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Evaluation of the Anti-ulcerogenic and Anti-oxidative Activity of Chitosan in Rats with Ethanol-Induced Gastric Ulcer

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Abstract:
Chitosan is a polysaccharide of natural origin. It has been applied in many fields, such as food and medicine, and it has antioxidant properties, so the present study was carried out to evaluate the anti-ulcerogenic and anti-oxidative activity of chitosan in rats. Thirty adult male albino rats weighing (170g ±5 g) were randomly divided into five groups (6 rats each); the first and second groups were fed a standard diet. The third, fourth, and fifth groups were fed a diet containing 2.5, 5, and 7.5% chitosan powder, respectively. At the end of the experimental period (30 days), the rats were deprived of food for 24 h with free access to water. The second, third, fourth, and fifth groups were given a single oral dose of ethyl alcohol at 10 ml/kg body weight to induce gastric ulceration. In contrast, the negative control group received a single oral dose of saline (0.9%, w/v). After 2 hours of administration of ethyl alcohol, stomachs were ligated around cardiac and pyloric, and gastric juice was collected. Results revealed that rats pretreated with chitosan led to a decrease in ulcer score from 11 to 5, an ulcer index of 1100 to 500, an ulceration% from 86 to 17.2, and an increase in the preventive index from 14 to 82.8, and activity of antiperoxidative enzymes compared with positive control rats. Rats supplemented with 7.5% chitosan have the most potent gastric cytoprotective and ulcer healing-promoting. In conclusion, administering chitosan as a protective agent prevents stomach ulcers in rats.

Keywords*: Ulcer score, Shrimp shells, Flavonoids, Total acid output, Preventive index, bread*

Introduction

Peptic ulcer is a digestive tract disease which characterized by a mucosal rupture with deepness greater than 3-5 mm in the stomach or duodenum (1) and (2). Gastric ulcer is a rife type of peptic ulcer that can turn into a dangerous chronic disease of the upper digestive tract (3).

Worldwide, the prevalence rate of peptic ulcer is about 80% in the developing countries and 40% in developed countries (4). Gastric ulcer is a chronic disease induced by an imbalance among offensive factors (gastric hydrochloric acid, pepsin, Helicobacter pylori, non-steroidal

anti-inflammatory drugs, excessive intake of alcohol, reactive free radicals and oxidants) and defensive mechanisms (mucus, prostaglandin, barrier, bicarbonate, mucosal blood flow and others) in the gastric mucosa (5) and (6). Gastric ulcer is characterized by necrosis, reduced blood flow, infiltration of neutrophils, inflammation and oxidative stress (7). The most common symptoms of peptic ulcer are waking at night with upper abdominal pain that increases with eating as well as belching, vomiting, heartburn, nocturnal pain, nausea, postprandial pain, weight loss due to decreased appetite (8) and (9). Several antiulcer drugs were used to prevent and treat gastric ulcers, these drugs have many side effects such as diarrhea, constipation, dizziness, fatigue, drowsiness skin rash, stomach pain, muscle aches and headache were happened However, the prolonged use of these drugs may be caused hepatotoxicity and enteric infections (10).

Shrimp is one of the important fisheries products worldwide (11) .Shrimp industries generate large amounts of shrimp bio-waste during processing, approximately 45-55% of the weight of raw shrimp (12). However, this bio-waste can be used. This has led to considerable scientific and technological interest in chitin and chitosan as an attempt to use these renewable wastes to produce value-added products such as chitosan (13). Chitosan, the de-acetylation product of chitin, is a polysaccharide of natural origin. Because of their diverse bioactivities, biocompatibility, non-toxicity, low-allergenicity and its excellent biodegradability, it has been widely, applied in many fields, such as food, medicine, cosmetics and agriculture (14). Chitosan is effective in preventing gastric ulcer and that the overall anti-ulcerogenic effects of chitosan is probably related to their antioxidant property, or to a neutralization of gastric juice by the gradual release of glucosamine or to their ability to maintain near to normal status the activity of free-radical enzymes and the level of GSH, which protects mucosa against oxidative damage by decreasing lipid peroxidation and strengthening the mucosal barrier (15). Therefore, this study aimed to evaluate the anti-ulcerogenic effects of chitosan extracted from shrimp shells in stomach ulcer rats.

