

The effect of many plant extracts on the peristalsis of small intestine in the rabbit.

Maha K, AL jameel , Tahani A, AL sandook

Department of Dental Basic Sciences , College of Dentistry , University of Mosul , Mosul , Iraq

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Abstract

Many plant extracts (PEX) required to treat moderate to severe acute and chronic intestinal pain or diseases. The use of plant extracts give many effects such as inhibitions or activator of gastrointestinal motility (peristalsis). Inhibition of intestinal peristalsis is done by many plants like *Ceratonia siliqua* (Carob) while activation of intestinal peristalsis is done by others plants such as *Senna alexandrina* (Senna or *Leguminosae*) and *Salvia officinalis* (*Labiatae*). The main purpose of using Senna is to treat acute constipation, also they use in slimming and laxative herbs. Because of their effects on gut motility is little known; therefore, the effects of low concentration (0.05, 0.1, 0.15, 0.2, 0.25) gm/L, and High concentration (0.3, 0.35, 0.4, 0.45, 0.5) gm/L of these extracts on intestinal peristalsis *in vitro* and their mechanisms of action were examined. Peristalsis was recorded in fluid-perfused segments of the rabbit small intestine.

The use of aqueous plant extracts and alcohol plant extracts give similar effects to all types of the plants, and all concentrations, with superiority effect of aqueous plant extracts than alcohol plant extracts.

Note : (1, 2, 3, 4, 5, 6, 7, 8, 9, 10) ml of stock solution = (0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5) gm/L concentration of each plant extract.

Key words: plant extracts (PEX), Carob, *Salvia*, Senna, peristalsis movement, inhibitions or activities of gastrointestinal motility, low concentration, High concentration, aqueous plant extracts, alcohol plant extracts.

Introduction

Generally smooth muscle makes up the visceral or involuntary muscle of intestine. The innervations of smooth muscle of intestine is provided by the autonomic nervous system, there are two responses in smooth muscle, many smooth muscle respond by constant contraction with long period called tonic contraction, another one called phasic contraction, its respond by short and constant contraction, with inhibition (1).

Two broad types of smooth muscle can be distinguished on the basis of the type of stimulus which results in contraction and the specificity with which individual smooth muscle cells react to the stimulus:

1. The multiunit type represents functionally independent smooth muscle cells which are often innervated by a single nerve terminal and which never contract spontaneously e.g. smooth muscle in the walls of blood vessels (2).

2. The visceral type represents bundles of smooth muscle cells connected by gap junctions, which contract spontaneously if stretched beyond a certain limit e.g. smooth muscle in the walls of the intestines blood vessels (3).

3. Originally, Senna was identified as a way of releasing the bloating and constipation and known to be a safe drug tested by the physicians. Also, when used in proper conditions, it could help patients suffering from chronic constipation (4). The Senna (*Senna alexandrina*) additives are known as stimulants, and drugs in this category stimulate intestinal motility and/or affect epithelial transport of water and electrolytes as anthranoids (5), and to irritate the interior and act as an aid to bowel movement. Senna, which has many other names such as *Cassia Angustifolia*, helps this process by stimulating of intestinal peristalsis, flushing out the

toxins from the body. The nature of Senna is to act as a laxative and to agitate the inner lining of the intestine to execute the process. The mechanism of the herb, Senna (*Senna alexandrina*) comes from a shrub with yellow flowers. Many consumerism diet sites are presenting this information, and these sites involve importing dry Senna leaves from India, China, and Arabic nations in order to sell their products. None are FDA approved, and may be seriously dangerous if not used with caution (6).

In medicine Senna have for millennia played a major role in herbalism and folk medicine, Senna act as purgatives and are similar to aloe, Senna is used in modern medicine as a laxative, acting on the lower bowel, it is especially useful in alleviating constipation (7). Senna increases the peristaltic movements of the intestine by irritating the intestinal mucosa. The plants are most often prepared as an infusion (8). Senna is also the primary ingredient found in most "diet, er's teas". The combination of acting as a stimulant which reduces a dieter's appetite, and the laxative properties that cause food to move through their system before as many calories can be absorbed is a combination that can lead to rapid and even dangerous weight loss (9). The stimulant action of sennosides should be taken into account for those who suffer from any conditions where stimulants are contraindicated, such as past heart disease, high blood pressure, anxiety attacks, etc. A generally invisible and harmless side effect of taking Senna medication regularly is Melanosis coli, a brown discoloration of the colon wall (5).

Dried *Salvia officinalis* (sage) leaf is used as a culinary spice and as a source of sage oil, which is obtained by steam distillation. Traditionally, sage and its oil have been used for the treatment of a wide range of illnesses; the name salvia derives from the

Latin word meaning "healthy" or "to heal". Extracts and teas have been used to treat digestive disorders, as a tonic and antispasmodic. The plant has been employed topically as an antiseptic and astringent and has been used to manage excessive sweating. Sage has been used internally as a tea for the treatment of gastritis (10).

