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Anti-ulcer effects of chamomile, sesame and flax oils on gastric ulcer-induced rat model

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ABSTRACT

This study looked at the gastroprotective effects of chamomile, sesame, and flax oil extracts on experimental rats with piroxicam-induced stomach ulcers. In this investigation, 36 albino rats weighing 100-10 g were separated into 6 groups, one of which was preserved as a control –ve group, while the other five were given one oral dose of 2ml oil every day for the duration of the experiment. First group was kept as a (+ve) control group, while the others were given orally administered oils (2 ml per rat each day) for four weeks. Feed intake, body weight gain percent and feed efficiency ratio were all part of the biological examination. The levels of glutathione and malondialdehyde in the stomach were determined. The Histopathological changes in stomach tissues were also looked into. The use of oils, according to the research, enhanced all previous criteria. Histological investigation confirmed the biochemical results. The best treatments were found to occur with high doses. Oils considered as a prophylactic measure against stomach ulcers induced by non-steroidal anti-inflammatory drugs, according to the study (NSAIDs).

Keywords: Natural oils, antioxidants, peptic ulcer

1. INTRODUCTION

Peptic ulcer disease is a chronic condition that affects millions of people around the world. This disease is projected to impact 10% of the population at some point during their life (Zapata-Colindres et al., 2006, Marcus et al., 2013). Peptic ulcers are caused by an increase in gastric acid and are usually identified by their anatomic location, such as gastric or duodenal ulcers. Infection with *H. pylori* and duodenal ulcers are linked. By enhancing cytokine production (Prabhu and Shivani, 2014 & Klein, 2010), neutrophil and macrophage infiltration into the mucosa, and the release of leukotrienes (LT) and reactive oxygen species, H. pylori boosts mucosal defense and promotes ulcer formation (Behrman, 2005). One of the most often used therapeutic plants is chamomile. It's in the pharmacopoeias of 26 different countries. The primary components of chamomile are amino acids, polysaccharides, fatty acids, essential oils, mineral elements, flavonoids, and other phenolic compounds (McKay, and Blumberg, 2006. Sesamin, sesaminol, gamma-tocopherol, cephalin, and lecithin are among the chemicals found in it. Sesame offers several pharmacological effects as a result of these components,

including antioxidant, antibacterial, cardiotonic, antidiabetic, hypocholesterolemia, anticancer, antiulcer, anti-inflammatory, and analgesic characteristics (Sirato-Yasumoto et al., 2001). In both experimental animals and humans, sesame has been shown to exhibit antioxidant activity, as well as blood pressure and serum lipid-lowering properties (Anilkumar, et al., 2010).

The advancement of knowledge about pathogens and their pathogens, ranging from acid-induction disorders to infectious diseases, has sparked a lot of research into the best management methods. Although ulcers caused by H. pylori infection are becoming less common, ulcers caused by non-steroidal anti-inflammatory drugs (NSAIDs) continue to be a clinically significant problem with the use of selective COX-2 Cyclooxygenase inhibitors. The stomach ulcer covers a duodenal ulcer and a gastric ulcer) (GU). Before tears, duodenal ulcers are most common in the early section of the duodenum or the stomach area (Holton, 2010). Gastric ulcer illness manifests itself in four ways: wounded bleeding, perforating, piercing, and blocking. Patients with peptic ulcers of any kind may find it difficult to comply. Despite advances in medical treatments and a lower overall prevalence of peptic ulcer disease (PUD), data on the occurrence of potentially life-threatening ulcer complications in patients remains conflicting. The steady decrease in *Helicobacter pylori* propagation, along with an increase in the use of nonsteroidal anti-inflammatory medicines has resulted in an increase in the rate of wound problems linked with drug usage, particularly among the elderly.

