Protective effect of cinnamon and chamomile extracts as anti-inflammatory on male rats

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ABSTRACT

Cinnamon is a favorite spice around the world because of its health benefits, flavors and preserves food. Chamomile is used to treat various diseases, cancer**,** diarrhea and healing wound. The present study was conducted to prepared aqueous extracts of cinnamon and chamomile by boiling at 100 Cº and soaking at room temperatures for various periods of times, investigated whether the soaking temperature and time during the preparation of extracts could influence the contents of total phenols and the anti-inflammatory effect of these extracts on male rats. Male albino rats (n=100) weighing 140±5g, were used in this study. Anti-inflammatory effect was studied using the formalin 4% to induce left hind paw edema. Our results found that aqueous extracts prepared by soaking at room temperature at different times were increased in its contents of polyphenols than those prepared by boiling. Orally aqueous cinnamon and chamomile extracts prepared by both boiling and soaking for different times had significant anti-inflammatory effects. The decreases in rats paw's thickness after inducing pedal inflammation (2, 4 and 6 hrs) was increased in parallel with boiling or soaking extraction time. Aqueous cinnamon and chamomile extracts prepared by soaking at room temperature had higher anti-inflammatory activity than that prepared by boiling.

Keywords: Inflammation-Anti-inflammatory – Cinnamon -Chamomile – Rats.

1- INTRODUCTION

Inflammation is the complex biological response of vascular tissues to harmful stimuli, such as pathogens, damaged cells, or irritants **(Ferrero-Miliani *et al.*, 2007).** Inflammation can be classified as either acute or chronic. Acute inflammation is the initial response of the body to harmful stimuli and is achieved by increased movement of plasma and leukocytes from the blood into the injured tissues. A cascade of biochemical events propagates and matures the inflammatory response, involving the local vascular system, the immune system,

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and various cells within the injured tissue. Acute inflammation is a short-term process, usually appearing within a few minutes or hours and ceasing upon the removal of the injurious stimulus **(Kumar, 1998)**. Signs of redness, increased heat, swelling, pain and loss of function **(Parakrama *et al.*, 2005)** characterize it**.** However, inflammation that has shows onset and persists for weeks or more is chronic. The symptoms are not as severe as with acute inflammation, but the condition is insidious and persistent. Chronic inflammation may follow on from acute inflammation or exist by itself. An acute inflammation will become chronic if the immune system is unable to rid the body of the offending foreign agent or if the agent is constantly able to reenter the body **(Kumar, 1998)**.

Cinnamon (*Cinnamomum cassia*) of the family Lauracease is known as Sweet Wood. It is a favorite spice around the world because of its health benefits, flavors and preserves food. It contains medicinally important essential oil in leaves, fruits inner and outer bark. Much of cinnamon's bioactivity resides in its oil, which is about 90% cinnamaldehyde **(Bown, 1995)**. Cinnamon possess chemopreventive, antispasmodic, sedative, hypothermic, choleretic, antibacterial, antifungal, antipyretic, antiviral, antiplatelet properties, antiseptic, lipolytic, anesthetic, cytotoxic, anodyne, hypolipidemic, and also stimulate immune system that may be useful adjuncts in helping to reduce the risk of cardiovascular disease and cancer **(Cralg, 1999).** The most favorite chemical constituents of cinnamon are volatile oil (cinnamaldehyde, eugenol, cinnamic acid, and weitherhin), mucilage, diterpenes and proanthocyanidins (**Jayaprakasha *et al.*, 2002)**.

Medicinally, cinnamon is used in the treatment of diarrhea **(Skidmore- Roth, 2003**), colic and colds, low vitality, poor appetite, rheumatism, kidney weakness and coldness, fevers, arthritic angina, and palpitations. It is externally used as a skin antiseptic to treat minor bacterial and fungal infections of the skin **(Aguilar, 1999*)***. Cinnamon bark have a potentiating effect on insulin **(Khan *et al.*, 1990)** and can be useful in the treatment of type 2 diabetes; as well as lowering triglyceride levels and serum cholesterol (**Onderoglu *et al.*, 1999; Broadhurst *et al.*, 2000 and Khan *et al.*, 2003).** Some of the plant constituents have shown effects against bacteria and fungi, including the molds that produce the carcinogenic aflatoxins ***(*Juglal *et al.*, 2002; McCann, 2003 and Gruenwald, 2004).** It is proven to effective against some species respiratory tract pathogens, including species belonging to the genera *Aspergillus, Candida, Cryptococcus* and *Histoplasma* **(Viollon and Chaumont, 1994; and Inouye *et al.*, 2001).**

