

محاولات لعلاج الآثار الناتجة عن شرب المياه الملوثة في الفأر الأبيض بالخلصة

المائية للثوم والزنجبيل

أ.د. حامد محمد متولي و د. عمرو عبدالحليم راشد

مقدم للشركة السعودية للصناعات الأساسية (سابق) ١٤٢٤ هـ

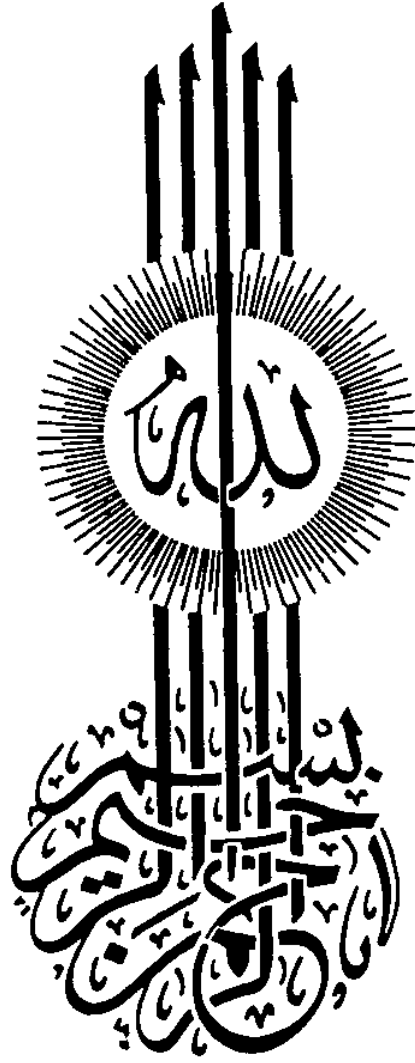
**Trials on treatment of toxic effect induced by drinking of polluted water in white rat, *Rattus norvegicus* by garlic and ginger water extract**

**Prof. Dr. Hamed Mohammad Mutwally**

**&**

**Dr. Amr Abdel Halim Rashed**

**Submitted to Saudi Basic Industries Company (SABIC) 1424 H**



## Introduction

### Herbal Medicine:

Alternative medicines are being increasingly used and investigated in the management of a variety of disorders as hepatitis, parasitic, bacterial, fungal, gastro-intestinal tract disorders etc..., Li, et al (2003).

Herbs and related products are commonly used by patients who also seek conventional health care. Some herbs have been extensively studied, but little is known about others, Winslow and Kroll (1998).

Herbal medicine has never disappeared. Until this moment, there are still homeopathic pharmacies and certainly people still use traditional herbal cures. Nowadays, there has been a drift back to natural cures and herbal medicines in reaction against the ever-increasing complexity of modern drugs. There is a huge number of medicinal herbs are actually used for the aide of herbal cure and among are garlic and ginger.

#### 1- **Garlic, *Allium Sativum* (*Lilaceae*)**

Garlic is one of the oldest and most valued of all cultivated plants. It have come into Southern Europe from the East. Certainly, it was known to the Ancient Egyptians who used it as a food and medicine. The builders of the pyramids were eating garlic and they believed that it gives them the power to work.

The word garlic originates from the Anglo-Saxon “gar-leacor spear” plant. *Allium*, the ancient latin name for garlic, is dlerived from the celtic all, signifying hot or burning, so it was named as *Allium sativum*, Van Dalen, (1998). Generally, researches have shown that eating garlic regularly by over a period of time can significantly lowers blood pressure, reduce the level of cholesterol in blood and decreases the tendency of blood to clot, thus it is useful in the prevention and treatment of cardiovascular disorders. Garlic also acts against bacteria viruses, fungi and parasites, and so stimulates the formation of white blood cells. Externally, also garlic can be used for treating infected bites and wounds and also to draw out insect stings and thorns. Even with the development of modern antibiotics, many people still regard garlic as the remedy to be tried first

when infection threatens. As mentioned above, garlic is used in treating wide spectrum of diseases and in this review some but not all successful clinical trials will be mentioned.

### **Effects of garlic on blood pressure:**

Many authors emphasized on the role of garlic in treating cardiovascular disorders. Silagy and Neil Haw (1994) reported that a moderate to poor quality supplement of 600-900 mg/ day for one to three months were associated with a modest reduction in systolic and diastolic blood pressure. However, they added that more studies and informations are required to treat patients with hypertensive properties. They used dried garlic preparation in their clinical trials.

In addition, Ackerman, et al (2001) suggested possible small short term benefits of garlic on some lipid and other factors. They added that garlic preparation may lead to small reduction in the total cholesterol level at one month (0.03-0.45 mmol/l) and at 3 months (0.32-0.66 mmol/l). Finally, they revealed insignificant effect on blood pressure and blood glucose.

### **Role of garlic in reducing plasma lipids, lipoproteins and triglycerides:**

Isaacsohn, et al (1998) proved that garlic powder exhibited significant effect in reducing plasma lipids and lipoproteins. They used a dose of 300 mg of garlic three time a day for 12 week in parallel with placebo. They also added that a significant reduction in triglycerides up to 350 mg/dl or sometimes lower were observed. They concluded that garlic powder (900 mg/d) treatment for 12 weeks was effective in lowering levels in patients with hypercholesterolemia.

Stevenson, et al (2000) carried out 21 trials to evaluate the role of garlic in reducing serum cholesterol. Out of these trial, ten favored the effect of garlic over placebo.

McCordle, et al (1998) found a significant reduction in total cholesterol levels of 22-81 mg/dl, which was equivalent to a decrease of approximately 9% compared with placebo.

Oi, et al (1999) reported that the administration of allicin and volatile sulfur containing compounds in garlic enhances thermogenesis by increasing noradrenalin secretion via  $\beta$ -adrenergic stimulation.

They added that this increase leads to increasing in metabolism of triglycerids and catabolism of brown adipose tissue in rats.

### **Pulmonary Diseases and garlic:**

Kim-Park et al (2000) showed that garlic extract significantly modulates the production and function of both endothelium-driven relaxing and constricting factors and this may contribute to its protective effect against hypoxic pulmonary vasoconstriction.

### **Garlic as antineoplastic agent:**

A plenty of studies have shown that aged garlic extract suppresses cancer growth and enhances immune system against tumor growth, Hu, et al (2002).

Balasenthil, et al (2000) studied the protective effect of garlic (*Allium Sativum*) on circulatory lipid peroxidation and antioxidants. They speculated that garlic extract significantly decreased lipid peroxidation and subsequently inhibits the carcinogen 7.12. dimethylbenz [a] anthracene, which induces buccal pouch carcinogenesis in male hamsters.

Milner (1996) and Sundaram and Milner (1996) reported that garlic has certain compounds which have anticarcinogenic and anti-tumorigenic properties. Iciek, et al (2001) found that diallyl disulfide in garlic has an antiproliferative effect on human hepatoma cell line. They suggested that when reactive sulfur is connected to neoplastic agents, this would have antiproliferative effect against liver tumours.

Hu, et al 2002 investigated the effect of aged garlic extract to inhibit not only tumor growth, but also the migration of malignant cells. They recorded for the first time that aged garlic extract inhibits rat sarcoma cell migration if not completely stopped it. They added that, unlike other cancer treatment methods, garlic play a role in fighting cancer without significant side effect.