As a result of this pattern, wound problems become more prevalent in senior patients while decreasing in younger people (Milosavljevic et al., 2011; Marcia et al., 2020). Piroxicam Px works primarily by suppressing prostaglandin synthesis through nonspecific inhibition of cyclooxygenases (COX-1 and 2) in the form of competitive antagonism with arachidonic acid. This impact lowers the secretion of gastroprotective mucin in an indirect way, increasing the risk of gastric ulcer formation (Steinmeyer, 2000). This study shows that treatment with omeprazole did not reduce the incidence of piroxicam-induced gastric ulcer in sash rats, and that most of these mice still developed significantly increased gastric enlargement or gastric outlet obstruction. PX is a long-acting non-steroidal anti-inflammatory medication used to treat osteoarthritis (Ibrahim et al., 2019).

Practical applications

Essential oils have been found to be protective against peptic ulcers, according to the findings of this study. The levels of superoxide dismutas, catalase malondialdehyde, hydrogen peroxide, and glutathione reduced in serum blood provide clear evidence that the products of oils (chamomile, sesame, and flax) have gastro protective effect against piroxicam-induced gastric ulcers, as well as anti-inflammation (CRP, IL-6, and PG2) in More clinical research is needed to validate existing findings and to propose the regular use of natural oils in meals as a preventative strategy for delaying peptic ulcer advancement in vulnerable people or in the early stages of the disease.

2. MATERIALS AND METHODS

Chemicals, Drugs and Natural oils

Omez drug (Omeprazole) was obtained from Egypt Pharmacia Company, Abor City. Each tablet contains 20 mg of Omeprazole. The animal dose (20 mg/kg) adjustable to anterior is that listed by (Raeesi, 2019). Brexin drug (Piroxicam) was obtained from Pharmacia Company, Abor City. Each tablet contains 20 mg of piroxicam. The animal dose (30 mg/kg) adjustable to anterior is that listed by (Barbastefano et al., 2007). Natural oils (Sesame oil, Chamomile oil and flax oil) were purchased from the local market in Kafr El Sheikh City, Egypt.

Thirty-six adult male Sprague–Dawley rats (110 ±10 g) were used in this study. Six groups of six rats were purchased from the NRC animal unit (Giza, Egypt). They were kept in the animal home of Kafr El-Sheikh University's Faculty of Specific Education's Home Economics Department under carefully controlled environmental conditions. All animal interventions were carried out in accordance with NIH guidelines. In addition, standard biosecurity and institutional safety precautions were followed. Rat protocols numbers IAACUC-KSU-1141-2020 were authorized by the Institutional Aquatic Committee for Animal Care and Use at Kafr El-Sheikh University. Prior to the trial, rats were fitted and watched for five days. They were also fed a regular diet and given water. The rats were subsequently divided into four groups (each with six rats).

Experimental Animals Protocol

Group 1: Negative control group (- ve): This group served as normal control group during the experimental period with taking normal saline. The rest of the rats were affected by peptic ulcer were divided as follows: -

Group 2: Positive control group (+ ve): Peptic ulcer piroxicam (30 mg/kg) Piroxicam.

Group 3: Omeprazole drug group (Omeprazole 20 mg/kg b.w): The drug solutions were prepared using normal saline, it was taken daily over the course of the experiment (Raeesi, 2019).

Group 4: Basel diet + 2ml Sesame oil per day for each rat .
Group 5:. Basel diet + 2ml Chamomile oil per day for each rat .
Group 6: Basel diet + 2ml flax oil per day for each rat .

After the trial period ended (30 days in July 2020), animals were sacrificed, blood samples were taken, and stomachs were opened along the larger curve. The gastric lumen was rinsed with normal saline and examined. Tissue antioxidants, inflammation, and free radicals were measured and ulcers.

Induction of peptic ulcer by Piroxicam

The animals were then fasted for 24 h it was allowed drink water, before induction of peptic ulcer Then give piroxicam (30 mg/kg) was fed orally administered to the rats (Barbastefano et al., 2007).

Calculation of some Nutritional Parameters

The amount of food eaten by rats was registered daily (Food intake), While weight was measured once a week to identify the gained weight (body weight gain). At the end of the experiment period the following equations was used to calculate. Body weight gains, feed efficiency ratio (FER) are according to (Chapman et al., 1959).

Body weight gain (BWG)

Animals were weighed one a week. At the end of experiment calculated for them as a mean and standard error for each group.