Sage promotes good digestion and is considered one of the best remedies for stomach troubles (11). Sage stimulates the appetite, eases gas pains, removes mucus in the stomach, relieves biliousness and dyspepsia, and is beneficial in digesting foods of all kinds, both savory and sweet (12). Its bitter component stimulates upper digestive secretions, increasing bile flow and pancreatic function, and it is said to keep the stomach, intestines, kidneys, liver, spleen and sexual organs healthy (6).

Carob (*Ceratonia siliqua*) the fruit of a small evergreen tree indigenous to the Mediterranean region; it is used mainly as a material for distilling or as animal feeding. Carob is rich in calcium, potassium and phosphorus. It was included vitamins and tannin therefore its use medically as anti spasmodic, also as a tea for digestive complaints, flatulence, inflammation of the intestinal mucosa, in diarrhea. (9).

Materials And Methods

Preparation of Water Extract and Sterilization:

Forty grams of dry plants were placed in 160 ml of sterile distilled water and left at room temperature for 24 hours, the mixture was filtered; firstly by gauze and secondly by filter paper (Whatman No. 1). After filtration it was placed into incubator at 40°C. The liquid has evaporated, and the precipitated extract was left at the base of beaker. Five ml distilled water was added to 1 gram of plant extract powder to produce 200 mg/ml as standard concentration. Sterilization was carried out by passing through a sterile filter membrane 0.22 micrometer (13). The standard concentration (stock solution) was used to prepare other concentrations.

These concentrations are (0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5) gm/L.

Preparation of Ethanol Extract and Sterilization:

Twenty grams of dry plants was soaked in 200 ml of ethanol. The same procedure as in water extract was applied but the solvent for extraction was 95% ethanol. Five ml of Dimethyl Sulfoxide was added to 1 g of plant extract powder and sterilized by pasteurization (14). The same concentrations were prepared as in water extract.

Experimental animals :

Healthy rabbits type *Oryctolagus Cuniculus* of either sex weighting 1.5-1.75 Kg were selected for the study (15 animals). The animals were housed under laboratory condition at temperature (22± 2) °C with a natural light / dark cycle and fed with standard diet, vegetable, crushed wheat, corn and water. Until the time of experiment. Animals were sacrificed after cervical dislocation, and the ileum was excised,

flushed of lumen content and placed in Tyrodes solution at room temperature gassed with 95% O₂ and 5% CO₂ until use (use the electrical aerator).

Preparations of intestinal segments:

For studying peristalsis, the distal small intestine was divided into segments, each being approximately (2-3) cm long. The intestinal segments were set up in parallel in organ bath containing normal physiological fluid (Tyrodes solution) 50ml at 37°C for half hours before experiment to stabilize the tissue. Record the activity of intestinal smooth muscle by using Chromatography device, after fixation the segment in organ bath and the intestinal segments was tied to an inflow cannula, which permitted to continuous infusion of per warmed standard solution at flow rate 0.5 ml/minute. After basal peristaltic activity had been recorded for at least 30 minute, the plant extracts to be tested were administered to the bath on the surface of intestinal segments by disposable syringe (5ml), variety plant extracts administered on the surface of intestinal segments from low concentration (1ml, 2ml, 3ml, 4ml), and continues administered to the high concentration (5ml, 6ml, 7ml, 8ml, 9ml) until reach 10ml (15).

Results

The present study showed under control condition regular peristalsis contraction of intestine which were recorded stayed constant which not influenced by the addition of (Tyrodes solution), the peristalsis movement was evaluated after administration senna extract on the solution (Tyrodes solution) on intestinal segments of rabbits inside the organ bath; this evaluation increase when added another higher concentration until reach 10ml (0.5) gm/L. Also there was same effect enhance when add *Salvia officinalis* extract, while there was very clear inhibitor effect when add carob extract as it's become visible in following figures. Note that this activity (evaluation or inhibition) similar in aquatic extracts or alcohol extracts.

Figure 1: recording the effect of senna extract on the intestinal motility after added (1, 2, 3, 4, 5, 6, 7, 8, 9, 10) ml, from stock solution at concentration (0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5) gm/L of *Senna alexandrina* extract to the organ bath and this concentration lead to an increase of peristalsis movement in a concentration – related manner, while tyrodes solution did not affected on peristalsis contraction of isolated segments perfusion of the rabbits small intestine, slowly increased the intraluminal pressure; when the peristaltic pressure threshold (PPT) marked. (PPT) was transiently enhanced by 1 ml, a more pronounced increase of PPT was caused by 3, 4, 5, 6, ----- 10 ml of senna extract. An increase in the frequency of peristaltic waves was also observed. Spike like increase of intraluminal pressure was triggered.