### **Garlic as stimulant for immune system:**

Colic, et al (2002) studied the effects of garlic aqueous extracts and garlic ethanolic extract on proliferation of rat thymocytes and splenocytes in culture stimulated with concanavalin A. They found that both extracts significantly modulate lymphocytic proliferation triggered by this potent T-cell mitogen. They also revealed that the extract only was not mitogenic for lymphocytes but also the higher concentration of extract was inhibitory.

### **Garlic and diseases of gastrointestinal tract:**

Cellini, et al, (1996) and Sivam et al (1997) demonstrated that *in vitro* experiments showed that growth of *Helicobacter pylori* was inhibited by garlic extract. The epidemiological investigation made by You et al (1998) revealed that regular garlic consumption protects against *H.Pylori*. Ernst (1997) reported that a large body of evidence implies that higher intake of garlic is associated with reducing the risk of stomach cancer but he warned from induction of nausea and vomiting with high garlic intake.

Ernst (1999) in a preliminary study on trying garlic to treat *Helicobacter pylori* infection found that after 4 to 8 week of ingestion of dried garlic 3 times daily, 15 out of 20 patients showed negative test for such bacteria.

### **Garlic as a general antimicrobial agent:**

Harris, et al (2001) mentioned that usage of garlic and its sulfur chemistry has a wide spectrum action against bacteria, fungi, and protozoa.

### **Antibacterial effect of garlic:**

Sovova, et al (2001) pointed out that a promising results were performed during the *in vitro* using garlic in the treatment of the bacterium *Helicobacter pylori* which inducing chronic gastritis. Tsao and Yin (2001) investigated the *in vitro* antimicrobial activity of garlic oil containing four diallyl sulphides against *Staphylococcus aureus*, methicillin-resistant *S. aureus*, three *Candida* spp. and three *Asperigillus* spp. They found that garlic oil with a higher concentration of the four diallyl sulphides (dillyle disulphide, diallyl trisulphide and dially tetrasulphide) have a role in the prevention and treatment of the above mentioned microbes.

### **Antifungal activity of garlic:**

Venugopal & venugopal (1995) proved that diluted garlic extract could be used as effective antidermatophytic agent against many pathogenic fungi and its effect is equivalent to the drug ketoconazol in treating such dermatological diseases.

### **Garlic as antiprotozoal agent:**

Ankri, et al (1997) studied the effect of allicin extracted from garlic on the cytopathic effect of *Entamoeba histolytica*. They revealed that allicin inhibit the enzyme cysteine proteinase which is one of the active contributor to amebic virulence which causing destruction of monolayers of baby hamster kidney cells.

### **Garlic as detoxification agent:**

Van Dalen (1999) recommended garlic as eliminating agent for heavy metals and a different types of toxicants. He also added that garlic extract can eliminate the released bacterial endotoxins which could be lethal in many cases so it is used for treating septicemia.

Moustafa, et al (2000) reported that S-allylcysteine which is organosulfur compound purified from garlic had an antioxidant and scavenging effect. They mentioned that it reduces the toxic effect of doxorubicin (potent anticancer drug) at a percent of 28% and reduces the mortality rate.

Guyonnet, et al (2002) found that diallylmonosulfide and diallyldisulfide, two garlic constituents, were found to be inhibitors to aflatoxine B1 (AFB1) which initiate carcinogenesis in rat liver. They revealed that allylsulfides increasing the metabolism of AFB1 and subsequently prevent their accumulation against AFB1-induced carcinogenesis. Helen, et al (2003) found that S-allyl

cysteine sulfoxide (SACS) isolated from garlic can combat the toxic effect of nicotine which inducing lung cancer. They also found that the levels of antioxidants like vitamins A, C and E in liver and so glutathione in all tissues increased significantly in SACS treated rats.

### **Chemical compounds found in Garlic**

Garlic contains many effective groups which have a potential pharmacokinetic action against a wide variety of diseases. Kodera, et al (2002) studied the physical, chemical and biological properties of S-allyl cysteine. They showed that it was rapidly absorbed from gastrointestinal tract.

#### **Active ingredients in Garlic:**

The major active ingredient in garlic is called allicin which is a volatile oil containing sulfur which is responsible for its pungent odor, van Dalin, (1999). Allicin is formed by the action of the enzyme allinase. This enzyme and its odor are destroyed by cooking and subsequently cooking lessens the medicinal effect of garlic. The allicin (garlic oil) is formed of four diallyl sulphides which are

- Diallyl monosulphide
- Diallyl disulphide
- Diallyl trisulphide
- Diallylteta sulphide

Iciek et al (2001) encountered diallyl disulfide, cystamin mercaptoethanol disulfide, thiosulfate, immunothiol and pyridoxal phosphate jointed with cystine. In the light of the above mentioned, the useage of garlic assisting in:

- Reducing blood Pressure.
- Treating digestive infection and gastric upsets.
- Lowering blood cholesterol.
- Lowering serum lipids.
- Expelling intestinal parasites.
- Treating fungal and bacterial infections.
- Treating respiratory disorders.
- Fighting neoplstic diseases and inhibiting migration of malignant cells.
- Increasing the rate of catabolism of lipids and triglycerides.

#### **2- Zinger (*Zingiber officinalis*, *Zingiberiaceae*)**

This plant originating in Southeast Asia and it is grow best in tropical and subtropical regions with good rainfall, hot and humid Summer. Not many herbs have such a long and salubrious history as ginger. More than 5000 years ago, the ancient Chinese and Indians looked upon ginger as the

universal medicine. The ancient Greeks ate ginger wrapped inside bread after meals to help in digestion, Shelley, (2002). Ginger is well known in the form of ginger sticks or ginger ale. It has been used by travelers and drivers to avoid motion sickness. The efficacy of ginger rhizome for the prevention of nausea, dizziness, and vomiting as symptoms of motion sickness (kinetosis), as well as for postoperative vomiting and vomiting of pregnancy, Langner et al (1998).

#### **Ginger for treating seasickness, nausea and vomiting:**

Qian and Liu (1992) showed that ginger Juice exhibits anticholinergic and antihistaminic action on gastric and intestinal smooth muscles. They concluded that ginger produces antimotion sickness action possibly by central, peripheral anticholinergic and antihistaminic effect.

Ernst and Pittler (2000) reported that during a study on six volunteers, they found that ginger was superior to placebo and metoclopramide in treating postoperative nausea and vomiting. The amount of ginger given to post operative patient was 1gm daily. They concluded that ginger favouring over placebo.

#### **Ginger and reduction of serum lipids:**

Shanmugam, et al (1999) found a significant decrease in the levels of cholesterol, phospholipids and free fatty acids in tissues (liver, intestine, kidney and aorta) and serum of ginger treated rats. Simultaneously, level of serum triglyceride were also significantly reduced in the same rat groups.

Fuhrman, et al (2000) revealed that aortic atherosclerotic lesion areas were reduced by 44% in mice that consumed 250 mg of ginger extract once a day. The same amount also leads to reduction in plasma triglycerides and cholesterol.

#### **Cardiotonic effect of ginger:**

Kobayashi, et al (1988) found that in guinea pig isolated atrial cells, (8)-gingerol caused an increase in the degree and the rate of longitudinal contraction. They added that the measurement of extravesicular  $Ca^{+2}$  contraction using a  $Ca^{+2}$  electrode indicated that gingerol accelerated the  $Ca^{+2}$  uptake of fragmented sarcoplasmic reticulum prepared from canine cardiac muscles.