Biological analyzes

Collection and preparation of blood samples for analysis

When experimentation period was over, animals in all groups were anesthetized by di-ethyl ether. Blood samples were collected from the inner canthus of the rat's eye using heparinized capillary tubes, and then the serum was obtained after centrifugation at 3000 rpm for 10 minutes. Samples were preserved in a deep freezer at -20 ˚C until be used for various biochemical analyzes. Blood samples were testing for determination of (CRP), (IL-6) and (PG2) levels in serum. Using equipment obtained from a laboratory kits company in Kafr elsheikh Governorate, Egypt; as the following:

Measurement of some anti-inflammation parameters (CRP, IL-6 and PG2)

C- reactive protein level (CRP): was measured depending on the method of (Vaishnavi, 1993). IL-6 interleukin-6 was assessed and quantified according to the method of (Mousavizadeh, 2009). PG2 prostaglandin was measured depending on the method of (Robert, 1979).

Measurement of some antioxidant enzymes level in tissue

Confirmation of glutathione reduced (GSH) activity according to (Beutler et al., 1963). Confirmation of superoxide dismutase SOD activity was according to Nishikimi et al., (1972). Enzymatic catalase CAT activity was measured by according to Aebi (1984).

Measurement of some free radical level in tissue

Malondialdehyde (MDA) measured calorimetrically according to the method of Satoh (1978). (H_2O_2) hydrogen peroxide was measured depending on the method of Aebi (1984).

Histopathological analysis

For Histopathological examinations using the light microscope specimens were processed to form paraffin blocks, paraffin wax tissue stomach blocks were prepared by cutting them into slices of 4-micron thickness. The obtained tissue slices were collected on glass slides, and subjected was deparaffinized and stained by hematoxylin and eosin stain (Bancroft et al., 2012).

Statistical data analysis

All tests were accomplish using computer package of the statistical analysis program (SPSS, version 24, 2016), the collected data were presented as means ± standard deviations (means ± S.D), statistically analyzed using one way analysis of Variance (ANOVA), and the means between groups were compared by least significant difference (LSD) statistic test, according to Artmitage, and Berry (1987).

3. RESULTS AND DISCUSSION

Data in Table (1) showed that final weight, body weight gain, body weight gain% and food efficiency ratio (FER) were significantly lower in peptic ulcer rats than in the negative group and showed non- significant differences in food intake. sesame oil and chamomile oil protected groups showed significant increase in final weight, body weight gain, body weight gain% and feed efficiency ratio however explained non- significant difference in food intake compared with control (+ve) group. While, significant decrease in final weight and feed efficiency ratio and found slight deficiency in body weight gain and body weight gain% whoever appeared non- significant difference in food intake compared with control omeprazole drug group. flax oil protected group showed significant increase in final weight, body weight gain, body weight gain% and feed efficiency ratio however explained significant decrease in food intake compared with control (+ve) group. While, non - significant difference in final weight, body weight gain, body weight gain% and feed efficiency ratio (FER) and however showed significant decrease in food intake compared with control omeprazole drug group.

Table 1 Body weight gain (BWG), food intake (FI) and food efficiency ratio (FER) of peptic ulcer rats protected with sesame oil, chamomile oil and flax oil.

Groups	Initial weight (gm)	Final weight (gm)	Wight gain (gm)	Wight gain%	Food intake (gm)	FER
Control (+ve)	110.60 ±6.84 a	171.20 ±4.14 c	60.60 ±8.98 c	55.34 ±11.60 c	14.27 ±0.18 a	0.141 ±0.021 d
Control (-ve)	105.80 ±3.76 a	201.81 ±42.01 a	96.01 ±13.54 a	91.37 ±12.55 a	14.32 ±0.13 a	0.224 ±0.102 a
Omeprazole	108.60 ±2.19 a	209.01 ±47.73 a	100.40 ±18.42 a	92.71 ±15.29 a	14.26 ±0.07 a	0.234 ±0.113 a
Sesame oil	108.01 ±2.73 a	183.20 ±10.68 b	75.20 ±12.77 ab	69.86 ±13.43 ab	14.25 ±0.05 a	0.175 ±0.029 c
Chamomile oil	105.80 ±3.76 a	187.01 ±16.68 b	81.20 ±17.97 ab	77.07 ±18.40 ab	14.16 ±0.01 a	0.191 ±0.042 b
flax oil	104.01 ±6.51 a	201.80 ±13.97 a	97.80 ±14.85 a	94.57 ±16.83 a	13.51 ±0.11 b	0.241 ±0.038 a

