

# Histological study of the Stomach and Small Intestine(duodenum) walls after giving watery Fenugreek seeds extract of adult white Mice

Dr. Bassim Abdullah Jassim College of Science / Muthana university

#### **Summary:**

The present study was designated to evaluate the histological effect of different doses of watery fenugreek seeds extract of the tissues layers of the wall of the stomach and small intestine (duodenum) after administration of watery fenugreek seeds extract in white mice. This study was carried out on 40 healthy adult mice aging (6-8 months). The experimental animals was divided into three treated groups (A, B, C) and one control group, (N=10). Preparation the watery fenugreek seeds extract for three doses (150 mg/g, 200 mg/g, 250 mg/g). the duration of administration was 30 days, the histological results of the group A, that administrated 150mg/g of fenugreek extract show slightly changes on the level of mucosal layer of the stomach and small intestine (duodenum), this changes were slightly increased in thickness as compare with the control group. The B treated group that administrated 200 mg/g of fenugreek extract showed aggregation of epithelial cells as broad band in active period and increased in the thickness of the mucosa. The lamina properia was more prominent and show more proliferation of the cellular structures of intestinal gland (stem, chief, and parietal cells). The secretary unit of the intestinal gland have narrow lumen filled with secretion. The group C that treated with 250mg/g characterized by prominent changes more than the previous stages but have more effect reached to the abnormal changes similar to the inflammatory effect.

### Introduction:

The simple stomach of human and domestic animals is a sac-like enlargement of the alimentary canal [1, 2]. The stomach is a muscular chamber in monogastric animals, or a series of chambers that serves as caving site for ingested food [3].

There are three distinctly different histological regions named according to the various glandular types present: cardiac glands region, fundus glands region and pyloric glands region [4, 5, 6].

The epithelial cells of the mucosa that coated the internal surface stomach are simple columnar epithelium that called surface epithelium cells or surface lining cells that extend into the gastric pits where the gastric glands are opened [7, 8].

The small intestines of mammals consist of (duodenum, jejunum, and ileum). The epithelium of small intestine is simple columnar with a striated border. Goblet cells occur among the columnar cells. The former increase in number from anterior to posterior with the greatest number occurring in the small intestine. Villi are confined to the small intestine in mammals [6, 9].

At the bases of the villi are invaginations of the epithelium, the crypts of Lieberkiihn (intestinal glands). Replacement of the mucosal epirhelium occurs by cell division primarily within the crypts. A muscularis mucosae, consisting of two layers of smooth muscle, separates the crypts from the underlying submucosa. [10]. The remainder of the wall of the intestine is comprised of a muscularis externa of smooth muscle and a serosa. [11. 2].



The Fenugreek is one important medicinal plants. An old practice of used the seeds, green leaves in food and medicinal application. It provides natural food fibre and other nutrients required in human body [12].

The fenugreek plant have very important signs, light green colored yellow-brown slender shaped pods having 10-20 seeds. In this plant flowering starts after 30-40 days of sawing[13]. The seeds, which mature in long pods, are used to preparation of the water extracts or powders for medicinal therapy. The active components which are soluble fiber, saponins, trigonelle, diosgenin and 4-hydroxyisoleucine and vitamins, flavonoids, terpenoids, carotenoids, cumarins, curcumins, lignin, saponin plant, sterolandetc [14]. gum, alkaloid, and volatile content.

Fenugreek seeds extract used for its antioxidant and treatment the following signs which include vomiting, fever, poor appetite, and diabetes. Fenugreek watery extract don't have any implicated in causing liver injury [15].

The fenugreek seeds extract was used as a tonic and stimulant to lactation and treatment of baldness. Constituents of fenugreek extracts include some of important components which include steroid saponins, dietary fibers, mucilages, and volatile oils. The Side effects of fenugreek extract include gastrointestinal upset, diarrhea. The fenugreek has not been implicated in cases of clinically apparent in gastrointestinal tract injury. The fenugreek extract has not effect on the levels of serum enzyme [16].

The fenugreek extract play important role in the liver protection of the against alcoholinduced damage. fenugreek seed extract effects of on collagen and liver lipids in liver-damaged rats, and the People who are chronic alcoholics have fatty livers as well as fibrosis that is characterized by collagen accumulation [17].