#### **Ginger fighting cancer**

Vimala (1999) mentioned that ginger and other members of family Zingiberaceae are very useful and used widely in treatment of gastric disorders, nausea, vomiting, liver complaints, asthma and many other disorders. He also found that ginger and ginger species effectively block the promotion of cancerous tumours. In addition, he concluded that ginger and other zingiberaceae rhizomes may be useful in preventing the promotion of cancer and that populations with high risks of cancer should be encouraged to include them in their diet.

### **Antipyretic and analgesic effect of ginger:**

General pharmacological studies were performed on (6)- gingerol and (6)- shogaol which are the pungent constituents of ginger by Suekawa et al (1984). They found that both intravenous and oral administration of the above constituents induce antipyretic and analgesic effect. They added that the effect of (6)- shogaol was mostly more intensive than (6)- gingerol.

### **Ginger as a treatment for rheumatism and musculoskeletal disorders:**

Srivastava and Mustafa (1992) found that ginger is very in treatment of inflammatory diseases, rheumatism, rheumatic arthritis, osteoarthritis and muscular discomfort. They carried out their clinical trials on 56 patient and non of them suffered from adverse effect as always accustomed with other anti-inflammatory drugs.

### **Zingiber as a detoxicant:**

Ahmed, et al (2000) mentioned that concomitant dietary feeding of ginger significantly attenuated malathion induced lipid peroxidation and oxidative stress in rats. Their results indicated the possible involvement of free radicals in organophosphate-induced toxicity and highlighted the protective action of ginger.

### **Active Constituents Of Ginger**

As reported by Huang et al (1991) one of the most active component in ginger is galanolacton which is a diterpenoid acts as a muscle relaxant and has an anticholinergic action.

Pancho, et al (1989) mention the components S-(+)- (6)- gingerol and (6) Shogaol among the active constituents of ginger.

Also Kobayashi, et al (1988) encountered (8)- gingerol as an active component in ginger.

In the light of the above it might be conclude that ginger can be safely used in treating of the following disorders:

- Travel sickness.
- Morning sickness.
- Indigestion.
- Crampative.
- Poor circulation.
- Arthritis.
- Common cold and flu
- Rheumatism and inflammatory diseases.
- Menstrual pain.
- General discomfort.

The aim of this study is to evaluate the effect of garlic and ginger water extract in treating the toxic effect of polluted pipe water on kidney and liver of the white rat

## **Material and Methods**

### **Collection of water samples:**

Water samples have been collected from tanks and pipes established in old building in El Shoeiba district (a rural community) in Makkah area. The water tank and the net of water pipes were rusty and extremely expired. Water was collected in a 2 liter clean bottle and kept in laboratory at a temperature of  $25\pm 2$  C°.

### **Analyses of water:**

Collected water Samples have been tested physically and chemically to compare with Standard maximum contaminant level (SMCL).

#### **A- Physical analyses:**

Samples were examined for the following properties.

- 1- Odour.
- 2- Taste.
- 3- Colour.
- 4- Turbidity.
- 5- Sediments.
- 6- PH number.
- 7- Conductivity.

#### **B- Chemical analyses:**

Sample were analyzed chemically using atomic absorption set supplied by Schemizo Company, USA.

Cations and anions were quantitatively measured as ppm. The cations measured were calcium, magnesium, potassium, sodium, iron, copper, zinc, lead, manganese, cadmium and chromium. Anions measured were chlorides, fluorides, nitrates, nitrites, sulphates, ammonia and bicarbonates. Total hardness, total alkalinity, suspended solids and total dissolved solids were measured too.

In contrast, distilled water used for control rats was also analyzed in the same manner.

#### **Experimental animals:**

The white rat (*Rattus norvegicus*, Wistar Albino Strain) has been used as a laboratory experimental model. Thirty two male and female rats (8-10 week - old) were divided into two groups

as 16 male and 16 females. Each group was divided into 4 subgroups as 4 rats per each. The first subgroup was considered as a control one while the other three subgroups considered as treated animals. The second, third and fourth groups under the main two groups were sacrificed after 24 hours, 3 and 5 days. The experimental design is shown in the following scheme.

Animals were kept on shelves in a conditioned room ( $25 \pm 2$  °C) and subjected to twelve hours dark-light cycle. Rats were caged separately as one per cage to prevent the mating behaviour between males and females and so the behavioral stress between male-male rats. Animals were treated the same and were fed *ad libitum* on animal food supplied by Arasco Feed Mill, Saudi Arabia which composed of 15% protein, 2.5% fat and 7% crude fibers.

#### **Preparation of garlic water extract:**

Twenty grams of garlic were chopped and strongly squeezed in a mesh and then the extract (1ml) was added to a 9ml of distilled water. The water extract was kept in a fridge in opaque glass vial. The extract was freshly prepared when required.

#### **Preparation of ginger extract:**

Twenty grams of ginger rhizome were copped and strongly squeezed using a suitable mesh allowing the extract to be released (1ml). Ginger diluted extract obtained was added to 9ml of distilled water and kept as mentioned above. Animals were allowed to drink collected water for 4 weeks to induce renal and hepatic pathology. Control rats were allowed to drink distilled water.

A pilot study has been done preliminary to assess the time required to induce the toxic effect in liver and kidney. By the end of fourth week, treated male and female rats were enforcedly drunk the water extract of both garlic and ginger. Each animal received 3ml of diluted extract twice a day with the aid of intragastric plastic or metal tube for five days. The three treated subgroups were sacrificed at the end of the first, third and fifth day successively. The control rats were sacrificed at the end of fifth day.

Animals were dissected after being suffocated by  $\text{CO}_2$  and a random pieces of their kidneys and livers were taken and fixed in buffered 10% formalin solution.

Tissues were processed for routine histology and then photographed.

### **Results**

#### **(1) Analyses of water samples:**

##### **A- Analyses of distilled water (tables 1 & 2):**

Two samples of distilled water have been analysed physically and chemically. As shown in table 1 & 2, no significant differences were observed between the analyses of the two specimens.

**B- Analyses of samples of water pipes collected from Al Shoaiba district (Tables 3 & 4):**

Comparing to results of distilled water specimens analysed, some cations and anions exceed the SMCL. As iron, copper, lead, cadmium. Iron, however, increases up to three times than the SMCL. Cadmium and chromium increased 2.5 and 2.3 times respectively than SMCL. Copper increased by 1.5 to 1.7 times than SMCL. Lead and ammonia increased by 0.40 times than SMCL.

**(2) Effect of drinking of pipes water on kidney of male and female white rats:**

The histopathological signs in both male and females were:

- a- Infiltration of inflammatory cells around both renal arteries and veins and so in different sites among renal tissues particularly in cortical region.

