Histological Effects of Excessive Consumption of *Zingeber officinale* on Liver and Spleen of the Mice

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Abstract

Ginger (*Zingeber officinale*) is a natural dietary component with antioxidant and anti-inflammation. In the present study, the influence of ginger ethanol extract on liver and spleen of mice was investigated. The animals were divided in to four groups then treated with different concentrations of ginger extract (0, 50, 75, 100 mg/ kg) for 10 days, and then the animals scarified to evaluate histological change on liver and spleen. Results showed that liver section of mice treated with (50 mg/kg) of extract exhibited no clear pathological lesion with the presence of moderate of kuppfer cell. While the sectional liver treated with (75 mg/kg) of extract showed double nuclei and proliferation of cells. Aggregation of mononuclear cells mainly macrophage and lymphocyte in liver parenchyma was observed in liver section of mice treated with (100 mg/kg) of extract. Spleen section of mice treated with (50 mg/kg) of extract showed hyperplasia of red pulp with proliferation with mononuclear cell around sinusoid form cord like structure. While, the sectional spleen treated with (75 mg/kg) of extract showed moderate hyperplasia of white pulp. Moderate peri-arterial hyper plasma and aggregate of lymphocyte and mononuclear cells in red pulp was notes in spleen section of mice treated with (100mg/kg) of extract.

Keywords: Ginger, ethanol extract, liver, spleen, mice.

Introduction

Zingiber officinale is a flowering monocotyledon plant which belonging to zingiberaceae family. This genus has 85 species and *Z.officinale* is the most important between them. This species called culinary ginger and *Z. zerumbet* or Shampoo ginger [1].

This species has fresh rhizomes and the plant grows in the fertile humid soil in hot environment[2].The plant is cultivated in different parts of the world such as South Africa, China, India and many other countries [3].

The *Zingiber* species have plenty of active constituents such as sesquiterpene hydrocarbons [5] and these compounds are zingiberene, bisapolene, zingiberol, curcurmene, singerone, garanio and others [6].

However, the phenolic compounds in *zingiber* rhizomes are present [4]. Paradol compounds, chanphene, geronial, linalool, borneol and others are present in ginger rhizomes [7]. Carbohydrates, Lipids, Wax, Minerals and Vitamins are present with proteolytic enzyme which called Zingibain [8].

The medicinal value of ginger is due to pharmacologically active compounds, such as the anti-inflammatory gingerols, that the plant produces and stores in its rhizomes [9,10]. Ginger has been demonstrated to have various pharmacological activities such as antiemetic, antiulcer, anti-inflammatory, antioxidant, anti-platelet, glucose- and lipid-lowering, cardiovascular and anti-cancer activities [11,12].

The active principle in ginger is gingerol [13]; in cloves are eugenol, which has made it the subject of numerous health studies [14], beta-caryophyllene used as an anesthetic [15] and a variety of flavonoids that includes kaempferol and rhamnetin [14,16]; zerumbone possessed an anti-inflammatory property especially in treating UC [ulcerative colitis], which is an inflammation bowel disease [17]. The inflammation was also treated in addition to respiratory problems and it could be useful for snake bites and sex stimulation as mentioned in the Arabic medicine [18].

This study is designed to evaluate the histological change in liver and spleen of mice administrated with different concentration of extracts from the dried rhizomes powder of ginger.

Materials and Methods

Plant fresh rhizomes were brought from Syria, and some of the rhizomes planted in the house garden. The grown plant was identified in Baghdad University Herbarium and stored under Ref. No. 46589 to represent the first species cultivated in Iraq. Rhizomes were dried under 37°C for 4-5 days and grounded to a powder form, then stored in a dry place under room temperature.

Preparations of plant extracts: The powdered rhizome (100 g) was extracted with 500ml of ethanol 80% instead of distilled water [19].

Experimental Design: Twenty adult mice were used for this experiment. The animals were kept under conventional condition (temperature 20-22C˚, humidity 60-70%, 12 hrs light-12 hrs dark cycles) and fed with standard rodent chow. Food and water were available at all time. These experiments were carried out in animal house belong to biology department, college of science, Baghdad University. The animals were divided into four groups. These groups were as follows:

- **First group (G1):** received diet and water *ad libitum* and served as **control**.
- **Second group (G2):** dosed oral daily with **50 mg/ml** of ginger extract.
- **Third group (G3):** dosed oral daily with **75 mg/ml** of ginger extract.
- **Fourth group (G4):** dosed oral daily with **100 mg/ml** of ginger extract.