The fenugreek seeds extract(Trigonella foenum graecum) have effect of treated some of pathological cases such as the gastric ulcer in addition that the aqueous extract and a gel fraction isolated from the seeds showed significant ulcer protective effects. The fenugreek extract decrease the lipid peroxidation induced by ethanol presumably by improve antioxidant potential of the gastric mucosa and mucosal injury and accelerated of increase the thickness of mucosa. Histological examination showed that the fenugreek seeds extract have more action in preventing lesion formation and supported the epithelial layer. fenugreek seeds extract possess antiulcer therapy, [18].

The fenugreek seed has been immunological responses shown to affect the intestinal microbiota in animals. The pH in the cecum and colon were reduced. Higher concentrations of l-lactic acid were recorded in the small-intestinal digesta. The addition of fenugreek increased the relative concentration of the T-cell in the blood. Proliferation rate and phagocytosis activity of monocytes were not affected by the additive, [14,8].

Aim of study:

Observation the histological changes in the wall structures of the stomach and small intestine after administration of watery fenugreek seeds extract.

### Materials and methods:

The experimental animals was divided into three groups (A, B, C) and one control group. (N=10).

Preparation the watery fenugreek seeds extract for three doses of (150 mg/g, 200 mg/g, 250 mg/g). the mechanism of extract administration according the following for 30 days.

Trigonella seeds, purchased from the local market, Mode (50) grams of plant powder used in a glass flask with a capacity of 1000 ml airtight lid and container to 500 ml of cold water



distilled, and shake the mixture using a motor stirrer device for 24 hours at room temperature and then the separation of the filtrate using a centrifuge Centrifuge quickly 3000 | rpm [25] put the filtrate in glass bottles and dried in an electric oven degree (40 m) for drying the extract and the survival of the solid material to prepare the concentrations required to test the impact [26].

Concentration prepare (stock).

Dissolve 500mg active ingredient in 50 ml DW

Mean = 500 mg /50 ml(DW) = 500,000 $\mu$ g /50 ml DW = 10,000 $\mu$ g /ml

Mean each 0,1 ml of stock solution equal to 1000  $\mu g$  active ingredient

1-Group (A) received 150 mg/g of fenugreek.

2-Group (B) received 200 mg/g. of fenugreek

3-Group (C) received 250 mg/g. of fenugreek.

Treatment was carried out for 30 day of experiment time, samples were collected to examination the histological changes in the wall of the stomach and duodenum.

within 20 minutes after scarified, the stomach and small intestine(duodenum), were examined to observe its location and isolated from internal viscera after the bleeding of the experimental animal. The tissue samples were washed with tap water and injected with 10 % formalin solution ,for 48 hours.

After fixation by formalin 10 %, a pieces of 8  $\mu$ m were dissected.

Dehydration of specimen was done to remove of all extractable water by dehydrate diffusing through the tissue .Alcohol is the most commonly used. The dehydration process continues by upgrading the alcohol from 50 % to absolute alcohol (50%, 60%, 70%, 80%, 90%(1), 90%(2), 100%(1), 100%(2), [20].

Clearing was done by xylen. The impregnation is the complete removal of clearing reagent by substitution as paraffin penetrates the tissue with use of no less melting point 56-58 C  $^{\circ}$  the temperature of the paraffin baths .

Embedding in paraffin of the tissue are method paraffin when solidified provides a firm medium for keeping .Section at 5-7 um have been done by using rotary microtome .Then the section was stained .

The sections were stained with the following stains :

1- Alum hematoxylin & eosin (H&E).

2- Periodic acid Schiff (PAS), [20].

# **Results:**

# **Control group:**

The histological study of the stomach wall structures in the white mice appear composed of four histological layers which includes (mucosa, submucosa, muscularis, and serosa).

# First layer:

The first layer of the wall of stomach from the internal surface called mucosal layer which composed of epithelial layer from simple columner epithelia and lamina properia that consist of loose connective tissue. The histological results showed some of simple tubular and coiled gastric gland this gland which composed of some of cells included (stem, mucous neck, parietal, and chief cells), the lamina properia that separated between the mucosa and submucosal layers. **Second layer:** 

The second histological layer of the wall of the stomach called submucosal layer which composed of dens connective tissue contain by lymphatic and blood vessels.



## Third layer :

The third histological layer which composed of smooth cells layer arranged in the wall of the stomach in deferent orientation which called tunica muscularis.