**Table (1) Physical analyses of distilled water**

No	Physical characters	SMCL	Number of water sample	
			1	2
1	ODOUR	UNOBJECTIONABLE	Unobjectionable	Unobjectionable
2	TASTE	UNOBJECTIONABLE	Unobjectionable	Unobjectionable
3	COLOUR	15 units	Normal	Normal
4	TURBIDTY	5 units	No Turbidity	No Turbidity
5	SEDEMINTS	_____	No Sediments	No Sediments
6	PH	6.5 _____ 8.5	6.54	7.13
7	CONDUCTIVITY	2500 Ms/cm	247	237

**Table (2) chemical analyses of distilled water**

No	Chemical characters (Average composition) (ppm)	Standard maximum contaminant levels SMCL	Number of water sample	
			1	2
1	TOTAL HARDNESS	UP to 500	22	18
2	TOTAL ALKALINITY	500 p.p.m	22	18
3	CALCIUM	200 p.p.m	5.2	4.9
4	MAGNESIUM	150 p.p.m	2.24	2.29
5	POTASSIUM	20 p.p.m	0.0	0.0
6	SODIUM	200 p.p.m	0.0	0.0
7	IRON	0.3 p.p.m	0.019	0.018
8	COPPER	1.0 p.p.m	0.052	0.049
9	ZINC	15 p.p.m	0.005	0.003
10	LEAD	0.05 p.p.m	0.009	0.008
11	MANGANESE	0.3 p.p.m	0.07	0.027
12	CADMIUM	0.01 p.p.m	0.025	0.025
13	CHROMIUM	0.05 p.p.m	0.13	0.13
14	CHLORIDES	250 p.p.m	11.36	9.52
15	FLOURIDES	0.8 p.p.m	0.00	0.00
16	NITRATES	44 p.p.m	0.22	0.13
17	NITRITES	0.1 p.p.m	0.007	0.004
18	SULPHATES	400 p.p.m	0.00	0.00
19	AMMONIA	0.05 p.p.m	0.002	0.002
20	BICARBONATES	450 p.p.m	38	0.53
21	SUSPENDED SOLIDS	0.25 p.p.m	0.03	0.01
22	TOTAL DISSOLVED SOLIDSE	1500 p.p.m	6	7

**Table (3) physical analyses of water samples Collected from Al Shoaiba district in Makkah Al Mokaramah**

No	Physical characters	SMCL	Number of water sample	
			1	2
1	ODOUR	UNOBJECTIONABLE	UNOBJECTIONABLE	UNOBJECTIONABLE
2	TASTE	UNOBJECTIONABLE	UNOBJECTIONABLE	UNOBJECTIONABLE
3	COLOUR	15 UNIT	>15	>15
4	TURBIDTY	5 UNITS	38	51
5	SEDEMINTS	_____	—	—
6	PH	6.5 _____ 8.5	4.8	5.7
7	Conductivity	2500 Ms/Cm	1720	1530

**Table (4) chemical Analyses of water samples Collected from Al shoaiba district in Makkah Al Mokaramah**

No	chemical characters (Average Compostion) (ppm)	SMCL	Number of water sample	
			1	2
1	TOTAL HARDNESS	Up to 500	39	47
2	TOTAL ALKALINITY	500 p.p.m	43.7	33.7
3	CALCIUM	200 p.p.m	16.3	11.6
4	MAGNISIUM	150 p.p.m	35.1	31.6
5	POTASUIM	20 p.p.m	0.1	0.2
6	SODIUM	200 p.p.m	9.3	4.1
7	IRON	0.3 p.p.m	0.70	0.92
8	COPPER	1.0 p.p.m	1.47	1.70
9	ZINC	15 p.p.m	0.74	0.67
10	LEAD	0.05 p.p.m	0.066	0.055
11	MANGANESE	0.3 p.p.m	0.07	0.070
12	CADMIUM	0.01 p.p.m	0.025	0.025
13	CHROMIUM	0.05 p.p.m	0.13	0.13
14	CHLORIDES	250 p.p.m	167	174.18
15	FLORIDES	0.8 p.p.m	0.48	0.33
16	NITRATES	44 p.p.m	1.29	1.09
17	NITRITES	0.1 p.p.m	0.006	0.004
18	SULPHATES	400 p.p.m	2.3	2.8
19	AMMONIA	0.05 p.p.m	0.05	0.07
20	BICARBONATES	450 p.p.m	66.37	69.71
21	SUSPENDED SOLIDS	0.25 p.p.m	34	36
22	TOTAL DISSOLVED SOLIDS	1500 p.p.m	67	63

- b- Inflammation of renal glomeruli (glomerulitis) ranging from mild to severe degrees.
- c- In many cases, shrinking and atrophy of renal corpuscles were noticed.
- d- Haemorrhage has been frequently observed in cortical region.
- e- Dilation of renal veins was noticed particularly in cortical region.
- f- Dilatation of large collecting tubules was also frequently observed.

As revealed in Plates (4) & (7), it is clear that female rats were responding to treatment with garlic extract more than males. At the end of the fifth day, the histopathological signs observed in female rats were very mild infiltration of inflammatory cells around both renal artery and veins and at the vascular pole of renal corpuscles. However, a very few number of glomeruli developed atrophy and sometimes degeneration.

### **(3) Effect of treatment by garlic extract on kidney of male and female of white rats:**

Kidney of both males and female responded well to garlic extract. The inflammatory cells reduced in number from around renal arteries and veins. Also the congested corpuscle restored its normal histology particularly at the end of fifth day. This proves that derivatives of garlic oil (allyl sulphides) have an anti-inflammatory effect.

Moreover, necrosis induced in renal tissues particularly in cortical region subsided and healed. Interestingly, by the end of the fifth day, female rat exhibited very good response to treatment by garlic rather than males.

### **(4) Effect of treatment by ginger extract on kidney of male and female of white rats:**

Garlic was surpassing in treatment of inflammatory disorders in kidney if compared to ginger. However, the females and as been mentioned before were responding also to ginger extract rather than males.

The kidneys of male rats were strongly affected by water pipe more than females. Ginger extract had an anti-inflammatory effect but generally less than that of garlic. As illustrated in plates (10) & (13) the inflammatory cells are still mild and distributed among the renal tissue. Comparing to autopsied kidney of male and females treated with garlic, a very few number was found at the end of fifth day. It might be suggested that garlic extract has a power anti-inflammatory effect more than that of ginger extract.

What supports this is the histopathology illustrated in plates 11 & 12 where no changes were observed after the first and second dose in female rats. Progress takes place after ingestion of third dose.

#### **(5) Effect of treatment by garlic extract on livers of male and female rats:**

Liver was less affected by drinking of pipes and tanks water. In both males and female the main histopathological signs were:

- a- Infiltration of inflammatory cells around portal veins, central veins and bile ducts and ductules. This inflammation ranged from mild to severe degrees.
- b- Formation of necrotic foci among liver parenchyma which were small sized but not extensive.
- c- As a result of congestion of portal veins, bile duct, and ductules were subsequently affected by damaging of their walls, narrowing of ducts and deposition of collagen fibres around them.

At the end of fifth day, there was a marked progress in liver cure. However, a few number of inflammatory cells were still deposited around both portal and central veins as revealed in plates 17, 20, and 20. What supports that liver was less affected is the frequent and normal mitosis observed at the end of fifth day.

Both male and female rats responded well to garlic extract. Perhaps, this was due to mild pathological effect induced by drinking pipes and tanks water on liver which was less affected than kidney.

#### **(6) Effect of treatment by ginger extract on livers of male and female rats:**

As illustrated in plates 21-26, histopathological symptoms were mild. This proves that elements which exceeded the SMCL had a worse effect on kidney.

As mentioned before, males and females responded well to ginger extract but here we can not confirm whether ginger has a power anti-inflammatory effect or not. Beyond controversy, garlic proved to be effective anti-inflammatory agent in elimination of toxic effect in kidney.