Materials and methods

2-Materials and Methods

2.1. Materials

Shrimp shells were obtained from Amir Al Bahar fish restaurant at Shibin El-Kom, Menoufia, Egypt. Kits were purchased from Alkan Medical Company, St. El Doky, Cairo, Egypt. Ethyl alcohol (95%) and all other chemicals and reagents were purchased from Al-Gomhoria Company for Trading Drugs, Chemical and Medical Instruments, Cairo, Egypt. Thirty adult male albino Sprague–Dawley rats weighing (170g±5) used for the present study were obtained from Helwan Farm, Cairo, Egypt. The animals were acclimatized for 7 days in our animal house (Regd. No MUFHE / F /NFS / 4 / 22) before dietary manipulation. They were housed two per cage in an air- conditioned room (22± 2°c) with 12 h light/ dark cycle and had free access to standard pellet diet and water. All the procedures were performed in accordance with the Institutional Animal Ethics committee.

2.2. Methods

2.2.1. Preparation of shrimp shells and isolation of chitosan

Shrimp shells were carefully washed many times with tap water and swilled several time with distilled water, dried in an electric draft oven at 45 °C, and ground in a grinder (Braun Biotech International GMBH. D.34212 Melungeon, Germany). The fine powder stored at -10°C until used. Demineralization (by 1M HCl for 2 hr. at 45°C), Deproteinization (by IM NAOH for2 hr. at 75□C) and Deacetylation(by 40% NAOH for4 hr. at 90□C) are followed for the isolation of chitosan from the dried shrimp shells powder according to **(16).**

2.2.2 Determination of chemical composition of chitosan and bioactive compounds

Moisture, protein, fat, fiber and ash were determined in chitosan as described in the method of **(17)**. The carbohydrates were calculated by difference. Total phenolic of chitosan was determined according to the method of **(18)**. Total flavonoid of chitosan was measured according to **(19).**

2.2.3. Experimental protocol

Thirty adult male rats Sprague Dawley weighting (170g ±5 g) were used in this study. Rats were housed in environmentally controlled atmosphere and were fed standard diet according to AIN-93 guidelines (20) in Animal House, Department of Nutrition and Food Science, Faculty of Home Economics, Menoufia University, Egypt for adaptation period (one week). Rats were randomly divided into five groups (6 rats each), the first and second groups were fed a standard diet. The third, fourth and fifth groups were fed on the diet containing 2.5, 5 and 7.5% of chitosan powder respectively. At the end of experimental period (30^{th} day), all rats were deprived of food for 24hr. before ulcer induction and allowed to drink water only. The second, third, fourth and fifth groups were given a single orally dose of ethyl alcohol at 10 ml/kg body weight according to (21) to induce gastric ulceration for 2 h while negative control group (healthy group) received a single orally dose of saline (0.9%, w/v).

2.2.4. Collection of gastric secretion and determine ulcer index

After two hours of administration of ethyl alcohol to rats and under anesthesia by diethyl ether were sacrificed and their stomachs were ligated around both openings (cardiac and pyloric openings) and injected by 4 ml distilled water, the gastric juice was collected in sterilized tube, and centrifuged at 500rpm for 5 minutes to estimating gastric secretion parameters including volume in (ml), titratable acidity, MEq/l and total acid output MEq/h. Stomach examined for ulceration. Evaluation of degree of ulceration was expressed in terms of ulcer score which is calculated by dividing the total number of ulcers in each group by number of rats in that group according to (22). Ulcer index (U.I) was calculated by multiplying ulcer score x 100 according to (23), the ulceration (%) was calculated by dividing the number of animals with ulcer by the total number of animals and multiplying by hundred according to (24) and the preventive index was calculated according to the method of (25).

2.2.5. Determination of the volume, pH, total acidity and titratable acid output of gastric juice

The volume of gastric juice was measured by graduated cylinder according to the method described by (15). pH value was determined according to (26). Total acidity of gastric juice was determined by titration of 1 ml gastric juice in 10 ml of distilled water with 0.01 N NAOH

using two drops of phenolphthalein as an indicator according to the method described by (27). Total titratable acid output amount of NaOH that neutralize 100mg of gastric juice (28).