Chamomile (*Matricaria chamomilla*) is used to treat various diseases, cancer **(Hernández-Ceruelos *et al.*, 2002),** diarrhea **(de la Motte *et al.*, 1997)**, and healing wound **(Glowania *et al.*, 1987)**. Chamomile flowers contain 0.24- to 2.0-percent volatile oil that is blue in color. The two enter constituents, (-)-alpha-

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bisabolol and chamazulene account for 50-65 percent of total volatile oil content. Other components of the oil include (-)-alpha-bisabolol oxide A and B, (-)-alpha-bisabolone oxide A, spiroethers (cis- and trans- en-yndicycloether), sesquiterpenes (anthecotulid), cadinene, farnesene, furfural, spathulenol, and proazulene (matricarin and matricin) **(European Pharmacopoeia, 1996).**

The constituents of chamomile have antimicrobial properties include alpha-bisabolol, luteolin, quercetin, and apigenin. Chamomile extracts blocks aggregation of *Helicobacter pylori* and various strains of *Escherichia coli* **(Annuk *et al.*, 1999)** and inhibits the growth of poliovirus and herpes virus. Chamomile esters and lactones demonstrate activity against *Mycobacterium tuberculosis* and *Mycobacterium avium*. Chamazulene, alpha-bisabolol, flavonoids, and umbelliferone display antifungal properties against *Trichophyton mentagrophytes* and *Trichophyton rubrum* **(Turi *et al.*, 1997).** Apigenin, alpha-bisabolol, and the cisspiroethers appear to provide the most significant antispasmodic effects. Other flavonoids and the small amount of coumarins contribute to smooth muscle relaxation **(Achterrath-Tuckermann *et al*., 1980).**

In the plant kingdom, nearly all plants are medicinal. Therefore, the present study was conducted to prepared aqueous extracts of cinnamon and chamomile by soaking at 100 C^{o} and room temperatures for various periods of times and was used to investigate whether the soaking temperature and soaking time during the preparation of extracts influence the content of total polyphenols and the anti-inflammatory effect on male rats.

2- MATERIALS AND METHODS

1-2- Materials:

1-2-1- Herbs: Cinnamon (*Cinnamomum cassia*) and chamomile (*Matricaria chamomilla*) were purchased as dried material from a local Company for Medicinal Plants and Herbs, Cairo, Egypt.

1-2-2- Animals: Male albino rats (n=100 rats), Sprague Dawley strain weighing 140±5g, were obtained from the Laboratory Animal Colony, Helwan, Egypt.

1-2-3-Chemicals: Casein, cellulose, vitamin mixture, mineral mixture and formalin were obtained from El-Gomhorya Company for Pharmaceutical and Chemical, Cairo, Egypt.

1-2-4- Drugs: Feldene (Piroxicam) is an anti-inflammatory agent was obtained in the form of ampoules from Pfizer Egypt Company, Cairo, Egypt.

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2-2- Methods:

2-2-1- Preparation of aqueous extracts*:*

The aqueous cinnamon and chamomile extracts were prepared using distilled water (1:10, W/V) as described by **Kassi *et al.*, (2004)**. Extracts were prepared by boiling prepared materials at 100 Cº for different times (i.e. 5, 15, 30, 45 and 60 minutes). Whereas, soaking extracting method was conduct for 3, 6, 9 and 12 hours at room temperature. Then, the aqueous extracts were filtered using cheesecloth and stored at -4°C until used.

2-2-2- Determination of total phenols:

Total phenols of different aqueous extracts of cinnamon and chamomile were determined by using Spectrophotometer apparatus according to the methods described by **Singleton and Rossi, (1965).**

2-2-3- Preparation of basal diet:

The basal diet (AIN-93M) was prepared according to **Reeves *et al.*, (1993).** It consists of casein 20%, soybean oil 5%, Choline chloride 0.20%, vitamin mixture 1.0%, mineral mixture 4.0%, fibers 5%, L-Cystine 0.18%, sucrose 10% and the reminder was corn starch.