### **Discussion**

Drinking water may be polluted with contaminants that may have effects on people's health. Contaminants have aesthetic effects on water such as taste, odor, turbidity and coloration. Such contaminants which including ions of heavy metals as lead, cadmium, chromium, copper and iron can badly affect liver, kidney, lung, bones and nervous system. In the present study, kidneys livers of which rat were affected by toxicants. In addition, other anions as ammonia, nitrates and nitrites in integrity with other cations may complicate the situation and perhaps in severe cases leads to death. As revealed by Eubank (1997), lead induces severe neurological and toxic effects on renal function. They added that these symptoms were caused even for short periods of exposure. However, the

symptoms mentioned by Eubank et al extremely compatible with the present results. They mentioned that renal glomeruli were profoundly affected by lead poisoning and that runs parallel to our results.

As mentioned by Eubank et al (1997), lead pipes used for service connections from water mains and so lead contamination of water from rocks and soil are the two main causes for polluting drinking water. In the same time, the main dependence in our kingdom is upon ground water so, there is a convenient reason to expect lead reaching or exceeding the SMCL. Concerning to iron, it is considered as the most element occurs naturally in many ground water and so in pipes water. In spite of being iron as significant element for health, however, humans and animal may be sensitive for its increasing in their drinking water.

Iron levels above SMCL may impart an objectionable taste or odor but it is not poisoning agent for water except in very higher levels. Pitt and Field (1990) reported that when cadmium and chromium raise above SMCL, they would be very dangerous for kidney and liver. They also emphasized on cadmium which may cause renal failure even in short periods of exposure. Mostafa et al (2000) and Van Dalen (1999) recommended garlic oil for treating pathological symptoms induced by heavy metals but they did not confirm its roll in eliminating such metals. However, the authors here can not confirm this too, but the encouraging and promising results obtained during this study enhances the usage of garlic in treating toxic effects of polluted water. This requires an extensive study on each of these elements separately to investigate the effect of both garlic and ginger on elimination of heavy metals.

As illustrated in plates 14-26 liver was mildly affected. They authors here investigated that the anti-inflammatory effect of both garlic and ginger was nearly equal for the two herbs. Probably if there was a severe toxic effect, it would be an indicator to confirm which of the two herbs is effective in elimination of toxic effect in liver or any other organ with mild symptoms. In the light of the above the authors suggest the followings:

- a- Garlic is a surpassing anti-inflammatory agent rather than ginger.
- b- Long term treatment by both garlic and ginger would be better and effective than short term and ensure prevention of adverse effect in treated hosts.
- c- Rusty and old expired pipes and tanks had a worse effect on water connected to houses.
- d- Using of standard PVC or iron pipes instead of lead pipes would be healthy and prevent the increasing of lead salts and ions in drinking water.
- e- Carrying out extensive studies on the detoxification effect of garlic on each of the element previously mentioned separately.

## SUMMARY

The effect of both garlic (*Allium stivum*) and ginger (*Zingiber officinalis*) on treatment of toxic effect induced by polluted drinking water was studied. This is the first trial to use such medicinal plants as detoxicants in both liver and kidney of the white rat.

Thirty-two males and females (8-10 week old) of the white rate were used as experimental models. Rats were divided into two main groups each of sixteen rats. The two main groups were divided in 4 subgroups each consists of 4 rats. The first group considered as a control and the other three were treated groups. Both males and females were enforcedly drunk water extract of both garlic and ginger for five days to evaluate the effect of short term treatment on liver and kidney of rats.

The study revealed that drinking of polluted water for thirty days caused liver and renal disorders. Symptoms investigated were necrosis, inflammatory cells infiltration, hemorrhage, atrophy of renal corpuscles, congestion of renal gomeruli (glomerulitis). Each rat was given 3 ml of each extract daily and they were autopsied after 24 hours, 3, and five days.

Garlic extract were much more effective in treating symptoms induced by polluted water rather than ginger. However, the two extracts exhibited very encouraging results, but garlic was surpassing in most cases.

Females were well responding to treatment rather than males. Also female rats showed marked progress in treating with the two extracts. The authors concluded that treating with water extract of both garlic and ginger gave good results. and they recommend long term treatment of the two herbs with a lower doses that would be better and to great extent effective in treating toxicosis induced by polluted water.

## ملخص البحث

تم في هذا البحث دراسة علاج الآثار المترتبة على شرب المياه الملوثة على الكلى والكبد بالخلاصة المائية لكل من نباتي الثوم والزنجبيل ، هذا وتعتبر هذه الدراسة هي الأولى من نوعها والتي يستخدم فيها هذان النباتان لمحاولة إزالة آثار التسمم بالمياه الملوثة في الفأر الأبيض في المملكة العربية السعودية .

هذا وقد استخدم الفأر الأبيض كحيوان معلمي في هذه الدراسة حيث تم استخدام (٣٢) فأر من الذكور والإناث ( ١٦ ذكر ، ١٦ أنثى ) تتراوح أعمارها بين ٨ - ١٠ أسابيع .

وتم تقسيم الفئران إلى مجموعتين متساويتين من الذكور والإناث ، وقسمت كل مجموعة رئيسية إلى ٤ مجموعات كل تتكون من أربعة فئران وعوملت المجموعة الأولى كمجموعة ضابطة بينما اعتبرت الثلاث مجاميع الأخرى كمجاميع معاملة وكل مجموعة فيها قسمت إلى مجموعتين كل منهما تضم فأرين الأولى عوملت بخلاصة الثوم المائية والثانية عوملت بخلاصة الزنجبيل المائية .

وقد استعملت تقنية التشريب الإجباري عن طريق أنبوبة التشريب المعدية حيث كانت الفئران تعيش على شرب المياه الملوثة لمدة ثلاثون يوماً ثم بدأت التجربة بتشريب جميع الفئران المعاملة ذكوراً وإناثاً ٣ مل من الخلاصة المائية لهذين النباتين حسب تقسيم المجموعات ، كما ذكر من قبل لمدة خمسة أيام وذلك لمعرفة تأثير هاتان الخلاصتان على إزالة آثار المياه الملوثة من الكبد والكلى .

هذا وقد أجريت تجربة استطلاعية مسبقة لمعرفة الزمن اللازم لإحداث الأعراض التسممية في كل من الكبد والكلى ، وكانت الظواهر المرضية حدوث التهابات في الكبة وحول كريات ملبيجي ، وكذلك ترشيح للخلايا المناعية في مناطق متعددة وخاصةً في مناطق القشرة كذلك وجود احتقان في الشرايين والأوردة داخل الكلى وحدث نزيف ، كذلك فإن الأعراض التي ظهرت في الكبد كانت حدوث احتقان حول الأوردة البابية وكذلك الأوردة المركزية وحدث تجمع للخلايا البيضاء والمناعية في مناطق عديدة كما ظهر في القطاعات الهستولوجية أيضاً لوحظ حدوث ظاهرة التركز في بعض أجزاء من القطاعات .

وقد تم قتل الفئران بعد نهاية اليوم الأول ، الثالث ، الخامس لاستبيان تأثير العلاج على فترات قصيرة بواسطة خلاصتي الثوم والزنجبيل ، وقد وجد أن خلاصة الثوم كانت أكثر فاعلية في إزالة بعض هذه الآثار من كلٍ من الكلى والكبد إلى حد كبير إضافةً إلى أن أعراض التحسن قد ظهرت سريعاً في حالة العلاج بالمستخلص المائي للثوم في كلٍ من الكلى والكبد ، أما بالنسبة للزنجبيل فقد ظهرت أعراض التحسن ولكن في اليوم الخامس ، وفي بعض القطاعات لم تظهر أي استجابة أو تحسن حتى في اليوم الثالث وبقيت بعض الآثار وحتى نهاية اليوم الخامس .