2.2.6. Biochemical analysis

Malonaldehyde (MDA), Glutathione peroxidase (Gpx), Catalase (CAT), and superoxide dismutase (SOD) were determined in stomach tissue according to the methods described by. (29), (30), (31) and (32), respectively.

2.2.7. Histopathology examinations of the stomach

Histopathology examinations of the stomach was determined according to (33).

2.2.8. Technological methods

*** Preparation of bread**

(34) showed that baladi bread was prepared by mixing 0.580kg wheat flour (82% extraction), 406 ml water, 0.004 kg yeast and 0.012kg salt by hand for about 6 min to form the needed dough (to produce 825g of bread). Wheat flour was replaced by chitosan at the level of 2.5, 5 and 7.5 % .

Sensory evaluation

Sensory evaluation of baladi bread samples carried out by fifteen judges according to **(35)**. Judging scale fore appearance, taste, flavor, texture, compressibility, color and over all acceptability was as follow: Excellent (9-10), Very good (8-7), Good (5-6), Fair (3-4), Poor (1-2) and very poor (>1).

2.2.9. Statistical analysis

All data were analyzed using **SAS, (36)** statistical software and expressed as mean ± standard deviation. Analysis of variance between groups was achieved using one-way ANOVA followed by LSD multiple range test, with a significance level set at $P \leq 0.05$

3. Results and Discussion

Table (1) illustrated chemical constituents, total phenolics and total flavonoids of chitosan. Chitosan had moisture (7.24%) and ash (1.76%). (37) found that the shrimp shell chitosan samples had moisture ranged between 7.69 and 8.25%, Besides, our results are similar with this reported by (38) who reported that chitosan had ash (1.2%). Also, chitosan contains fat (0.51%), protein (1.25%), fiber (7.80%) and carbohydrate (81.44%). (39) found that chemical components of chitosan were fat (0.54%), protein (1.33%), fiber (33.6%) and carbohydrate (55.8%). Moreover, (40) showed that chemical components of chitosan were fat (0.54%), protein (1.5%), fiber (33.4%) and carbohydrate (55.8%). As shown in the same Table, chitosan contains total phenolics (17.90 mg GAE//100g) and total flavonoids (30.15 mg CAT/100g). (19) reported that chitosan had total phenolic compounds (22.0 mg/ l00gm) and total flavonoids (10.0 mg/l00gm). Moreover, (41) showed that chitosan contain total phenols (184.7mg/ l00gm). (40) reported that the variation could be due to difference in the age of the shrimps from which the sample was taken.

Data recorded in Table (2) reflected the effect of chitosan on volume, pH, tetrable acidity and total acid output in gastric juice of stomach ulcer rats. The negative control rats had significantly ($P \leq 0.05$) higher in pH and lower ($P \leq 0.05$) in volume gastric juice, tetrable acidity and total acid output compared to stomach ulcer rats. On the other hand, rats which received ethyl alcohol had significantly ($P \leq 0.05$) high in volume gastric juice, tetrable acidity and total acid output and lower ($P \leq 0.05$) in pH compared to stomach ulcer rats supplemented with chitosan (2.5, 5 and 7.5%). (42) said that the oral administration of

ethanol to rats caused development of lesions in the gastric mucosa, an increase in the volume of gastric juice, and acid output, and a decrease in the activity of pepsin. Supplementation stomach ulcer rats with chitosan (2.5, 5 and 7.5%) resulted in elevation (P≤ 0.05) in pH values as well as reduction in the values of volume of gastric juice, tetrable acidity and total acid output compared with positive control rats. These results might be due to the acid-neutralizing capability of chitin and chitosan by the gradual release of glucosamine residues into the gastric mucosa. The result of this study came in accordance with that reported by (15) rats pretreated with chitin and chitosan showed a significant decrease in volume gastric juice, tetrable acidity and total acid output when compared with the ulcerated group. Furthermore, supplementation stomach ulcer rats with 7.5% of chitosan was more effective in increasing PH values and reducing the values of volume of gastric juice, tetrable acidity and total acid output than those supplemented with 2.5% and 5% of chitosan. The anti-gastric ulcer effect may be due to the high amount of total phenols and total flavonoids in chitosan. (43) showed that Formation of chitosan into gel in the stomach and protection of the stomach from the digestive effect of acid and pepsin. Also, (44) showed that the anti-ulcerogenic effect of chitosan because is a rich source of phenols and attributed to the improvement of the antioxidant status of rats due to scavenging activity of free radicals.