2-2-4- Experimental design:

Animals were maintained under standard conditions of humidity, temperature and light (12-h light: 12-h dark cycle), fed on basal diet and water *ad libitum* for one week before starting the experimental for acclimatization. After acclimatization period (one week), all rats were randomly assigned to study anti-inflammatory effect of aqueous cinnamon and chamomile extracts.

Anti-inflammatory study was studied by the method described by **Northover and Subramanian, (1962)**. It depends upon induction of pedal inflammation in rats paw by 0.1ml of formalin 4%. After acclimatization period (one week), rats (n= 100) were divided as follows:

Group (1): Rats (n=5) were fed on the basal diet only, received orally 1 ml/100g of saline solution and kept as a positive control.

Group (2): Rats (n=5) were fed on the basal diet only, received orally 1 ml/100g of saline solution and kept as a standard group.

Group (3): Rats (n=90) were fed on the basal diet and given orally aqueous extracts by tube feeding for seven days at a volume of 1 ml/100g of body weight. This group was divided into four subgroups as followed:

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Subgroup (1): Divided into five subgroups (five animals each). Each subgroup was given orally aqueous cinnamon extracts prepared by boiling at 100Cº for different times (5, 15, 30, 45 and 60 min., respectively).

Subgroup (2): Divided into four subgroups (five animals each) and treated with aqueous cinnamon extracts prepared by soaking at room temperature for different times (3, 6, 9 and 12 hrs, respectively).

Subgroup (3): Divided into five subgroups (five animals each) and given orally aqueous extracts of chamomile prepared by boiling at 100Cº for different times (5, 15, 30, 45 and 60 min., respectively).

Subgroup (4): Divided into four subgroups (five animals each) and given orally aqueous chamomile extracts prepared by soaking at room temperature for different times (3, 6, 9 and 12 hrs, respectively).

At the end of experimental period (7 days), the second group was given (I/P) intraperioteneally Feldene (Piroxicam) as anti-inflammatory drug in a dose of 4 mg/kg of body weight. After one hour of the treatment, each rat in all groups was injected with 0.1 ml of formalin 4% in the plantar side of the left hind paw. The paw thickness caused by formalin was measured using skin caliber immediately and every two hours till 6 hours after injection. The difference between the initial and subsequent reading gave the actual edema volume. Anti-inflammatory effect was assessed by the reduction in the thickness of rat's paw.

2-2-5- Statistical analysis:

The results were expressed as mean ± SE and statistical significance was assessed using one-way analysis of variance (ANOVA) test according to **Snedecor and Cochran, (1980).**

3- RESULTS AND DISCUSSION

3-1- Effect of aqueous extraction methods on total phenols contents:

Total phenols in aqueous cinnamon and chamomile extracts prepared by boiling at 100 Cº and soaking at room temperature for different times are presented in Figures (1 and 2). Results showed that total phenols (mg/100ml) in all aqueous cinnamon extracts were higher than that of all aqueous chamomile extracts. Total phenols in all aqueous extracts were increased with increased extraction time, suggesting that soaking for a long period promoted extraction. This result was seminary agreed with that of **Xinguo *et al.*, (2006)** who reported that the total polyphenols in tea solutions increased with higher temperatures and longer soaking times. Results also, indicated that extraction by boiling at 100 Cº

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slightly decreased the total polyphenols content than the extraction by soaking at room temperature for different times. This result suggested that in the extraction at the 100°C a small amount of polyphenols was destroyed, or may be reacted with other components to form an insoluble complex or may be oxidized. This notion was proposed when polyphenols were extracted from seeds of Dolichos lablab **(Vijayakumari *et al.*, 1995).**