وكذلك فقد كانت الاستجابة للتحسن واضحة في الإناث أكثر منها في الذكور، وحتى فإن أعراض التسمم بالمياه الملوثة كانت أقل في الإناث عنها في الذكور، وهي نتيجة طبيعية لأن الإناث أكثر مقاومة بسبب وجود هرموني الاستروجين والبروجيسترون وكذلك قلة نشاط الأنثى إذا ما قيس ذلك بنشاط الذكر ، وعلى ذلك فقد ظهرت أهمية الخلاصة المائية لهذين النباتين في علاج أعراض التسمم إن كان الثوم قد أظهر فاعلية أكبر في إزالة آثار التسمم في نهاية اليوم الخامس من العلاج ويبدو للباحثين أن الزنجبيل قد يحتاج إلى فترة أطول من ذلك ولكن هذا يحتاج إلى إجراء المزيد من التجارب لمعرفة المزيد من الحقائق عن هذه ين النباتين واللذان من المتوقع وفي القريب جداً أن تكون لهما أهمية فائقة وكبيرة في علاج كثير من الأمراض المتعلقة بالتسمم .

## References

- 1- Ackerman, R.T.; Mulrow, C.P.; Ramirez, G.; Gardner, C.D. Morbidoni, L. and Lawrence, V.A. (2001). Garlic shows promise for improving some cardiovascular risk factors. *Archive of Internal Medicine*. 161 (6): 813-825.
- 2- Ahmed, R.S.; Seth, V.; Pash, S.T. and Banerjee, B.D. (2000). Influence of dietary ginger (*Zingiber officinale*) on oxidative stress induced by malathion in rats. *Food and Chemical Toxicology*. 38 (5): 443-450.
- 3- Ankri, S.; Miron, T.; Rabinkov, A.; Wilchek, M. and Mirelman, D. (1997). Allicin from garlic strongly inhibits cysteine proteinase S and cytopathic effect of *Entamoeba histolytica*. *Antimicrob Agents Chemotherapy*. 41 (10): 2286-2288.
- 4- Balasenthil, S; Arivazhagan, S and Nagini S. (2000). Garlic enhances circulatory antioxidants during 7,12-dimethylbenz [a] anthracene-induced hamster buccal pouch carcinogenesis. *Ethnopharmacology*. 72 (3): 429-433.
- 5- Cellini, L.; Di Campli, E; Masulli, M; Dibartolomeo, S. and Allocati, M. (1996). Inhibition of *Helicobacter pylori* by garlic extract (*Allium sativum*). *Immunology and Medical Microbiology*. 13: 273-277.
- 6- Colice, M.; Vucevic, D.; Kilibarda, V.; Radicevic, N. and Savic, M. (2002). Modulatory effect of garlic extracts on proliferation of T-lymphocytes *in vitro* stimulated with concanavalin A. *Phytomedicine*. A (2): 117-124.
- 7- Ernst, E. (1997) Can *Allium* vegetables prevent cancer? *Phytomedicine*. 4:79-83.
- 8- Ernst, E. (1999). Is garlic an effective treatment for *Helicobacter pylori*? *Archive of Internal Medicine*. 159 (8): 2484-2485.
- 9- Ernst, E. and Pittler, M.H. (2000). Efficacy of ginger for randomized clinical trials. *British Journal of Anaesthesia*. 84 (3): 367-371.

- 10- Eubank, W.; Carpenter, J.D. and Maltzberger, B.A. (1995). Understanding water test. Report of water Quality Initiative Publication. A report submitted to Missouri University, U.S.A. pp: 1-15.
- 11- Fuhrman, B., Rosenblat, M.; Hayek, T.; coleman, R. and Aviram, M. (2000). Ginger extract consumption reduces plasma cholesterol, inhibits LDL oxidation and attenuates development of atherosclerosis in atherosclerotic, apolipoprotein in E-deficient mice. *The Journal of Nutrition* 130 (5): 1124-1131.
- 12- Guyonnet, D.; Belloir, C.; Suschetet, M.; Siess, M.H. and Le Bon, A.M. (2002). Mechanism of protection against aflatoxin by genotoxicity of rats treated by organo-sulfer compounds from garlic. *Carcinogenesis*. 23 (8): 1335-1341.
- 13- Harris, J.C.; Cottrell, S.L.; Drummers, S. and & Lloyd, D. (2001). Antimicrobial properties of *Allium sativum* (garlic). *Applied Microbiology and Biotechnology*. 57 (3): 282-286.
- 14- Helen, A.; Krishnakumar, K.; Vijayammal, P.L. and Augusti, K.T. (2003) A comparative study of antioxidants S-allyl cysteine sulfoxide (SACS) and vitamin E on the damages induced by nicotine in rats. *Pharmacology*. 67 (3): 118-117.
- 15- Hu, X.; (ao, B.N.; Hu, G.; He, J.; yang, D.Q. and war, y. S. (2002). Attenuation of cell migration and induction of cell death by a garlic etrat in rat sarcome cells. *International Journal of Molecular Medicine*. 9 (6): 641-643.
- 16- Huang, Q.R.; Iwamoto, M.; Aoki, S.; Tanaka, N.; Tajima, K.; yamahara, J.; Takaishi, y.; yoshida, M.; Tomimatsu, t. and Tamai, y. (1991). Anti 5-hydroxytrytamine effect of galanolactone, diterpenoid isolated from ginger. *Chemical and Pharmacological Bulletin of Tokyo*. 39 (2): 397-399.
- 17- Iciek, M.B.; Rokita, H.B. and Wlodek, L.B. (2001). Effect of diallyl disulfide and other donors of suefane suefer on the proliferation of human hepatoma cell line (Hep G2). *Neoplasma*. 48 (4): 307-312.

- 18- Isaacsohn, J.L.; Moser, M.; Stein, E.A; Karen Dudley, R.N; davey, J.A.; Ellen Liskov, R.D. and Black, H.R. (1998). Garlic powder and plasma lipids and lipoproteins, a multicenter, randomized, placebo-controlled trials. *Archive of Internal Medicine*. 158 (11): 1189-1193.
- 19- Kim-Park, S.and Ku D. p (2000). Garlic elicits a nitric oxide-dependant relaxation and inhibits hypoxic pulmonary vasoconstriction in rats. *Clinical and Experiment Pharmacology and Physiology*. 27 (10): 780-786.
- 20- Kobayashi, M.; Ishida, y.; shoji, N. and Ohi jumi, y. (1988). Cardiotonic action of (8)-gingerol, an activator of the Ca<sup>+2</sup> pumping adenosine triphospatase of sarcoplasmic reticulum in guinea pig atrial muscles. *Journal of pharmacology and Experimental therapy*. 246 (2): 667-673.
- 21- Koder, y.; Suzuki, A.; Imada, O.; Kasuga, S.; Sumioka, I.; kanezawa, A.; Twa, N.; Fujikawa, M.; Nagae, S.; Masamoto, K.; Maeshige, K. and Ono, K. (2002) Physical, chemical and biological properties of s-allyl cysteine anino acid derived from garlid. *Journal of Agriculture Food. Chemistry*. 50 (3): 622-632.
- 22- Langner, E.; Greifenberg, S. and Gruenwald, J. (1999). Ginger: History and uses. *Advances in Therapy*. 15 (1): 15-44.
- 23- Lee, G.F, Dee, P.E. and Ann Jones-lee. (1997). Lead as a stormwater runoff pollutant. *Landfill and water Quality Management*. "A technical paper", Agency for Toxic Substances and Diseases Registry. Atlanta, U.S.A.
- 24- Li, y. M.; Ryan, P. and Batey, R.G. (2003). Traditional Chinese medicine prevents inflammation in liver injury in mice. *American Journal of Chinese Medicine*. 31 (2): 170-175.
- 25- Lucinda, G. and Miller, P. (1998). Herbal Medicinals. *Archive of Internal Medicine*. 158: 2200-2211.]
- 26- McCrindle, B.W; Helden, E. and Conrer, W.T. (1998). Garlic extract therapy in children with hypercholestero- lemia. *Archive of Pediatrics and Adolescences Medicine*. 152: 1089-1094.