Table (1). Chemical constituents, total phenolics and total flavonoids of chitosan

Parameters	Chitosan
Moisture (g/100 g)	7.24±1.60
fat (g/100 g)	0.51±0.21
protein (g/100 g)	1.25±0.43
ash (g/100 g)	1.76±1.10
Fiber (g/100 g)	7.80±1.73
Carbohydrates (g/100g)	81.44±4.93
Total phenols (mg GAE//100 g DM)	17.90±1.41
Total Flavonoids (mg CAT/100 g DM)	30.15±1.39

Each value in the table is represented as mean ±standard deviation of three replicates (n=3).
DM=Dry matter GAE = gallic acid equivalent CAT= catechin

Table (2). Effect of chitosan on volume, pH, tetrable acidity and total acid output in gastric juice of stomach ulcer rats

Groups / Parameters	negative control	Stomach ulcer rats: Positive control	Chitosan (2.5%)	Chitosan (5%)	Chitosan (7.5%)	LSD
Volume of gastric juice(ml)	2.6e±0.1	4.92a±0.08	4.06b±0.09	3.52c±0.08	2.86d±0.11	.127
Ph	3.30a±0.02	1.16e±0.01	1.39d±0.03	2.36c±0.17	3.08b±0.02	.110
Tetrable acidity (Meq/L)	8.72e±0.34	13.84a±0.45	13.42b±0.31	12.02c±0.19	9.4d±0.26	.380
Total acid output (Meq/1h)	166.2e±3.27	274.2a±4.08	266.6b±1.67	225.6c±3.43	206d±1	3.65

Each value in the table is represented as mean ±standard deviation (n=6).
Mean under the same column bearing different superscript letters are different significantly (P ≤ 0.05).

The effect of chitosan on ulcer score, ulcer index, % ulceration and preventive index of stomach ulcer rats illustrated in Table (3). It was observed that positive control rats which received ethyl alcohol produced an increase in ulcer score, ulcer index and ulceration (%) while preventive index had an opposite trend when compared with stomach ulcer rats supplemented of chitosan. These results could be due to effect of ethyl alcohol on the mucosa of the stomach wall. These findings are supported by (45) and (46) who found that ethyl alcohol induce bleeding indicating severe gastric damage causing elevation ulcer score, ulcer index and ulceration (%). Alcohol ulcerogenic effects play a vital role in modification gastric mucosal defense mechanisms and increase the risk of gastric ulcers (47). Feeding stomach ulcer rats of chitosan led to reducing the ulcer score, ulcer index, ulceration% and increasing preventive index compared with positive control rats. This decrease in the ulcer score, ulcer index, ulceration% and increase preventive index may attributed to chitosan possess potent antioxidant activity due to its high content of flavonoids and phenolics compounds, which have good antiulcer effects. These results agree with those reported by (48) showed that chitosan protected gastric mucosa since it reduced ulcer score, ulcer index and ulceration%. (49) mentioned that anti-ulcer effects of flavonoids via several mechanisms as anti-acid secretion, inhibition of pepsin level and activity, increased mucus production and bicarbonate secretion. As well as flavonoids boost mucosal cytoprotective, antioxidative, anti-inflammatory, and antibacterial defenses against peptic ulcer. (50) found that the antiulcer effect of isolated chitosan may be due to its neutralization effect on H+ ions and pepsin in the gastric juices and exert its protective effect by coating the ulcerated area. Furthermore, stomach ulcer rats supplemented with 7.5% chitosan had the highest increase in preventive index and the highest decrease in ulcer score, ulcer index, ulceration% than those supplemented with 2.5 and 5% compared with positive control rats. (43) showed that mechanism of the antiulcer effect of chitosan is probably due to inhibition of reduction in mucus formation by indomethacin. Chitosan has other minor effects which may contribute to its antiulcer effects such as antiacid activity, antibacterial activity against *H. pylori* Formation of chitosan into gel in the stomach and protection of the stomach from the digestive effect of acid and pepsin.