At the end of the treatment, the animals were sacrificed after ten days and the organs (liver and spleen) were obtained and immediately fixed in formalin solution.

Histopathological examination:

Animals were killed and small piece of kidney tissue taken from experimental animals were fixed in 10% neutral formalin, alcohol-dehydrated, paraffin-embedded and then sectioned to mean thickness of 4 μm. The histological examination was evaluated by assessing the morphological changes with Hematoxylin and Eosin (H&E) stains [20].

Results and Discussion

Large number of studies have revealed that a regular consumption of herbs provide good protection against chronic disease [21]. In this study the influence of ginger ethanol extract on liver was compared with liver section of normal mice which showed normal structure appearance with vascular sinusoids and central lobular vein (Fig.(1)). While, there is no clear pathological lesion with the presence of moderate kuppfer cell was observed in mice treated with (50 mg/ml) of extract (Fig.(2)). While, the sectional of liver treated with (75 mg/kg) showed double nuclei and proliferation of cells (Fig.(3)). Aggregation mononuclear cells mainly macrophage and lymphocyte in liver parenchyma was observed in mice treated with (100 mg/ml) of extract (Fig.(4)), because Ginger extract contains chemical constituents such as gingerol, shogaol, phenolic1, 3-diketones, zingerone, have been shown to protect against lipid peroxidation, a significant scavenging effect of oxygen radicals [22], and Gingerol has been found to possess various pharmacological and physiological effects including anti chronic inflammation, analgesic, antipyretic, gastroprotective, cardiotonic, and anti-hepatotoxic activities [9, 10]. However, few are known about that whether *Z.officinale* can maintain the normal immune function of immune system [24]. Spleen section of normal mice showed normal structure appearance with showed normal red pulp and normal white pulp (Fig.(5)). The histo-pathological change of the spleen as observed under the microscope of (50 mg/ml) of extract showed hyperplasia of red pulp with proliferation of mononuclear cell around sinusoid form cord like structure (Fig.(6)). While, the sectional spleen treated with (75 mg/kg) of ginger extract showed moderate hyperplasia of white pulp (Fig.(7)). Moderate periarterial hyperplasia was observed in spleen mice treated with (100 mg/ml) of ginger extract (Fig.(8)).

The main cause of proliferation of mononuclear cell around sinusoid form cord like structure is Zerumbone. Zerumbone was more active to stimulate lymphocytes proliferation [25]. Du *et al.* (2010) find that *Z. officinale* can maintain the normal immune function of immune system because it increases the higher titer of antibody such as IgG, IgA and IgM [23].

While Al-Qattan *et al* (2008) found that the ethanol ginger-extract consumption has been shown to re-duce plasma cholesterol and inhibit LDL oxidation in atherosclerotic mice [26].

Another study that showed fatty changes surrounding portal triad in the liver of rats which were treated with spices or their essential oils recovered the membrane damage by decreasing lipid peroxidation and improving anti-oxidants [27].

Also, ginger extract influences both cell mediated immune response and non specific proliferation of lymphocyte [28].

So the high consumption of ginger effect on the histological section of liver and spleen.

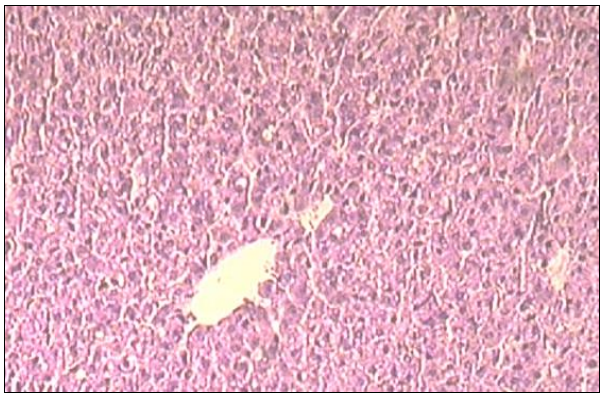

Fig.(1) Section of liver of control G1 showed normal central vein, normal hepatocytes and normal arrangement of liver plate (100X).