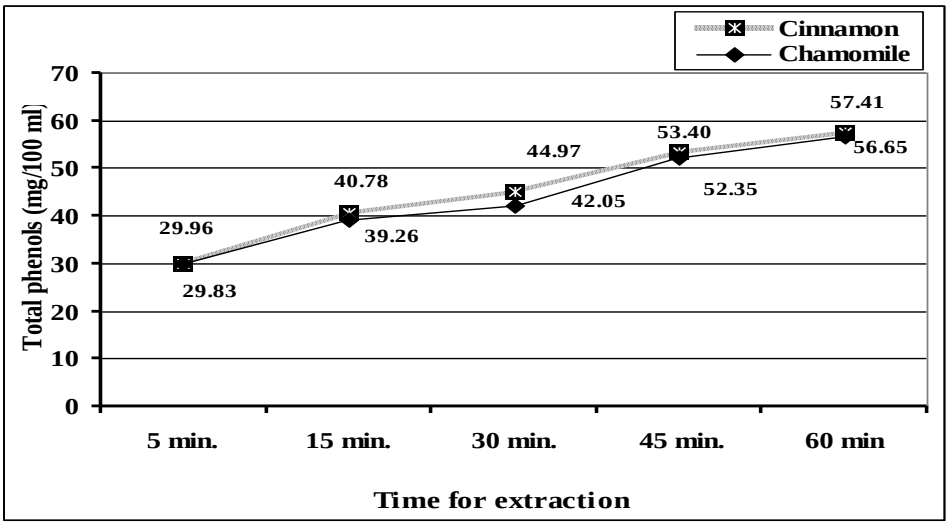

Figure (1): Total phenol content of cinnamon and chamomile extracts prepared by boiling for different times.

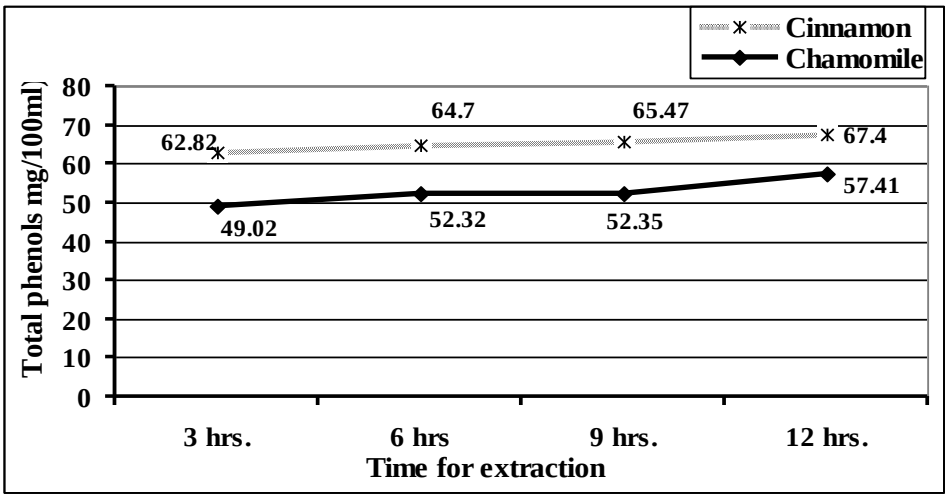

Figure (2): Total phenol contents of cinnamon and chamomile extracts prepared by soaking at room temperature for different times.

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3-2- Anti-inflammatory effect of aqueous cinnamon extracts:

The effect of aqueous extracts of cinnamon prepared by boiling at 100 C° for different times (5, 15, 30, 45 and 60 min) on paw's thickness (edema) in rats is shown in Table (1). The obtained results showed that rats given anti-inflammatory agent and rats given orally the aqueous cinnamon extracts at a volume of 1ml/100g of body weight had significant anti-inflammatory effect as compared to positive rats, 2, 4 and 6hrs post administration. Aqueous cinnamon extracts prepared by boiling for 45 and 60 minutes induced significant decreased in paw's thickness in rats as compared with anti-inflammatory agent as well as extraction for 5, 15 and 30 mins, 2 hrs post administration. At four hours post administration; no significant difference was observed in paw's thickness between rats given orally cinnamon extracts and standard group. Rats given orally cinnamon extract prepared by boiling for 5 min. had a significant increase in paw's thickness as compared to those treated with anti-inflammatory agent and with extracts prepared at 30, 45 and 60 minutes. There was a significant decrease in paw's thickness of rats given orally extract of cinnamon prepared by boiling for 60min as compared to standard group, 6hrs post administration.

Table (1): Effect of aqueous cinnamon extracts prepared by boiling for different times on the paw's thickness of rats.