Table (3). Effect of chitosan on ulcer score, ulcer index, % ulceration and preventive index of stomach ulcer rats

Groups / Parameters	Negative control	Stomach ulcer rats			
		Positive control	Chitosan (2.5%)	Chitosan (5%)	Chitosan (7.5%)
Ulcer score	-	11	7.2	5.2	5
Ulcer index	-	1100	720	520	500
% Ulceration	-	86	63	44.2	17.2
Preventive index	-	14	37	55.8	82.8

Data presented in Table (4) revealed the effect of chitosan on antioxidant enzymes and oxidative stress parameters in gastric mucosal of stomach ulcer rats. Ethanol exposure leads to the formation of ROS which has harmful effects on the damage of the stomach and

elevated antioxidative enzymes which was noted to protect gastric mucosa from ulceration (51). Stomach ulcer rats had lower catalase (CAT), glutathione peroxidase (Gpx) and superoxide dismutase (SOD) and higher MDA than those rats in negative control group (P≤0.05). The decrease in the activities of CAT, Gpx, SOD and increase in the levels of MDA may be due to the oxidative stress resulting from stomach exposure to ethyl alcohol. These results are in accordance with those observed in (52) who found that ethanol administration significantly increases the levels of lipid peroxide in gastric mucosa and reduces the major antioxidant factors, such as superoxide dismutase (SOD) and catalase (CAT) Also, (53) and (46) who found that ethanol caused elevation in MDA level with reduction in CAT, Gpx and SOD activities in ethanol-induced gastric ulcer rats.(15) observed that oral administration of ethanol induced an increase in lipid peroxidation in the gastric mucosa, which resulted in reduction in the activity of antiperoxidative enzymes (SOD and CAT) and glutathione-dependent antioxidant enzymes (GPx and GST). Increase in the level of lipid peroxides in the ulcerated gastric mucosa reflected the damage to the mucosal cell membrane, Lack of antioxidant defense might lead to an increase in the lipid peroxidation and subsequent hurtful effects. In the same Table the levels of antioxidant enzymes (SOD, Gpx and CAT) were markedly ($p \leq 0.05$) increased in stomach ulcer rats which supplemented with chitosan (2.5%,5%, and 7.5%) while MDA had an opposite trend compared with positive control rats. These results showed that chitosan is effective in preventing ethanol induced gastric ulcer and this is due to its antioxidant activity. (54) observed that chitosan possess protective effects against ethanol-induced gastric mucosal injury by enhancing antioxidative status, inhibiting the expression of pro inflammatory cytokines, improving the gastroprotective factor production and rising the activity of alcohol metabolism enzymes to enhance alcohol metabolism in mice. These results had the same trend as that of (55) who showed that chitosan is effective reactive oxygen species (ROS) scavenger. (56) who found that feeding rats with chitosan (140 mg/kg BW) for 3 weeks induced increased catalase and reduced MDA levels compared with positive control. As the results indicated that stomach ulcer rats which supplemented with 7.5% of chitosan has the most potent gastric cytoprotective and ulcer healing-promoting actions, where it recorded the highest elevation in GPx, CAT and SOD activities by150.94, 131.54 and 149.21% respectively and reduction in MDA by 54.49% compared to positive control rats. (48) reported that chitosan inhibited gastric ulceration induced by indomethacin as well as a significant reduction in blood and gastric tissue MDA and an increase in mucin secretion. (15) showed that anti-ulcerogenic effects of chitosan is probably related to a counteraction of free radicals through their antioxidant property, a neutralization of gastric juice by the gradual release of glucosamine, their ability to maintain near to normal status the activity of free-radical enzymes and the level of GSH, which protects mucosa against oxidative damage by decreasing lipid peroxidation and strengthening the mucosal barrier.

