Windows Microsoft Office 2000.
- Tietz,N.W.(1976):Fundmental of Clinical Chemistry. Philadelphia,W.B. Laboratory Test,3<sup>rd</sup>.Ed. AACC.
- Ucar, F.; Yavuz, Taslipinar, M.; Alp, B.F.; Aydin, I.; Aydin, F.N.; Agilli ,M.; Toygar, M.; Ozkan, E.; Macit ,E.; Oztosun ,M.; Cayci T.and Ozcan A.(2013): The Effects of N-Acetylcysteine and Ozone Therapy on Oxidati Stress and Inflammation in Acetaminophen-Induced Nephrotoxicity Model *Ren .Fail.* [Epub. ahead of print].
- Xu, X.; Zhu, M.and Hu, M.(2011): Effects of lycopene on blood cells and fibrinolytic activity in hyperlipidemic rats. *Wei Sheng Yan Jiu.*,40(5):620-3.
- Young,D.S.(1975):Determination of GOT.*J.Clin.Chem.*,21:1.
- Zhang, Q.Y.; Wang ,L.Y.; Kong ,F.Y.; Deng ,Y.S.; Li, B.and Meng ,Q.W.(2012 ):Constitutive accumulation of zeaxanthin in tomato alleviates salt stress-induced photoinhibition and photooxidation. *Physiol Plant.*,146(3):363-73.

## التأثير المضاد للالتهاب لبعض مضادات الأكسدة الغذائية

طارق محمد عبدالرحمن عفيفي<sup>١</sup>، محمد عبد المجيد السعدني<sup>٢</sup>، شيرين محمد حسن عامر<sup>٣</sup>  
أستاذ مساعد التغذية وعلوم الأطعمة - كلية الإقتصاد المنزلي - جامعة المنوفية<sup>١</sup>، مدرس بقسم التغذية وعلوم  
الأطعمة - كلية الإقتصاد المنزلي - جامعة المنوفية<sup>٢</sup>، الباحثة<sup>٣</sup>

### الملخص

في هذه الدراسة تم استخدام ٤٥ ذكور الفئران البيضاء وزن ١٤٥±٥٥ جم لدراسة الأود  
يما المخلبية وقد تم أحداث الأود يما المخلبية بحقن الفئران بالفورمالين بتركيز ٠.١ ملجم/كجم  
من وزن الجسم. الدراسة استمرت المدة ٢١ يوم من تاريخ الحقن. المأخوذ اليومي من الطماطم  
والسبانخ والملوخية بتركيز (١٠ و ٥%) في الغذاء ملجم/كجم من وزن الجسم وأيضا (ن-استيل  
سسثاين) وقد تم تقدير حجم الأود يما بعد ١ و ٢ و ٤ و ٥ ساعات وأيضا بعد  
٤ و ٦ و ٨ و ١٢ و ١٩ و ٢١ يوم من تاريخ الحقن وحتى نهاية التجربة. وقدرت أيضا صورة الدم  
الكاملة وبعض من وظائف الكبد وأيضا تم تقدير المألوندهيد. ووجد الأتي المجموعة التي تتغذي  
علي السبانخ بتركيز ١٠% لوحظ فيها انخفاض معنوي واضح في حجم الأود يما بعد ٦ أيام من  
تاريخ الحقن. وأيضا كلا المجموعتان التي تتغذي علي نبات الطماطم ٥% و الملوخية ١٠%  
لوحظ بها انخفاض معنوي واضح في حجم الأود يما بعد ٨ أيام من الحقن. أيضا المجموعة التي  
بها نبات السبانخ ٥% أظهرت انخفاض معنوي واضح في حجم الأود يما بعد ١٢ يوم وحتى  
في كل من المجموعات التي تغذت باستخدام نبات الـGPT نهاية التجربة يوجد انخفاض في أنزيم  
لطماطم والسبانخ ٥%. كل المجموعات ماعدا مجموعة (ن استيل سسثاين) حدث بهم نقص  
معنوي واضح في مستوي المألوندهيد. أيضا المجموعات التي في عليها نبات الطماطم  
والسبانخ (٥ و ١٠%) قللت عدد خلايا الصفائح الدموية. أيضا المجموعة التي تتغذي علي  
نبات الطماطم ٥% والسبانخ ١٠% والملوخية ٥% أحدثت نقص معنوي في عدد  
الليمفاويات. هذه النتائج جميعها تشير إلي أن هذه النباتات تعتبر مضادات جيدة للالتهابات  
متمثلا في نموذج الأود يما المخلبية