Figure 2 : recording the effect of *Salvia officinalis* (Labiatae) extract on the intestinal motility after added it at (1, 2, 3, 4, 5, 6, 7, 8, 9, 10) ml, at


concentration (0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5) gm/L to the organ bath and this concentration lead to an increase of peristalsis movement in a concentration-related manner, while tyroid solution did not affected on peristalsis contraction of isolated segments perfusion of the rabbits small intestine

Figure 3: demonstrated that the peristalsis movement was already inhibited by adding low concentration of *Ceratonia siliqua* (Carob) (1, 2, 3, 4, 5) ml (0.05, 0.1, 0.15, 0.2, 0.25) gm/L, then the inhibition increase after add more concentrations of carob extract or high concentrations (6, 7, 8, 9) ml,

(0.3, 0.35, 0.4, 0.45) gm/L, and the peristalsis movement as complete, absence of any motor activity after added high concentration of carob extract (10 ml, 0.5) gm/L).

Note :

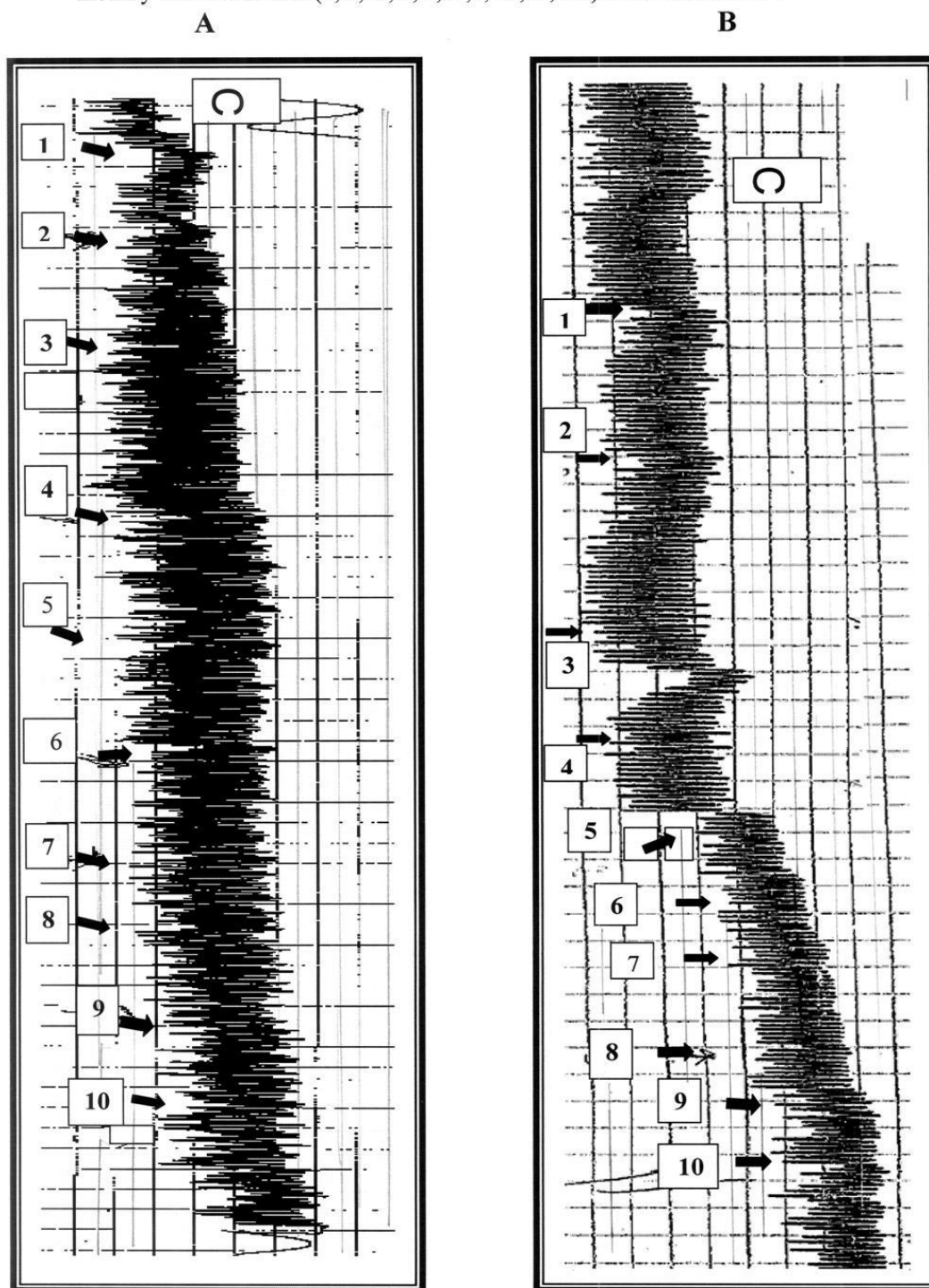
C = control .