Data presented in Table (5) and Photo (1) showed the sensory evaluation of baldy breads made by different levels of chitosan. It was observed that there was no significant ($p>0.05$) changes in appearance, texture, compressibility color and overall acceptability among baldy bread made by different levels of chitosan (2.5, 5 and 7.5%) and control bread. Also, there

were no significant changes (P> 0.05) in taste and flavor between baldy breads made by 2.5% of chitosan and control breads. The lowest values of taste and flavor were recorded in baldy breads made by 7.5% of chitosan. (57) showed that no significant (p>0.05) changes were found in flavor, texture, crispness among control and breads made by 3.5 and 7% of shrimp shells chitosan. (58) showed that chitosan could be incorporated into bread to provide its beneficial health effects through chitosan was used to substitute wheat flour to make bread. As chitosan is a rich source of natural antioxidants, flavonoids and other phenolic (59).

Table (4). Effect of chitosan on antioxidant enzymes and oxidative stress parameters in gastric mucosal of stomach ulcer rats

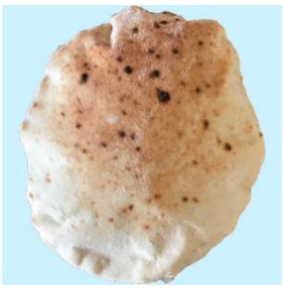
Groups / Parameters	Negative control	Stomach ulcer rats: Positive control	Chitosan (2.5%)	Chitosan (5%)	Chitosan (7.5%)	LSD
MDA (nmol/g tissue)	14.12e±0.44	38.94a±1.80	25.46b±0.70	21.8c±0.36	17.72d±0.58	1.183
CAT (U/g tissue)	31.44a±1.41	10.05e±0.11	20.1d±0.65	23.52c±0.34	25.22b±0.91	1.010
GPX (nmol/g tissue)	33.32a±1.24	11.54e±0.45	22.42d±0.59	25c±0.94	26.72b±0.93	1.241
SOD (U/g tissue)	30.22a±1.18	10.08e±0.68	20.34d±13.07	22.52c±0.60	25.12b±0.33	0.980

Each value in the table is represented as mean ±standard deviation (n=6).
Mean under the same column bearing different superscript letters are different significantly (P ≤ 0.05).

Table (5). Sensory evaluation of baldy breads made by different levels of chitosan

Variables	Chitosan portions: 0%	2.5%	5%	7.5%	LSD
Appearance	9.3a±0.82	9.1a±0.73	8.8a±0.91	8.7a±0.82	0.79
Taste	9.1a±0.73	9.1a±0.99	8.7ab±0.82	8.5b±0.97	0.59
Flavor	9.6a±0.51	9.6a±0.52	9.3ab±0.48	9.1b±1.73	0.47
Texture	9.8a±0.42	9.8a±0.70	9.8a±0.84	9.7a±0.42	0.54
Compressibility	9.2a±0.78	9.1a±0.99	9.0a±0.94	8.9a±0.73	0.72
Color	9.6a±0.69	9.5a±0.52	9.1a±0.73	9.0a±1.05	0.63
Overall acceptability	9.35a±0.66	9.2a±0.91	9.0a±1.05	8.8a±0.91	0.76

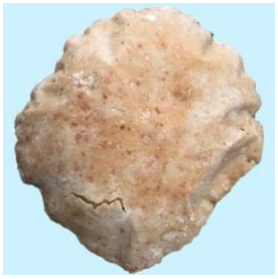
Each value in the table is represented as mean ±standard deviation (n=6).
Mean under the same column bearing different superscript letters are different significantly (P ≤ 0.05).