## Fourth layer:

The outer layer of the stomach wall is called serosa which consist of the loose connective tissue and which covered by a simple layer of spuamous epithelia (mesothelium )

### Small intestine (duodenum):

The histological result of the wall of the duodenum in the white mice composed of four histological layer.

# First layer:

The internal surface of the lumen of duodenum called mucosa which consist of some of sublayers which including the epithelial layer from simple columenr epithelia with brush border and delicate layer of smooth muscle cells called muscularis of mucosa this layers which rest on the layer of loose connective tissue called lamina properia. The lamina properia which include some of intestinal gland called gland of lieberkuhn. The glands of lieberkuhn which have some of essential cells (stem, absorptive, goblet, paneth, and entroendocrin cells.

### Second layer:

The second layer of duodenum wall which composed of the dense connective tissue called submucosal layer, there are some of intestinal gland in the tunica submucosa called brunners glands.

## Third layer:

The histological study showed the third layer of the duodenum wall which consist of smooth muscle arranged in their layers inner circularand outer longitudinal which responsible of the movement the small intestine.

### Fourth layer:

The results of the study appear that outer layer of the duodenum wall which composed of the loose connective tissue and cover by the thin layer of the mesothelium.

# **Treated groups:**

There are three treated groups(A, B, and C) each group was administration with deferent concentration of the watery fenugreek seeds extract (150mg/g, 200mg/g, 250mg/g) for thirty days of the experimental study.

# Group (A):

The histological results of the treated group (A) showed some the histological changes in the four layers of the stomach and intestine wall (mucosa, submucosa, muscularis, and serosa ) layers which administration with 150mg/g of watery fenugreek seeds extract .

# 1-Stomach:

### Mucosal layer:

The mucosal layer of the stomach in the white mice showed slightly increase in the thickness more than the control group. The epithelia of the stomach was simple columnar epithelia rest on the basal lamina. Proliferation of the epithelial cells belong epithelial layer of the internal surface of the stomach. The gastric gland in the cardiac region were more prominent than the control group with clusters of parietal cells in deferent location of the gastric gland. The lamina properia was clear and separated between the mucosa and underlying histological layer.



### Submucosal layer:

The second layer of the histological layers of the gastric wall which composed of the dense connective tissue. The submucosal layer appear promenint than the control group grossly and more prominent. The submucosa have extensive infiltration of adipose tissue.

#### Muscular layer:

The tunica muscularis which appear normally histological structures composed of layers of the smooth muscle cells without any histological changes.

#### Serosal layer:

The outer serosal layer the out limit of the wall of the stomach in mice which consist of loose connective tissue with some of collagen and reticular fibers in addition covered by the very thin layer of mesothelium.

### 2- Small Intestine (Duodenum):

#### **Mucosal layer:**

The epithelial columnar cells of the mucosa in the duodenum characterized by slightly proliferation and as a cluster in deferent position of the epithelial layer. The lamina properia clear in demarcation that separated mucosa from the underlying tissue. The intestinal gland were normally in histological structures.

## Submucosa, muscular, and serosal layer:

The histological component of the submucosal and muscular and serosal layers were normally structures without any histological changes finding that similar to the histological structures of the same layer in the control groups.

#### Group (B):

The histological results of the treated group B show some the histological changes in the four layers of the stomach and intestine wall (mucosa, submucosa, muscularis, and serosa) layers which administration with 200mg/g of watery fenugreek seeds extract.

#### 1-Stomach:

#### Mucosal layer:

The mucosal layer in the group (B) show thicker than the mucosal layer in the previous group (A) and control groups. The proliferation of the epithelial cells and aggregation as broad band and elevated in the level of the columnar cells belong the mucosa. The lamina properia became more prominent and show more proliferation of the intestinal gland cells(stem, chief, and parietal cells), with deferent figures of mitotic divisions. The secretary unit of the intestinal gland have narrow lumen filled with secretion. The lamina properia was normally.

#### Submucosal layer:

The submucaosal layer chractrized by present of hemorrhage spots in deferent location of this layer with dispersed dense connective tissue. Aggregation of fibrocytes cells in varies site of the sub mucosal layer with condensation in the fibers component in this layer.

### Muscular layer:

The tunica muscularis composed of smoothe muscle cells layers appear more prominent and increase in thickness and more proliferation in the smooth muscle cells than the previous groups of the experimental study.