Table 2 showed non- significant difference in relative organs weight of stomach and heart in peptic ulcer rats (v+) group but appeared significant decrease in relative organs weight of liver and kidney weight compared with negative control (v-) group. sesame oil and flax oil protected groups showed non- significant difference in relative organs weight of stomach, heart and kidney but appeared significant decrease in relative organ weight of liver compared with control (+ve) group, while non-significant deference in relative organs weight of stomach and liver but appeared significant increase in relative organs weight of heart and kidney compared with omeprazole drug group. chamomile oil protected group showed non- significant difference in relative organ weight of stomach but appeared significant decrease in relative organs weight of liver, heart and kidney compared with control (+ve) group, while showed non-significant deference in these organs compared with omeprazole drug group.

Table 3 and figure 1 showed significant increase in CRP, IL-6 and PG2 in control (+ve) compared with control (-ve) group. the protected of peptic ulcer rat with sesame oil, chamomile oil and flax oil groups showed significant decrease in CRP, IL-6 and PG2 compared with control (+ve) group, while compared with omeprazole drug group found non- significant difference in CRP and IL-6, however showed significant decrease in PG2 in sesame oil group, while chamomile oil group showed significant decrease in CRP and PG2, however showed non- significant difference in IL-6, but flax oil group showed significant decrease in CRP, IL-6 and PG2, the best results are in favor of the protective group with flax oil.

Table 2 effects of sesame oil, chamomile oil and flax oil on organs weight (stomach, liver heart and kidney) in peptic ulcer and colitis ulcer rats.

Groups	weight (stomach, liver heart and kidney) in peptic ulcer and colitis ulcer rats			
	Stomach (gm)	Liver (gm)	Heart (gm)	Kidney (gm)
Control (+ve)	0.84±0.02 a	4.42±1.06 a	0.49±0.07 a	0.94±0.13 a
Control(-ve)	0.79±0.07 a	3.16±0.14 b	0.45±0.07 a	0.78±0.06 b
Omeprazole	0.78±0.13 a	2.93±0.16 b	0.3±0.098 b	0.78±0.07 b
Sesame oil	0.81±.089 a	2.96±0.25 b	0.46±0.07 a	0.82±0.10 a
Chamomile oil	0.82±0.09 a	3.05±0.31 b	0.37±0.06 b	0.74±0.11 b
Flax oil	0.81 ±0.09a	3.30±0.17 b	0.47±0.11 a	0.82±0.11 a

Table 3 Effect of sesame oil, chamomile oil and flax oil on some anti-inflammation (CRP, IL-6 and PG2) in serum blood for peptic ulcer rats

Variables / Groups	CRP (mg/l)	IL-6 (Pg/ml)	PG2 (mg/l)
Control (+ve)	14.07± 4.20 a	20.83± 2.04 a	21.77± 2.39 a
Control(-ve)	6.8 ± 1.15 b	12.33± 0.83 b	14.3± 1.18 b
Omeprazole	7.77± 0.47 b	13.37± 2.12 b	15± 0.75 b
Sesame oil	6.4± 2.10 b	13.17± 1.27 b	12.8± 0.11 c
Chamomile oil	3.60± 0.46 c	11± 0.36 b	12.04± 0.89 c
Flax oil	0.74± 0.22 d	8.07± 0.90 c	11.01± 1.04 c