0% Chitosan

2.5% Chitosan

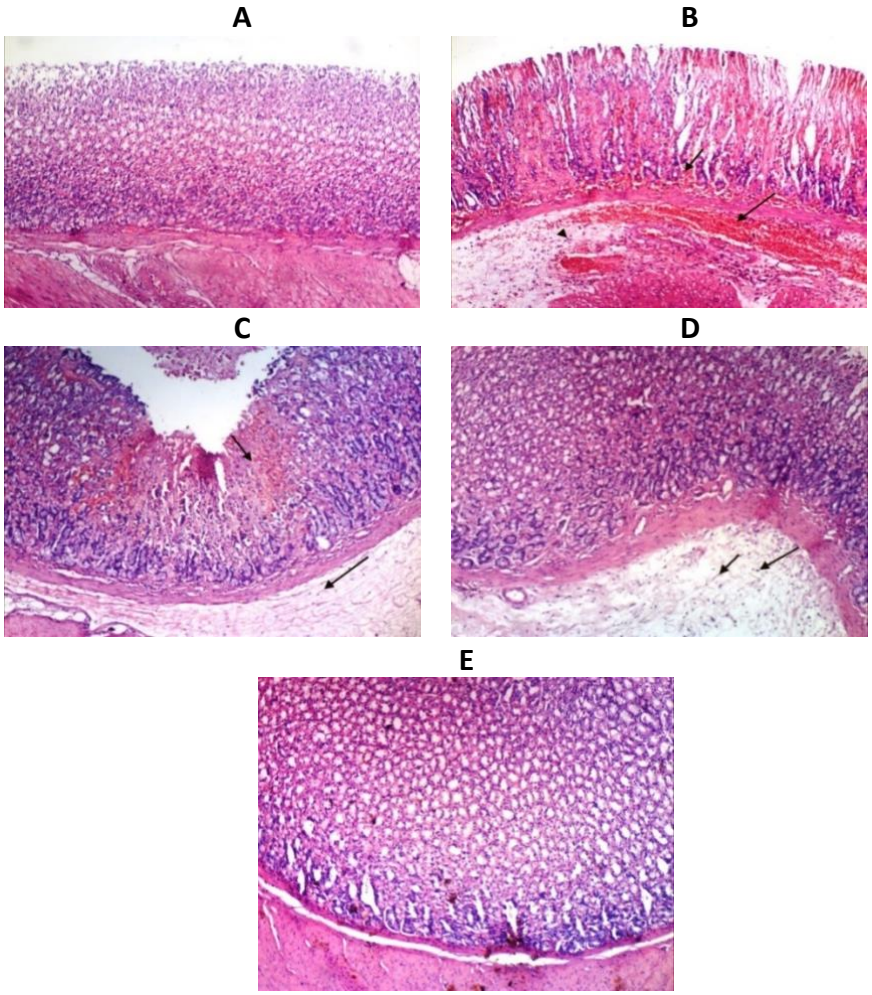
5% Chitosan



7.5% Chitosan

Photo (1): Baldy breads made by different levels of chitosan.

Photo (2) shows the effect of chitosan on histological examination of stomach tissues in stomach ulcer rats. Microscopical examination of stomach of rat from negative control revealed no histopathological changes with the normal histological gastric layers (Photo2A). While the examination of stomach ulcer rats stomach tissues showed necrosis of gastric mucosa, haemorrhage, submucosal haemorrage and inflammatory cells infiltration as well as focal necrosis and sloughing of gastric mucosa, submucosal oedema and submucosal inflammatory cells infiltration. Some examined sections showed shortening of gastric mucosa and congestion of submucosal blood vessels (Photo 2B). Similar results were reported by (54) and (46) who reported that rats fed orally with ethanol for 4 weeks resulted in the development of gastric ulcer with moderate lesions and hemorrhage on the surface of the epithelial layer in histopathological examination. (60) showed that stomach ulcer induced by the intubation of ethanol caused contraction/extension of blood vessels which results to ulcerative damage and hemorrhage in the stomach wall lining. Meanwhile, stomach ulcer rats which fed with a diet supplemented with 2.5% of chitosan had congestion of mucosal blood vessel, slight submucosal oedema and few inflammatory cells infiltration, whereas, other sections showed focal necrosis of gastric mucosa, haemorrhage associated with submucosal oedema (Photo 2C). As shown in (Photo 2D) stomach ulcer rats which fed with a diet supplemented with 5% of chitosan showed no histopathological alterations except slight submucosal oedema and few inflammatory cells infiltration. On the other hand, stomach ulcer rats which fed with a diet supplemented with 7.5% of chitosan revealed no histopathological alterations (photo 2E). From the foregoing we conclude that stomach ulcer rats which fed with a diet supplemented with 7.5% of chitosan had the best histological examination of stomach tissue. (15) revealed that the pre-treatment with chitosan was found to exert a significant anti-ulcer effect by preventing all the ethanol-induced ulcerogenic effects in experimental rats. Also, the levels of mucosal proteins and glycoprotein components were significantly depleted in ulcerated mucosa. (61) and (62) noted that flavonoids had an effective role in protection of gastric mucosal cells throughit has anti-inflammatory action, augmented cell proliferation and enhanced angiogenesis as well as increased mucus secretion. (42) showed that formation of chitosan into gel in the stomach and protection of the stomach from the digestive effect of acid and pepsin. Chitosan has the most potent gastric cytoprotective and ulcer healing-promoting actions.as well as gastric mucus-increasing action.