#### Serosal layer:

The serosal layer appear normally in histological structures without any changes found in this layer. Tunica serosa was similar to the previous groups histologically.



### Small intestine (duodenum):

#### Mucosa:

The mucosal layer of the duodenum appear more proliferation of the columnar epithelial cells. The cytoplasm of the epithelial cells have some of vacculation. The epithelial cells show in deferent shape of mitotic division. Clear lamina properia separated between the mucosa and underlying connective tissue. The intestinal glands (gland of lieberkhun) characterized by prominent lumen with more proliferation of the intestinal glands cells more than the previous groups and most this cells have spherical nucleus in shape.

#### Submucosa:

The histological structures of the submucosal layer of the stomach characterized by hemorrhage in some location of submucosal layer with increase in the thickness and amount of the connective tissue. The secreatory Brunners glands unit appear more prominent with cells have spherical nuclei. The peyers patches were normally in shape without any histological changes.

### Muscular and serosal layers:

Both muscular and serosal layers of the duodenum wall have normally histological component without any histological changes which are similar to the previous stages (G1, and control) groups of the experimental study.

### Group (C):

The histological results of the treated group C show some the histological changes in the four layers of the stomach and intestine wall (mucosa, submucosa, muscularis, and serosa ) layers which administration with 200 mg/g of watery fenugreek seeds extract.

### 1-Stomach:

### Mucosa:

The epithelial layer of the mucosa became more condensation than the previous G1, G2 and control groups. The cytoplasme of the epithelial cells have large vacculations. High proliferation of the epithelial cells belong the epithelial level of the mucosa. The gastric glands have wide lumen and filled with secretion more than the previous experimental groups. The proliferation of the cheif and pareital cells gastric gland more than the previous groups and have prominent oval nuclei. There are deferent figures of mitotic divisions showed in deferent location on the level of the epithelial and gastric gland cells this changes occur under the influence of the watery fenugreek seeds extract on the cellular structures of the mucosa. The basal lamina don't clear between the mucosa and underlying connective tissue.

### Submucosa:

The histological designed of the submucosal layer of the duodenum wall showed interactions with upper mucosal layer. The submucosal layer have many congestion of the blood streams. proliferation of the fibrocytes cells and prominent connective tissue fibers that embedding in the stroma of the submucosal layer.

### **Muscular:**

The tunica muscularis appeared more thickness as band structures more than the previous groups. The smooth muscle cells have dark nuclei with several figures of mitotic divisions. **Serosa:** 

The outer serosal layer became thicker than other previous treated and control groups with proliferation of the cellular components. The outer layer coated by prominent mesothelial layer.



# 2- small intestine (duodenum):

### Mucosa:

the epithelial cells of the mucosal layer of the duodenum showed cellular degeneration and high vacculation in the cytoplasm of the epithelial cells. The cells of the intestinal glands (goblet, paneth, absorptive and entroendocrine) cells don't clear in the histological section in the basal level of the mucosal layer. The lamina properia disappear between the mucosa and underlying connective tissue submucosal layer and showed some of inflammatory cells aggregation in the mucosal layer. The lumen of the intestinal gland have wider than the previous treated and control groups with some of apoptosis cells as a cluster in the lumen of intestinal glands.

### Submucosa:

The histological structures of the submucosal layer of duodenum have agraggation of fibrocytes and inflammatory cells. Blood congestion occur in some location of the submucosal layer with fibers degeneration.

#### **Muscular:**

The tissue features of the muscle layer appear more thicker than other previous groups with prominent oval nuclei. There are some of areas of hemorrhage in little positions of the tunica muscularis.

#### serosa:

the tunica serosa showed dispersed of loose connective tissue and blood congestion in several locations of the tunica serosa. The outer coated of mesothelia unclear and show destruction in the outer limit of the serosal layer.

#### Discussion:

### **Control group:**

The histological results of the wall in the stomach and intestine showed composed of four histological layers this results were agreement with (junqueira, 1995) that referred to the tissues structures of the stomach and intestine were consist of four layers which are (mucosa, submucosa, muscularis, and serosa). This result similar to [1,2].