Groups	Paw's thickness (mm) as Mean ± SE		
	2hr	4hr	6hr
Positive group	**a** 6.60±0.25	**a** 7.00±0.32	**a** 7.80±0.20
Standard group	**b** 5.80±0.20	**b** 4.60±0.25	**cd** 3.80±0.20
Treated groups Boiling time			
5 min.	**b** 5.60±0.19	**b** 4.80±0.30	**b** 4.40±0.19
15 min.	**b** 5.30±0.12	**b** 4.80±0.26	**bc** 4.20±0.12
30 min.	**b** 5.30±0.20	**b** 4.60±0.25	**cd** 3.80±0.20
45 min.	**c** 4.60±0.25	**b** 4.00±0.22	**de** 3.40±0.25
60 min.	**c** 4.40±0.25	**b** 4.00±0.32	**e** 3.20±0.12

-Different superscript letters in the same column denotes significant differences (p<0.05).
- SE: Standard Error.

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With regard to the anti-inflammatory effect of aqueous cinnamon extracts prepared by soaking at room temperature for different times on the paw's thickness of rats after induced pedal inflammation, results is recorded in Table (2). Results revealed that the anti-inflammatory agent not induced a significant anti-inflammatory effect as compared to positive group, 2 hrs post administration. The aqueous cinnamon extracts caused a significant anti-inflammatory effect as compared to anti-inflammatory agent and positive group after 2 hours of induced pedal inflammation. There was a significant decrease in paw's thickness of all rats given orally cinnamon extracts and standard rats given anti-inflammatory agent as compared to positive group, 4 and 6hrs post administrations. However, there were not significant differences in paw's thickness between rats given orally soaking aqueous cinnamon extracts and those given anti-inflammatory agent, 4 and 6hrs post administration. From the obtained data, it could be concluded that extraction for 60 min at 100 Cº and for 12 hrs at room temperature had the best results.

Table (2): Effect of aqueous cinnamon extracts prepared by soaking at room temperature for different times on the paw's thickness of rats.

Groups	Paw's thickness (mm) as Mean ± SE		
	2hr	**4hr**	**6hr**
Positive group	**a** 6.60±0.25	**a** 7.00±0.32	**a** 7.80±0.20
Standard group	**a** 5.80±0.20	**b** 4.60±0.25	**b** 3.80±0.20
Treated groups Soaking time			
3 hr.	**b** 4.80±0.37	**b** 4.20±0.20	**b** 4.00±0.16
6 hr.	**b** 4.80±0.37	**b** 4.10±0.19	**b** 4.00±0.36
9 hr.	**b** 4.40±0.19	**b** 4.00±0.22	**b** 3.60±0.25
12 hr.	**b** 4.20±0.26	**b** 3.80±0.37	**b** 3.40±0.25

-Different superscript letters in the same column denotes significant differences ($p<0.05$).
- SE: Standard Error.

In generally, results in Tables (1 and 2) revealed that the aqueous cinnamon extracts prepared by boiling at 100 Cº and soaking at room temperature for different times has a strong anti-inflammatory effect. This result was in

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accordance with those of **Atta and Alkofahi, (1998)** who showed cinnamon possess an anti-inflammatory effect against acute (xylene-induced ear oedema) and chronic (cotton-pellet granuloma) inflammation in rats. Inflammation induced by formalin may be related to a biphasic phenomenon. The first phase of edema is attributed to release of histamine and 5-hydroxytryptamine and second accelerating phase of swelling is attributed to prostaglandin like substances. The enzyme, phospholipase A2, is known to be responsible for the formation prostaglandins and leukotrienes as mediators of inflammation, which by attracting polymorphonuclear leucocytes to the site of inflammation would lead to tissue damage, probably by the release of free radicals. Phospholipase A2 converts phospholipids in the cell membrane into arachidonic acid, which is highly reactive and is rapidly metabolized by cycloxygenase (prostaglandin synthase) to prostaglandins, which are major components that induce pain and inflammation **(Higgs *et al.*, 1984).** Mechanism of anti-inflammatory effect of aqueous cinnamon extracts may be explained on basis of the inhibition of prostaglandins and the release of histamine. These results agreed with **Jonathan *et al.*, (2008)** who reported that cinnamon extract had significant effect in the inhibition of histamine release and synthesis of lipid-derived mediators. Cinnamon extract had a mixture of polymeric polyphenols **(Anderson *et al.*, 2004)** which has a potential role in regulating immune function **(Cralg, 1999)**, reduce inflammation **(Ames *et al.*, 1993 and Willett, 1994)** and possess antioxidant action that may prove beneficial against free radical damage to cell membranes **(Lee and Shibamoto, 2002).** Tristetraprolin (TTP/zinc finger protein 36) family proteins had anti-inflammatory effects by destabilizing proinflammatory mRNA. TTP was caused by the effect of polyphenols extract of cinnamon in adipocytes (**Heping *et al.*, 2008)**. Our data also found that, cinnamon aqueous extracts prepared by soaking at room temperature for different time had anti-inflammatory effect more than that prepared by boiling at 100 Cº for different times. These results may be explained on basis the higher content of total phenols and volatile oils in cinnamon aqueous extracts prepared by soaking at room temperature which had much of cinnamon's bioactivity **(Bown, 1995).** The constituents of volatile oil (cinnamaldehyde, eugenol, cinnamic acid and weitherhin), mucilage, diterpenes, and proanthocyanidins had antioxidant action which may prove beneficial against free radical damage to cell membranes **(Jayaprakasha *et al.*, 2002; Lee and Shibamoto, 2002 and Dragland *et al.*, 2003)**.