- 27- Miller, L.G. (1998). Herbal Medicinals. *Archive of Internal Medicine*. 58 (2): 2200-2211.
- 28- Milner, J.A. (1996). Garlic: its anticarcinogenic and antitumorigenic properties. *Nutrition Review*. 11 (2): S82-S86.
- 29- Mustafa, M.G.; Mima, T.; Ohnishi, S.T. and Mori, K. (2000). S-allylcysteine ameliorates doxorubicin toxicity in the heart and liver in cimce. *Planta Medica*, 66 (2): 148-51.
- 30- Mustafa, T.; Srivastava, K.C. and Jensen, K.B. (1993). Phamacology of ginger, *Zingiber officinale*. *Journal of Drug Development*. 6 (1): 25-39.
- 31- Oi, yuriko; Kawada, T; Shishido, C.; wado, K.; kominato, y.; Nishimura, S.; Arga, T. and Iwai, K. (1999). Allyl-containing sulfides in garlic increase uncoupling protein content in brown adipose tissue and noradrenaline and adrenaline secretion in rat. *Journal of Nutrition*. 129: 330-342.
- 32- Pancho, L.R.; Kimura, I.; Mnno, K.; Kurono, M. and Kimura, M. (1989). Reversed effects between (rude and processed ginger extracts on PGF2 alpha-induced contraction in mouse mesenteric viens. *Japanese Journal of Pharmacology* 50 (2): 243-246.
- 33- Pitt, R.E. and field, R. (1990). Hazardous and toxic wastes associated with Urban a stormwater runoff. *Proceeding of the Sixteenth Annual Hazardous Waste Research Symposium* pp: 274-289.
- 34- Qian, P. S. and Liu, Z. S. (1992). Pharmacologinc studies of antimotion sickness actions of ginger. *Chung-Kno Chung*. 12 (2): 95-98.
- 35- ShanmugamMurugaiah, J.; Namasivayam, N. and Padmanabhann Menon, V. (1999). Effect of ginger (*zingiber officinal is*) on lipid in rats fed atherogenic diet. *Journal of Biochemistry and Nutrition*. 27 (2): 79-87.
- 36- Shelley, D. (2002). Ginger: Our herb of the month. *Specialist Herbal Supplies*. 2 (11): article N<sup>o</sup>2.

- 37- Silagy, C.A. and Neil Haw. (1994). A meta-analysis of the effect of garlic on blood pressure. *Journal of hypertension*. 12(4): 463-468.
- 38- Sivam, G.P.; Lampe, J.W.; unless, B.; Swanzy, S.R. and Potter, J.D. (1997). *In vitro* susceptibility to garlic (*Allium sativum*) extract. *Nutrition and Cancer*. 27:118-121.
- 39- Sovova, M.; Sova P. and Mrazova, A. (2002) Pharma- ceutical importance of *Allium sativum*: Antibacterial effect on *Helicobacter Pylori*. *Eskoslovakia and Slovenia Farmacologia* 51(4): 168-172.
- 40- Srivastava, K.C. and Mustafa, T. (1992). Ginger (*zingiber officinale*) in rheumatism and musculoskeletal disorders. *Medical Hypotheses*. 39 (4): 342-348.
- 41- Stevenson, C; Dittler, M.H. and Ernst, E. (2000).Garlic for treating hypercholestrolemia. A meta analysis of randomized clinical trials. *Annals of Internal Medicine*. 133 (6). 420-420.
- 42- Suekawa, M.; Ishige, A.; yuasa, K.; Sudo, K.; Aburada, M. and Hosoya, E. (1984). Pharmacological studies on ginger: I. Pharmacological actions of pungent constituents, (6)-gingerol and (6)-shogaol. *Journal of Pharmacobi-odynamics*. 7 (11): 836-848.
- 43- Sundaram, S.G. and Milner, J.A. (1996). Diallyl disulfede inhibits the proliferation of human tumor cells in culture. *Acta Biochemica and Biophysica*. 13 15 (1): 15-20.
- 44- Tsao, S.M. and Yin, M.C. (2001). *In-vitro* antimicrobial activity of four diallyl sulphides occurs naturally in garlic and Chinese leek oils. *Journal Medical Microbiology*. 50 (7) 646-649.
- 45- Van Dalin, C. (1999). *Ginger, garlic, green onion as medicines*. Tylor & tylor New york. London, Sydeny.
- 46- Venugopal, P.V. and venugopal, T.V. (1995). Antidermatophytic activity of garlic (*Allium sativum*) *in vitro*. *International Journal of Dermatoloe*y. 34 (4): 278-229.

- 47- Vimala, S. (1999) Anti-tumour promoter activity in Malaysian ginger rhizobia used in traditional medicine. *British Journal of Cancer*. 80 (1/2): 110-116.
- 48- Warshafsky, S; Kamer, R.S. and Sivak, S.L. (1993). Effect of garlic on total serum cholesterol. A meta-analysis. *Annals of Internal Medicine*. 119: 599-605.
- 49- Winslow, L.C. and kroll, D.J. (1998). Herbs as medicines. *Archive of Internal Medicine*. 158 (20): 2192-2195.
- 50- You, W.C; Zhang, L.; Gail, M.H and Mitchell, H.O. (1998). *Helicobacter pylori* infection, garlic intake and precancerous lesions in a Chinese population at a low risk of a gastric cancer. *International Journal of Epidemiology*. 27:941-944.