The present study appear that the mucosal layer composed of the epithelial layer which rest on the basal lamina, the basal lamina consist of the loose connective tissue that separated between the mucosa and submucosa this result was similar to the finding of delman and brown which Saied that the mucosal layer consist of epithelial layer and basal lamina composed of loose connective tissue. Theses findings were confirm with [3,4]

The study showed the histological structures of the tunica muscularis consist of smooth muscle cells and tunica serosa was composed of the loose connective tissue and cover by the thin layer of the mesothelium. This finding was coincide with[6,7,8]

### **Treated groups:**

### Group A:

The present study showed the histological structures of the stomach and intestine find some of histological changes at the level of mucosa, and little changes in the submucosa which included increased in the thickness of this layer with slightly proliferation in the epithelial cells of the columnar epithelial cells this discretion that in agreement with the finding of the [18] who reported that the Proliferation rate and phagocytosis activity of monocytes were not affected by



the additive. The fenugreek seeds have effects on the intestinal microbiota and immunological variables.

#### Group B:

The current study appear the tissues components of the stomach and small intestine (duodenum) have more histological changes than the previous control and A groups in the histological layers of the wall. The mucosal layer appeared more thicker than the previous group and the epithelial cells aggregation in varies site of the epithelia and showed deferent figures of mitotic divisions in the gastric and intestinal glands cells. This finding was agreement with [16] that clamed The fenugreek seeds extract was used as a tonic and stimulant to lactation and treatment of baldness. Constituents of fenugreek extracts include some of important components which include steroid saponins, dietary fibers, mucilages, and volatile oils. The Side effects of fenugreek extract include gastrointestinal upset, diarrhea. The fenugreek has not been implicated in cases of clinically apparent in gastrointestinal tract injury. The fenugreek extract has not effect on the levels of serum enzyme.

The tissue structures of the muscularis and serosal layers. The muscular layer appear more prominent and increase in thickness and more proliferation in the smooth muscle cells than the previous groups of the experimental study. This results were agreement with [16].

while the tunica serosa was normally structures without any histological changes finding. This results were agreement with the coincide the [18, 21] were reported that the Proliferation rate and phagocytosis activity of monocytes were not affected by the additive. The fenugreek seeds have effects on the intestinal microbiota and immunological variables.

#### Group C:

The histological structures of the stomach and duodenum wall structures showed that the tunica mucosa was more condensation than the previous groups. The cytoplasme of the epithelial cells have large vacculations. Significant proliferation of the epithelial cells belong the epithelial level of the mucosa. The proliferation significantly increased of cheif and pareital cells gastric gland more than the previous groups. The basal lamina don't clear between the mucosa and underlying connective tissue. this histological finding was Similar observations [17,22] were demonstrated that the fenugreek seeds extract(Trigonella foenum graecum) have effect of treated some of pathological cases such as the gastric ulcer in addition that the aqueous extract and a gel fraction isolated from the seeds showed significant ulcer protective effects. The fenugreek extract decrease the lipid peroxidation induced by ethanol presumably by improve antioxidant potential of the gastric mucosa and mucosal injury and accelerated of increase the thickness of mucosa. Histological examination showed that the fenugreek seeds extract have more action in preventing lesion formation and supported the epithelial layer.

The histological changes in the other layers which included the submucosa, muscularis and serosa were due to the high concentration dosage of the watery fenugreek seeds extract which lead to some of significant pathological signs which characterized by aggregation of fibrocytes and inflammatory cells. Blood congestion occur in some location of the submucosal layer with fibers degeneration in submucosa, significantly increased in thickness and hemorrhage in tunica muscularis and blood congestion in several locations and histological destruction in the outer limit of the serosal layer. These results that confirmed with observation of the [23,24].





Fig.(1)- show the histological structures of the stomach of the control group of white mice A-epithelia. B-basal lamina. C-submucosa. D-muscularis.E-serosa. F-gastric glands. H&E stain.(x40)



Fig.(2)- the histological compositions of duodenum wall in control group longitudinal section, A-mucosa. B- submucosa. C-muscularis.D-serosa.E-intestinal glands F- duodenum lumen. H&E stain (x40)





Fig.(3)- show the histological structures of the stomach of A group in white mice. A-epithelia. B-basal lamina. C-submucosa. D-muscular layer. E-serosa. F- gastric glandular cells H&E stain (x40).