3-3- Anti-inflammatory effect of aqueous chamomile extracts:

The effect of aqueous chamomile extracts prepared by boiling at 100 Cº for different times (5, 15, 30, 45 and 60 min) on the paw's thickness in rats is shown in Table (3). Results showed that the anti-inflammatory agent and the aqueous

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chamomile extracts had significant anti-inflammatory effects as compared to positive group, 2, 4 and 6hrs post administration. There were no significant differences in paw's thickness between groups given orally aqueous chamomile extracts (1 ml/100g of body weight) and those given anti-inflammatory drug after 2, 4 or 6 hrs of induced pedal inflammation.

Table (3): Effect of aqueous chamomile extracts prepared by boiling at 100 C° for different times on the paw's thickness of rats.

Groups	Paw's thickness (mm) as Mean ± SE		
	2hr	4hr	6hr
Positive group	**a** 6.60±0.25	**a** 7.00±0.32	**a** 7.80±0.20
Standard group	**b** 5.80±0.20	**b** 4.60±0.25	**b** 3.80±0.20
Treated groups Boiling time			
5 min.	**b** 5.40±0.25	**b** 4.80±0.20	**b** 4.00±0.00
15 min.	**b** 5.30±0.30	**b** 4.60±0.25	**b** 4.00±0.00
30 min.	**b** 5.20±0.20	**b** 4.60±0.25	**b** 3.70±0.30
45 min.	**b** 5.20±0.20	**b** 4.50±0.32	**b** 3.60±0.25
60 min.	**b** 5.20±0.20	**b** 4.40±0.25	**b** 3.40±0.25

-Different superscript letters in the same column denotes significant differences ($p<0.05$).
- SE: Standard Error.

As shown in Table (4) results revealed that anti-inflammatory agent and aqueous chamomile extracts prepared by soaking at room temperature for different times (3,6, 9 and 12 hrs.) induced significant decreased in paw's thickness of rats after induction of pedal inflammation as compared to positive group, 2, 4 and 6hrs post administration. Aqueous chamomile extracts prepared by soaking for 6, 9 and 12 hrs had significant anti-inflammatory effect after 2 hrs of induced pedal inflammation as compared to anti-inflammatory drug. There was no significant differences in paw's thickness in rats given orally aqueous extracts and those given anti-inflammatory agent, 4 and 6 hrs post administration. The anti-inflammatory effect of aqueous chamomile extracts prepared by soaking for 12 hrs was significantly increased as compared to standard inflammatory drug, 6 hrs post administration.

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Table (4): Effect of aqueous chamomile extracts prepared by soaking at room temperature for different times on the paw's thickness of rats.

Groups	Paw's thickness (mm) as Mean ± SE		
	2hr	4hr	6hr
Positive group	**a** 6.60±0.25	**a** 7.00±0.32	**a** 7.80±0.20
Standard group	**b** 5.80±0.20	**b** 4.60±0.25	**b** 3.80±0.20
Treated groups **Soaking time**			
3 hr.	**bc** 5.40±0.19	**b** 4.60±0.19	**b** 4.20±0.12
6 hr.	**cd** 5.20±0.20	**b** 4.40±0.25	**b** 4.10±0.01
9 hr.	**cd** 5.20±0.12	**b** 4.20±0.20	**b** 3.80±0.26
12 hr.	**d** 4.80±0.12	**b** 4.00±0.16	**c** 3.20±0.12

-Different superscript letters in the same column denotes significant differences ($p<0.05$).
- SE: Standard Error.