A: negative control, B: positive control (stomach ulcer rat), C: stomach ulcer rat trea with 2.5% of chitosan, D: stomach ulcer rat treated with 5% of chitosan, E: stom ulcer rat treated with 7.5% of chitosan.

Photo (2): Effect of chitosan on histological examination of stomach tissues in stomach ulcer rats.

4. Conclusion

Based on these results, it could be concluded that chitosan extracted from shrimp shells has anti-ulcerogenic and antioxidant effects against gastric ulcer induced by ethyl alcohol which protects mucosa against oxidative damage by decreasing lipid peroxidation as well as a natural, safe and cheap. So we recommend chitosan could be incorporated into bread to provide its beneficial health effects.

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تقييم النشاط المضاد للتقرح والمضاد للأكسدة للشيتوزان فى الفئران المصابة بالقرحة الناجمة عن الإيثانول

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الملخص العربي:

الشيتوزان هو سكرعديد من أصل طبيعي. وقد تم استخدامه في العديد من المجالات كالغذاء والدواء وله خصائص مضادة للأكسدة ، لذا فقد أجريت الدراسة الحالية لتقييم التأثيرات الوقائية للشيتوزن علي قرحة المعدة في الفئران البالغه. تم تقسيم ثلاتون من ذكور الفئران البيضاء البالغة وزنها (170 جم ± 5 جم) عشوائيا لخمس مجموعات (6 فئران بكل مجموعة)، تم تغذية المجموعة الأولى والثانية على الوجبة القياسية ، في حين غذيت المجموعات الثالثة والرابعة والخامسة على الوجبة الغذائية القياسية التي تحتوي على 2.5 و5 و7.5٪ من مسحوق الشيتوزان على التوالي.في اليوم الأخير من التجربة (اليوم الثلاثون) ،تم تصويم الفئران لمدة 24 ساعة ,أعطيت المجموعات الثانية والثالثة والرابعة والخامسة جرعة واحدة عن طريق الفم من الكحول الإيثيلي مقدارها 10 مل / كجم من وزن الجسم لإحداث قرحه المعدة بينما أعطيت المجموعة الضابطة السالبة جرعة واحدة عن طريق الفم من المحلول الملحي (0.9٪، وزن / حجم)، بعد ساعتين من إعطاء الكحول الإيثيلي تم فتح جدار البطن وربط المعدة حول فتحتى الفؤاد والبواب، وتم جمع عصير المعدة وطرده مركزيًا، اشارت النتائج أن معاملة الفئران بالشيتوزان أدت إلى انخفاض في درجة التقرح من 11الي 5، مؤشر القرحة من 1100الي 500، نسبة التقرح من 86 الي 17.2 ، وزيادة المؤشر الوقائي من14 الي 82.8 ونشاط الإنزيمات المضادة الأكسدة مقارنة بفئران المجموعة الضابطة الموجبة. كما أوضحت النتائج أن تغذية الفئران على وجبه قياسيه تحتوي على 7.5٪ من الشيتوزان كانت اكثر فعالية في حماية خلايا المعدة والشفاء من القرحة، وقد خلصت الدراسة إلى أن استخدام الشيتوزان يظهر نشاطًا وقائيا مضادًا لتقرح المعدة في الفئران.

الكلمات المفتاحية: درجه التقرح، قشور الجمبري، الفلافونويدات، الحموضه الكليه، المؤشر الوقائي ، العيش