Fig.(4)- the histological compositions of the small intestine in A group longitudinal section. A-proliferation epithelial cells. B- submucosa. C- muscular layer. D- serosa E- intestinal gland cells . H&E stain (x40)





Fig.(5)- show the histological structures of the stomach in the B group in white mice . A-epithelial proliferation cells. B- submucosa. C-muscular layer. D-serosa. E-proliferation of gastric glandular cells H&E stain (x40)



Fig.(6)- the histological compositions of the small intestine in B group longitudinal section. A-Elongation of epithelial cells. B- prominent basal lamina. C- thicker submucosa. D- secretory unit of intestinal glan E-proliferation of intestinal gland cells.F- intestinal lumen H&E stain (x40)





Fig.(7)- show the histological structures of the stomach in the C group in white mice . A-destruction epithelial cells. B- submucosa. C-muscular layer. D-serosa. E-proliferation of the cells in the secretory unit and wide lumen filled with secretion. F- vacuolation in the cellular component in the mucosal layer. H&E stain (x40).



Fig.(8)- the histological compositions of the small intestine in C group longitudinal section. Adestruction epithelial cells. B- vacuolation in the large number of cells in mucosa. C- thicker aggregation of inflammatory cells near the basal line of mucosa. D- blood congestion. E-

# Al-Kufa University Journal for Biology / VOL.8/ NO.2/ Year: 2016 Print ISSN: 2073-8854 & Online ISSN: 2311-6544



dispersed of connective tissue fibers in submucosal layer.F- intestinal lumen. G- exfoliated epithelial cells degeneration. H&E stain (x40)



Fig.(9)- the cross section of the secretory unit of the gastric gland in the cardiac region in control group A- lumen of secretory unit of gastric gland. B- cells of the wall of secretory unit C- the wall of secretory unit. D- proliferation cells in the gastric mucosa. (40x staining with H&E stain).





Fig.(10)- the cross section of the secretory unit of the gastric gland in the cardiac region in (A) group A-increased the lumen wide of secretory unit of gastric gland filled with secretion. B-proliferation cells of the wall of secretory unit C- decreased the wall thickness of secretory unit. D- proliferation cells in the gastric mucosa. E-( 40x staining with H&E stain).



Fig.(11)- the cross section of the secretory unit of the gastric gland in the cardiac region in B group A- the lumen of the secretory unit. B- mitotic divisions in the cells of the secretory wall. C-decreased the wall thickness of the secretory wall (40x staining with H&E stain).





Fig.(12)- the cross section of the secretory unit of the gastric gland in the cardiac region in C group. A- the wide lumen of the secretory unit of gastric gland. B- prominent cells in the wall of secretory unit. C- thin wall of secretory unit. D- exfoliated cells in the lumen of secretory unit of the gastric glands. (40x staining with H&E stain).

References:

- 1- Schummer, A., Nickel, R. and Sack, W. O. (1979). The viscera of the domestic mammals. 2<sup>nd</sup> edn, New York, Pp. 147-168.
- **2-** Gartner, L. P. and Hiatt, J. L. (2000). Color atlas of histology. 3<sup>rd</sup> ed. Awolters Kluwer Company. Philadelphia.
- **3-** Kent, G. C. and Miller, L. (1997). Comparative Anatomy of the Vertebrates. Wm. C. Brown Publishers. Gannon University. 8<sup>th</sup> edn, P. 277-281.
- **4-** Wheater, P. R., Burkitt, H. G. and Daniels, V. G. (1987). Functional history. 2<sup>nd</sup> ed. Churchill livingstone. pp. 208-214.
- 5- Leeson, C. R., Leeson, T. S. and Parparo, A. A. (1988). Text Atlas of Histology. Saunders Company. Philadelphia. pp 221-234.
- 6- Ownby, C. L. (2002). Histology of parts index. Digestive system-1. htm.
- 7- Davis, B. O., Holtz, N. and Davis, J. C. (1985). Conceptual human physiology Bell and Howell Company. Pp. 462-465. davies). 140-153.
- 8- Karam, S. M. and Leblond, C. P. (1992). Identifying and counting epithelial cell types in the corpus of the mouse stomach. Anat. Rec. 232(2): 231-46.
- **9-** Ross, M. H.; Romrell, L. J. and Kaye, G. I.(1995). Histology. 3<sup>rd</sup> ed Williams and wilkins syndney. Tokyo PP: 609-621.
- **10-** Dellmann, H. (1993). Textbook of veterinary histology. 4<sup>th</sup> edn, Philadelphia. States of America. P. 167-171.