Generally results indicated aqueous chamomile extracts prepared by boiling at 100 Cº and soaking at room temperature for different times had significant anti-inflammatory effect. Anti-inflammatory effect of aqueous chamomile extracts was increased by increasing time of extraction. These results may be explained on basis the content of total phenols, which increased with increasing extraction time. These results agreed with those of **Hernandez-Ceruelos *et al.*, (2002),** who reported that chamomile (*Matricaria chamomilla*) is used to treat various diseases such as inflammation and cancer**.** Chamomile was found to be effective as hydrocortisone and demonstrated superior activity to bufexamac and fluocortin butyl ester **(Aertgeerts *et al.*, 1985).** *In vitro*, chamomile extract inhibits both cyclooxygenase and lipoxygenase, and consequently prostaglandins and leukotrienes **(Hormann and Korting, 1994).** Anti-inflammatory effect of aqueous chamomile extracts could be attributed to its components. Azulenes (chamazulene, prochamazulene, and guaiazulene) influence on the pituitary and adrenals, increasing cortisone release and reducing histamine release **(Berry, 1995).** Flavonoids, including apigenin, chamazulene and α-bisabolol contents in whole plant chamomile extract. The flavones act as anti-inflammatory agents due to interfering with the arachidonic acid pathway **(Hadly and Petry, 1999).** Salicylic acid in the form of a methyl ester provides an anti-inflammatory effect **(Pistorius *et al.*, 2003).**

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Data also revealed that aqueous chamomile extracts prepared by soaking at room temperature for different times had strong anti-inflammatory effect as compared to boiling at 100 Cº. These results may be related to the higher content of polyphenols and the presence of volatile oil in these extracts, which may be destroyed by heat. This result accorded with **Szelenyi and Isaac, (1979)** who reported that the high alpha-bisabolol contents in chamomile oil provide the majority of anti-inflammatory. Polyphenols may reduce inflammation and stimuli immune system **(Ascherio et al., (1992) and Dragsted et al., (1993).**

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التأثير الواقي لمستخلص القرفه والبابونج كمضاد للالتهاب في ذكور الفئران

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المستخلص

تعتبر القرفة من الأعشاب المعروفة في العالم وذلك لطعمها الحلو والفوائد الصحيه وتأثيرها الحافظ للأطعمه. كما أن البابونج له العديد من الفوائد الصحية في علاج الكثير من الأمراض مثل الاسهال، السرطان وعلاج الجروح. ولقد أجريت الدراسة لمعرفة تأثير طريقة تحضير مستخلص القرفة والبابونج عن طريق الغليان في١٠٠م ° والنقع في درجة حرارة الغرفة علي محتواهم من الفينولات وتأثيرهم المضاد للألتهاب في ذكور الفئران. ولقد أجريت الدراسة علي ١٠٠ فأر ذكر وزن ١٤٠± ٥ جم. وتم دراسة التأثير المضاد للألتهاب بأستخدام الفورمالين (٤%) وذلك لأحداث الألتهاب في أرجل الفئران. ولقد اظهرت نتائج الدراسه بأن الفينولات الموجوده في مستخلص القرفه والبابونج المحضرة بالنقع في درجة حرارة الغرفة لفترات مختلفه يكون أعلي من الفينولات الموجودة في المستخلصات المحضرة بالغليان. كما أظهرات النتائج بأن جميع المستخلصات لها تاثير معنوي فعال كمضاد للألتهابات وان هذا التأثير يزداد مع زيادة مدة الاستخلاص. كما أظهرت النتائج أن التأثير المضاد للألتهاب للمستخلصات المحضر بالنقع والذي يظهر من خلال تقليل سمك الالتهاب في أرجل الفئران بعد ٢، ٤و٦ساعات من إحداث الألتهاب يكون أفضل كمقارنة بالمستخلصات المحضره بالغليان.

الكلمات المفتاحيه: الالتهابات – مضادات الالتهاب – القرفه – البابونج – الفئران.

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