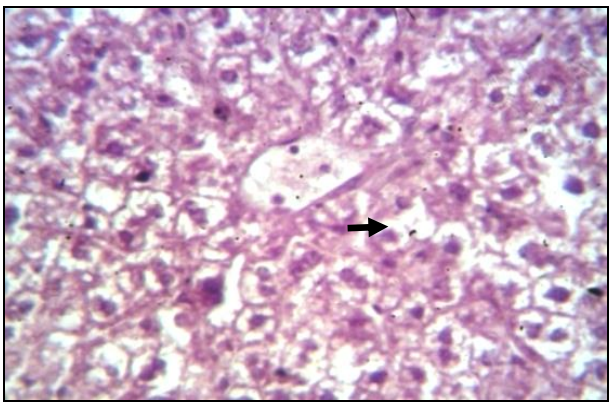

Fig.(2) Section of liver of G2 no clear pathological lesion except moderate of kuppfer cell (➞)(400X).

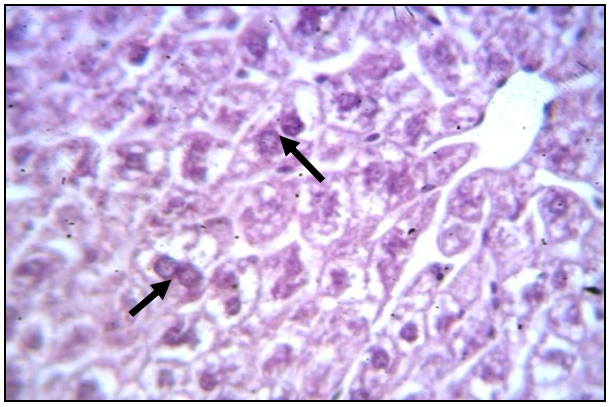

Fig.(3) Section of liver G3 showed double nuclei and proliferation of cells (➞) (400X).

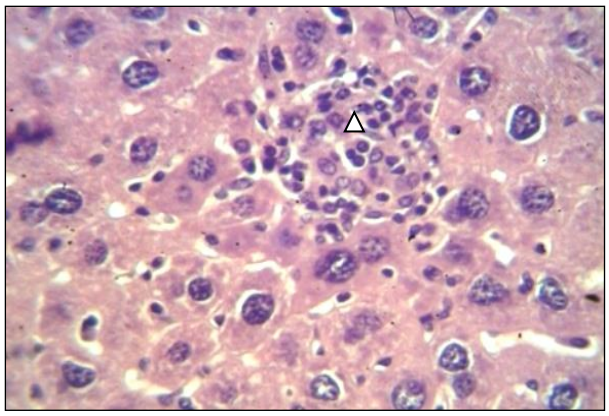

Fig.(4) Section of liver G4 showed aggregation MNCs mainly macrophage and lymphocyte in liver parenchyma (△) (400X).

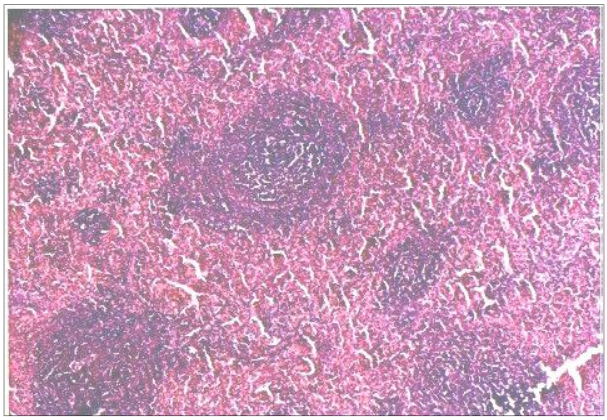

Fig.(5) Section of spleen of control G1 showed normal white pulp and normal red pulp (100X).

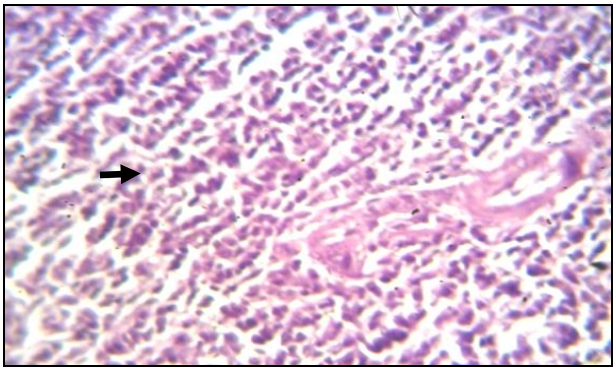

Fig.(6) Section of spleen G2 showed hyperplasia of red pulp with proliferation of mononuclear cell around sinusoid form cord like structure (➔) (400X).