## Contents

	<b>Page No.</b>
- Contents-----	i
- Introduction-----	1
- Review of Literatures -----	2
1-Garlic ( <i>Allium Sativum</i> )-----	2
- Chemical compounds found in garlic -----	9
- Active ingredients in garlic -----	9
2- Ginger ( <i>Zingiber officinalis</i> )-----	10
- Active constituents of ginger -----	13
- Aim of the study-----	14
- Materials & Methods-----	15
- Collection of water samples -----	15
- Analyses of water -----	16
- Experimental animals -----	18
- Preparation of garlic water extract-----	18
- Preparation of ginger extract-----	20
- Results-----	20
- Analyses of water samples -----	20
- Effect of drinking of drinking of pipes and tanks water on kidneys of male and female white rats-----	25
- Effect of treatment by garlic extract on kidney of male and female of white rats-----	26
- Effect of treatment by ginger extract on kidney of male and female of white rats -----	27
- Effect of treatment by garlic extract on livers of male and female of white rats-----	28

- Discussion -----	29
- Summary -----	32
- References -----	34
- Arabic Summary -----	

**Plate (1): Control kidney (cortical and medullary region)**

- A- Cortical region: The letter (G) refers to renal glomeruli, the letter (M) refers to Malpighian corpuscle and the letters (CT) refer to a collecting tubule. X100
- B- Medullary region. X100

**Plate (2): Kidney of male rat treated with garlic extract (after 24hrs.)**

- a- Showing heavy infiltration of inflammatory cells in two bands in cortico-medullary junction area (arrows). X100
- b- Revealing eosinophilic and lymphocytic infiltration around a renal artery (head of arrows). The arrow is pointed to inflamed glomerulus (glomerulitis). X200

**Plate (3): Kidney of male rat treated with garlic extract (after three days)**

- 1- Photomicrograph showing inflamed renal corpuscles and foci (arrows) Note other corpuscles restored the normal histology. X100

**Plate (4): Kidney of male rat treated with garlic extract (after 5 days)**

- a- Photomicrograph showing that renal architecture nearly became normal except one still inflamed corpuscle. Note also a thin renal arcuate vein (rv) with very few inflammatory cell around its wall. X100
- b- Another photomicrograph for the same rat showing healed corpuscles (arrows). Head of arrows is pointed to atrophied glomerulus. X100

**Plate (5): Kidney of female rat treated with garlic extract (After 24 hours)**

- a- This section shows inflammatory reaction (arrows) around renal corpuscles. Head of arrows are pointed to thin walled renal arcuate vein. Note that inflammatory cells are spreaded all over the section. X100
- b- A photomicrograph showing two hemorrhagic areas (head of arrows). Arrows are pointed to inflammatory sites. X100

**Plate (6): Kidney of female rat treated with garlic extract (after three days)**

- a- A photomicrograph showing inflammatory cells around two renal glomeruli (head of arrows). Arrow is pointed to mildly atrophied glomerulus. The letters (rv) refer to a thin renal vein.  
X100

**Plate (7): Kidney of female rat treated with garlic (after 5 days)**

- a- Showing healed glomeruli. Note that the four corpuscles restored their normal architecture . X200
- b- A photomicrograph showing a renal corpuscle with very few number of inflammatory cells near its vascular pole. X200

**Plate (8): Kidney of male rat treated with ginger extract (after 24 hours)**

- a- A photomicrograph showing an area of acute inflammation (circle) while the head of arrows are pointed to acute inflamed glomeruli (glomerulitis). Arrow is pointed to clumped inflammatory cells. The letter (d) refers to degenerated glomerulus. X100
- b- The same kidney showing multiple inflamed areas around glomeruli (arrows) and head of arrow is pointed to hemorrhagic foci. X100

**Plate (9): Kidney of male rat treated with ginger extract (After three days)**

- a- A photomicrograph showing two necrotic foci (big arrows). Head of arrows are pointed to healed glomeruli. Note also that other three glomeruli developed atrophy (small arrows).X100

**Plate (10): Kidney of male rat treated with ginger extract (after 5 days)**

- a- A photomicrograph showing atrophied glomeruli (arrows)and the rest of glomeruli restored their normal histology. Note also that the inflammatory cells scattered among the section. X100

**Plate (11): Kidney of female rat treated with ginger extract (after 24 days)**

- a- A photomicrograph showing clusters of inflammatory cells in form of bands and around renal corpuscles (small arrows). Large arrow is pointed to hemorrhagic area and letters (ag) refers to atrophied glomerulus. X100
- b- Showing severely inflamed glomerulus (head of arrow) and aggregates of inflammatory cells (arrow). X200

**Plate (12): Kidney of female rat treated with ginger extract (after Three days)**

- a- A photomicrograph showing infiltration of inflammatory cells in form of a band and around the wall of a dilated renal vein (rv), head of arrows. Large arrow is pointed to haemorrhagic site and small arrow is pointed to atrophied glomerulus. X100

**Plate (13): Kidney of female rat treated with ginger extract (after five days)**

- a- A photomicrograph showing that renal architecture restored its normal histology. Arrows are pointed to histologically normal glomeruli and head of arrow is pointed to still inflamed glomerulus. The letters (rv) refers to a renal vein. X100

**Plate (14): control liver**

- a- The letters (cv) refers to central veins while the arrow is pointed to a blood sinusoid. X100

**Plate (15): Liver of male rat treated with garlic extract (after 24 hours)**

- a- A photomicrograph showing congested portal vein (pv). Note the infiltration of inflammatory cells around the right side of congested vein arrows. X100

**Plate (16): liver of male rat treated with garlic extract. (after three days)**

- a- Photomicrograph showing inflammation around a portal vein (arrow). Note mild inflammation around two central veins. X100

**Plate (17): Liver of male rat treated with garlic extract (after 5 days)**

- a- A photomicrograph showing mild infiltration around two portal veins (arrows). X100

**Plate (18): Liver of female rat treated with garlic extract (after 24 hours)**

- a- Showing multiple inflammatory sites spreaded among liver parenchyma (small arrows) while the large arrow is pointed to necrotic foci. X100
- b- A photomicrograph showing heavy infiltration around two portal viens (PV) . X200

**Plate (19): Liver of female rat treated with garlic extract (after three days)**

- a- A photomicrograph showing mild congested portal vien (PV). Head of arrows are pointed to inflammatory cells and arrow is pointed to a bile ductule. X200

**Plate (20): liver of female rat treated with garlic extract (after 5 day)**

- a- A photomicrograph showing mildly congested central viens (head of arrows) . Big arrow is pointed to a portal vien restored its normal condition. Small arrow is pointed to active mitosis in liver. X100

**Plate (21): liver of male rat treated with ginger extract (after 24 hrs)**

- a- A photomicrograph showing clumps of inflammatory cells around a bile ductule (cholangitis), arrow is pointed to a narrow a bile ductule. Head of arrows are pointed to infiltration around a portal vien. X 200

**Plate (22): liver of male rate treated with ginger extract (after three days)**

- a- A photomicrograph showing mild infiltration around a portal vien (arrow) while head of arrows are pointed to inflamed area. X100

**Plate (23): liver of male rat treated with ginger extract (after five days )**

- a- A photomicrograph showing mild infiltration around two portal viens, circle & arrow.
- b- Magnified section showing that the portal vien nearly restored its normal condition with some inflammatory cells. X200

**Plate (24): Liver of female rat treated with ginger extract (after 24 hrs)**

- This section shows a congested portal vien (PV). Note the aggregations of inflammatory cells a- surrounding it. X100
- b- Another photomicrograph showing inflammatory cells around two portal viens (pv). Head of arrows are pointed to aggregations of inflammatory cells. Arrow is pointed to a bile ductue with deposits of collagen fibers. X200

**Plate (25): Liver of female rat treated with ginger extract (after 3 days)**

- a- A photomicrograph showing still congested and dilated portal vien (pv) with mild infiltrate inflammatory cells. Head of arrows are pointed to three inflammatory sites. X100

**Plate (26): Liver of female rat treated with ginger extract (after 5 days)**

- a- A photomicrograph showing two portal viens (arrows) with few number of inflammatory cells. Head of arrow are pointed to two central viens. X100