## Al-Kufa University Journal for Biology / VOL.8/ NO.2/ Year: 2016 Print ISSN: 2073-8854 & Online ISSN: 2311-6544



- **11**-Smith, D. M., Grasty, R. C., Theodosiou, N. A., Tabin, C. J. and Nasconer-Yoder, N. M. (2000). Evolutionary relationships between the amphibian, Ovian and mammalian stomachs. Evolution and Develop- ment . 2. (6):348-359.
- 12-Thompson Coon JS, Ernst E. (2003): Herbs for serum cholesterol reduction: a systematic view. J Fam Pract; 52, pp: 468-78.
- 13-Anitha Devi, N. Kamalakkannan and P. Stanely Mainzen P. (2002): Supplementation of fenugreek seeds to the rats. Effect on carbohydrate metabolic enzymes in digestive system and kidney. J. Ethnopharm. 80, vol.(3), pp:393-7.
- 14-Hasani-Ranjbar S, Nayebi N, Moradi L, Mehri A, Larijani B, Abdollahi M. (2010): The efficacy and safety of herbal medicines used in the treatment of hyperlipidemia; a systematic review. Curr Pharm Des;16, pp: 2935-47.
- **15-**Zimmerman HJ,(1999): the adverse effects of drugs and other chemicals on the liver. 2nd ed. Philadelphia: Lippincott, pp: 731-4.
- 16-Seeff L, Stickel F, Navarro VJ.(2013): Drug-induced liver disease. 3rd ed. Amsterdam: Elsevier, pp: 631-58
- **16**-Sushma N, Devasena T.(2010): Aqueous extract of Trigonella foenum graecum(fenugreek) prevents cypermethrin-induced hepatotoxicity and nephrotoxicity. Hum Exp Toxicol 29, pp: 311-9.
- 17-Nathan J, Panjwani S, Mohan V, Joshi V, Thakurdesai PA. (2014): Efficacy and safety of standardized extract of Trigonella foenum-graecum L seeds as an adjuvant to L-Dopa in the management of patients with Parkinson's disease. Phytother Res; 28, pp:172-8.
- **18**-Srinivasan K (2006) Fenugreek (Trigonellafoenum-graecum): A Review of Health Beneficial Physiological Effects. Food Reviews International 22: 203-224.
- **19**-Luna, I. G. (1968). Manual of histology staining methods of the armed force institute of pathology. 3<sup>rd</sup> ed. McGraw-Hill book Company. New York.
- **20**-Junqueira, L.C., Carneiro, J. and Kelley, R. (1995). Basic histology. 9<sup>th</sup> ed. Appleton and Lange. Stamford, Connecticut. U.S.A. Pp. 283-300.
- **21**-Thirunavukkarasu V, Anuradha CV, Viswanathan P. (2003): Protective effect of fenugreek (Trigonella foenum graecum) seeds in experimental ethanol toxicity. Phytother Res; 17, pp:737-43.
- 22-Ulbricht C, Basch E, Burke D, Cheung L, Ernst E, Giese N, Foppa I, et al.(2007): Fenugreek (Trigonella foenum-graecum L. Leguminosae): an evidence-based systematic review by the natural standard research collaboration. J Herb Pharmacother; 7, pp:143-77.
- 23- <u>Gärtner S, Tedin L, Männer K, Mader A, Vahjen W</u>.(2013): Fenugreek seed affects intestinal microbiota and immunological variables in piglets after weaning. <u>Br J Nutr.</u> 14;109(5):859-66
- 24-Basch E, Ulbricht C, Kuo G, Szapary P, Smith M. (2003): Therapeutic applications of fenugreek. Altern Med Rev; 8, pp:20-7.

25- الخزعلي، زياد متعب فجة سلطان (2001). در اسة تأثير مستخلص نبات الداتور ه Datura fastuosal في بعض أنسجة الجسم في الجرذان رسالة ماجستير ، كلية التربية ، جامعة القادسية .

26- الموسوي ، أحمد محمد ( 2000) . تأثير مستخلصات نبات الشيح Artemisia herba-alba في الدودة الشريطية القزمة Hymenolepis nana في الفأر الأبيض . رسلة ماجستير ، كليو العلوم ، جامعة بابل