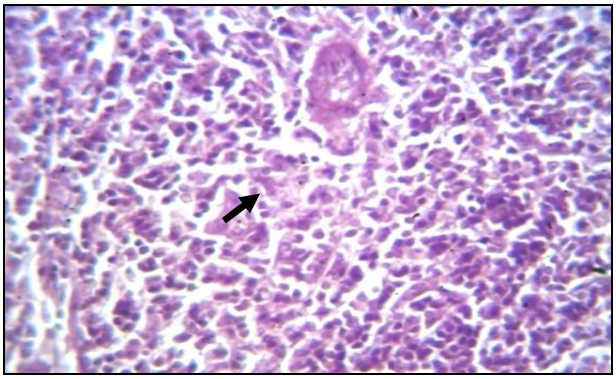

Fig.(7) Section of spleen of G3 showed moderate hyperplasia of white pulp (➔) (400X).

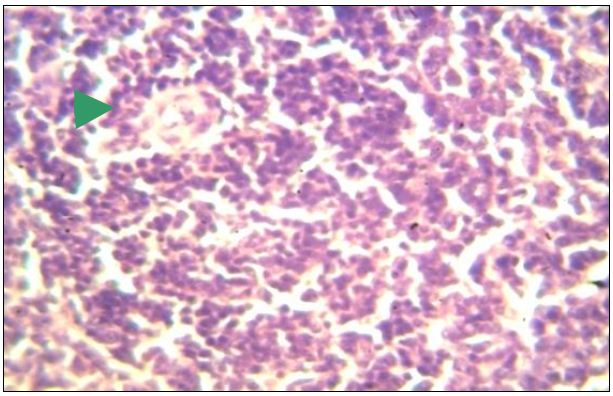

Fig.(8) Section of spleen of G4 showed moderate periarterial hyperplasia (▶) (400X).

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الخلاصة

يعد الزنجبيل مكون غذائي طبيعي مانع للتأكسد ومضاد للالتهابات . في الدراسة الحالية تم التحقق من تأثير المستخلص الكحولي لنبات الزنجبيل على كبد وطحال الفئران.قسمت حيوانات التجربة الى اربع مجاميع ثم جرعت بالزنجبيل بتراكيز مختلفة (١٠٠،٧٥،٥٠،٠ ملغم/كغم) لمدة ١٠ أيام وبعد ذلك تم تشريح الحيوانات ودراسة التغيرات النسيجية في الكبد والطحال.أظهرت نتائج المقاطع النسجية للكبد في الحيوانات المعاملة بالتركيز (٥٠ملغم/كغم) من المستخلص تغيرات طبيعية واعتدال في خلايا الكبد وخلايا kappfer بينما أظهرت نتائج المقاطع

النسجية للكبد في الحيوانات المعاملة بالتركيز (٧٥ملغم/كغم) من المستخلص مضاعفة النوى وأنتشار الخلايا.كما لوحظ تجمع الخلايا الاحادية النواة وبشكل أساسي الخلايا البلعمية والخلايا اللمفاوية في النسيج الحشوي للكبد في الحيوانات المعاملة بالتركيز (١٠٠ملغم/كغم) من المستخلص. بينما أظهرت نتائج المقاطع النسجية للطحال في الحيوانات المعاملة بالتركيز (٥٠ملغم/كغم) من المستخلص تضخم كمي في اللب الاحمر وأنتشار الخلايا الاحادية النواة بشكل حبال مرتبطة مع بعضها. بينما لوحظ في المجموعة المعاملة بالتركيز (٧٥ملغم/كغم) من المستخلص تضخم كمي في اللب الابيض. كما لوحظ زيادة الخلايا الاحادية النواةفي اللب الاحمر وحول الشريان المركزي تمثلت وبشكل أساسي الخلايا البلازمية والخلايا اللمفاوية في نسيج الطحال في الحيوانات المعاملة بالتركيز (١٠٠ملغم/كغم) من المستخلص.