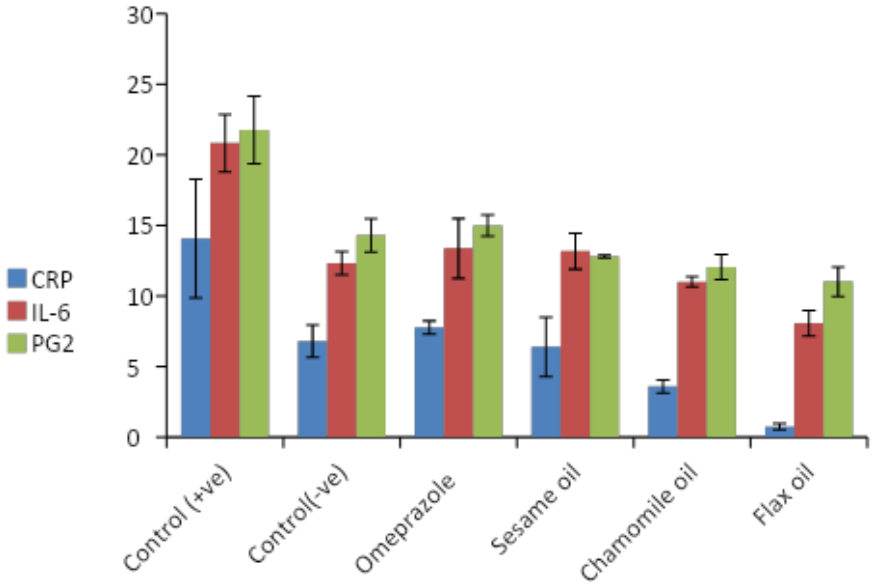

Figure 1 Effect of sesame oil, chamomile oil and flax oil on C-reactive protein (CRP), interleulin-6 (IL-6), prostaglandin (PG2)

Data in Table (4) showed significant increase in H2O2 and MDA in control (+ve) compared with control (-ve) group. the protected of peptic ulcer rat with sesame oil, chamomile oil and flax oil groups showed significant decrease in H2O2 and MDA compared with control (+ve) group, while non- significant difference in H2O2 and MDA in sesame oil group however explained significant decrease in H2O2 and MDA in chamomile oil and flax oil groups compared with omeprazole drug group, the best

results are in favor of the protective group with flax oil.

Table 4 Effect of sesame oil, chamomile oil and flax oil on free radical (H_2O_2 and MDA in tissue for peptic ulcer rats

Variables / Groups	H2O2	MDA
Control (+ve)	3.91 ± 0.75 a	1.6 ± 0.17 a
Control(-ve)	2.05 ± 0.59 b	0.94± 0.14 b
Omeprazole	1.60 ± 1.01 b	0.84± 0.08 b
Sesame oil	1.77± 0.33 b	0.82± 0.01 b
Chamomile oil	1.10± 0.04 c	0.53± 0.08 c
Flax oil	0.07± 0.03 c	0.35± 0.08 c

Table 5 showed significant decrease in (SOD, CAT and GSH) in control (+ve) compared with control (-ve) group. the protected of peptic ulcer rat with sesame oil and flax oil groups showed significant increase in (SOD, CAT and GSH) however chamomile oil group explained non- significant difference in CAT and showed significant increase in (SOD and GSH) compared with control (+ve) group, while compared with omeprazole drug group found sesame oil group significant increase in SOD but non- significant difference in CAT and GSH, however explained chamomile oil group significant increase in SOD and significant decrease in CAT but showed non- significant difference in GSH, while showed significant increase in (SOD, CAT and GSH) in flax oil group. The best results are in favor of the protective group with flax oil.

Table 5 Effect of sesame oil, chamomile oil and flax oil on antioxidant enzymes (SOD, CAT and GSH) in tissues for peptic ulcer rats

Variables / Groups	SOD	CAT	GSH
Control (+ve)	314.33 ± 11.02 e	6.01± 0.46 c	290.33± 10.07 c
Control(-ve)	352.67 ± 10.69 d	7.9 ± 0.53 b	310± 7.55 b
Omeprazole	400.33± 26.84 c	7.9± 0.4 b	325.33 ± 4.04 b
Sesame oil	443± 21.28 b	8.37± 0.32 b	329.33± 4.04 b
Chamomile oil	434.33± 8.96 b	6.5± 0.2 c	312± 3.61 b
Flax oil	561.33± 19.86 a	10.8± 0.75 a	358.67± 19.55 a

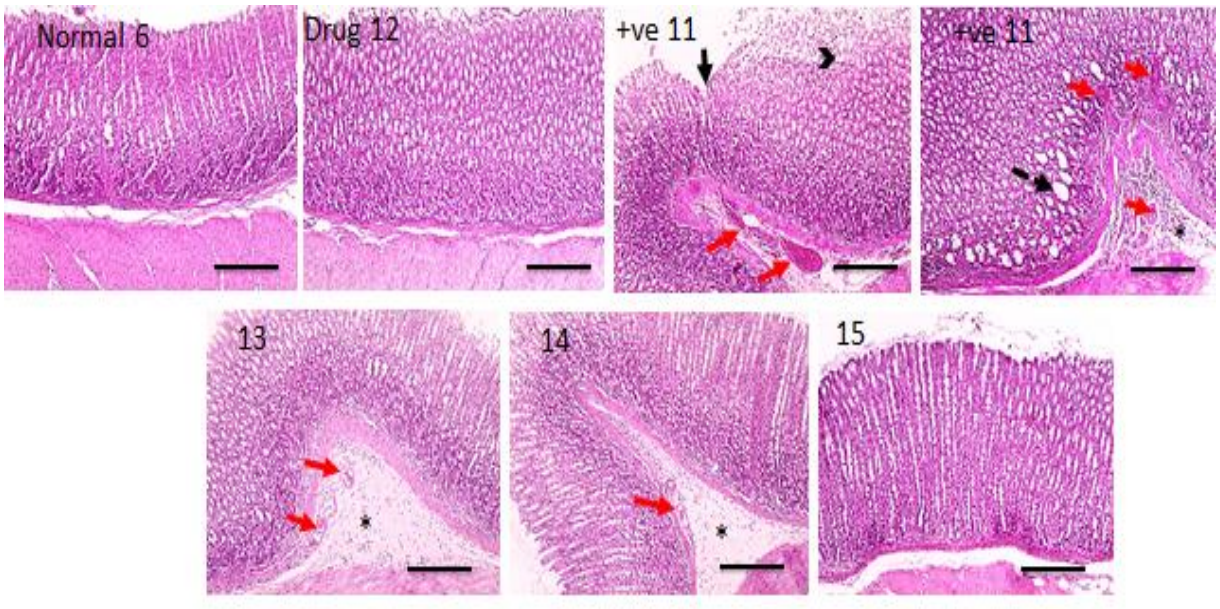

Figure 2 histopatological examination on gastric mucosa in negative, positive and treated groups. Microscopic pictures of HE stained sections of glandular gastric mucosa showing intact tubular glands which open in gastric pits (arrowhead) lined with columnar epithelium in negative control rat group 6 and group 12.

Sections of glandular gastric mucosa from positive control group 11 showing superficial erosion (straight arrow), disruption and desquamation of apical portion of glandular mucosa (arrowhead), dilated glands in basal portion of glandular mucosa (dashed arrow), congested blood vessels in mucosa and underlying submucosa (red arrow), edema with leukocytic cells infiltration. Sections of glandular gastric mucosa from treated group with sesame oil 13 showing normal gastric mucosa, congested blood vessels in underlying submucosa (red arrow) accompanied with edema with few leukocytic cells infiltration.

Sections of glandular gastric mucosa from treated group with chamomile oil 14 showing normal gastric mucosa, mildly congested blood vessels in underlying sub mucosa (red arrow) with decreased edema and very few leukocytic cells infiltration. Sections of glandular gastric mucosa from treated group with flaxseed oil 15 showing normal gastric mucosa, and submucosa. ×100, bar=100 μm

4. CONCLUSION

Consumption of natural oils showed significant gastric protection against piroxicam is indicative of their excellent gastro protective and anti-oxidative potentials in rats which confirmed by biochemical results and histological findings. Therefore, it could be used as protective agents against gastric injury.

Ethical approval

The study was approved by Institutional Aquatic Committee for Animal Care and Use in Kafr El-Sheikh University approved rat protocols number: IAACUC-KSU-1141-2020.

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Conflict of interests

The author declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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