Arrow () indicate the pointed of adding the plants extracts concentrations.

A = aqueous plant extracts.

B = alcohol plant extracts .

Figure 1: Recording the continuous effect of senna extract on the intestinal motility after added it at (1, 2, 3, 4, 5, 6, 7, 8, 9, 10) ml concentration .



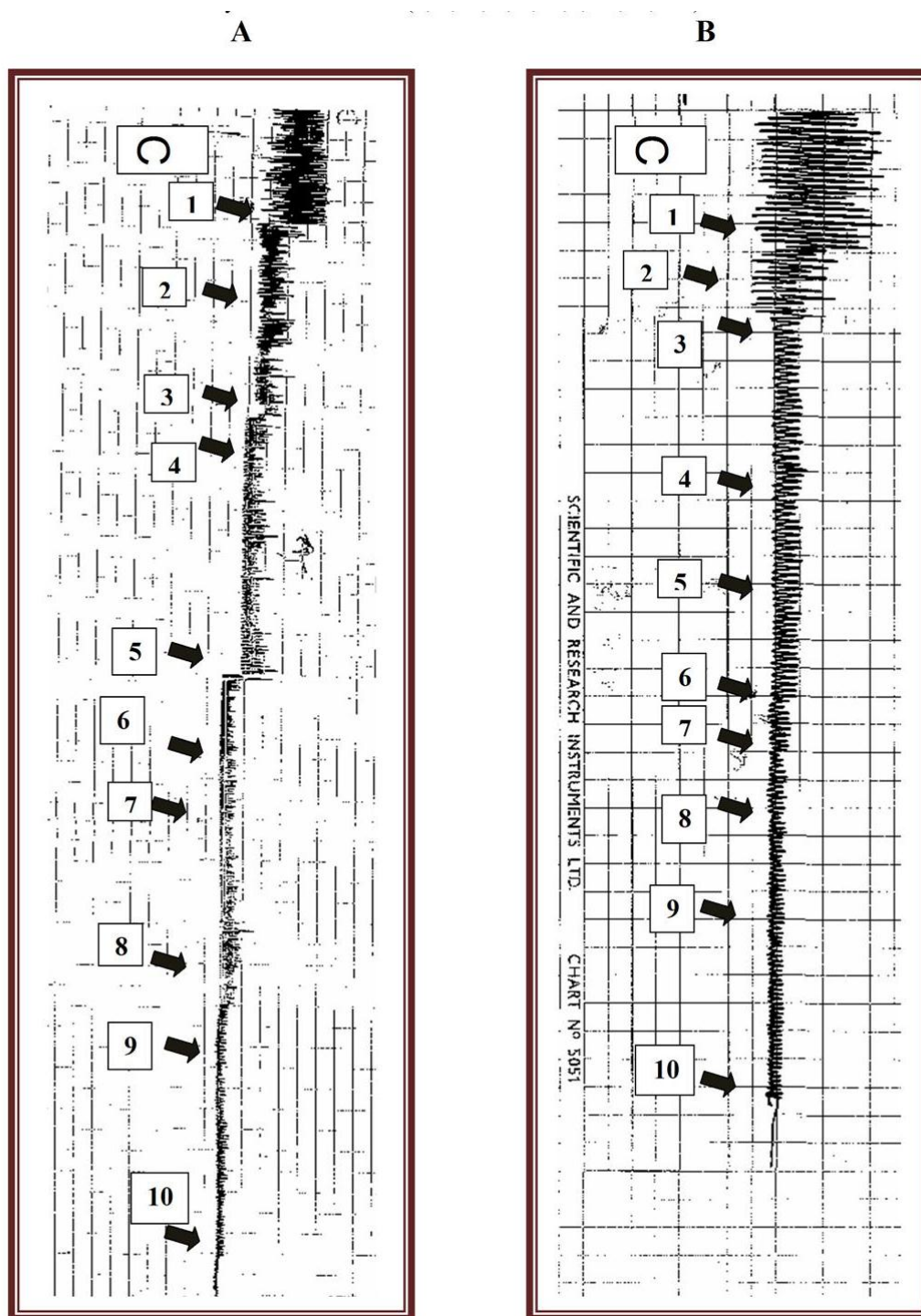


Figure 2 : Recording the continuous effect of (*Salvia* or *Sega*) extract on the intestinal motility after added it at (1, 2, 3, 4, 5, 6, 7, 8, 9, 10) ml concentration .

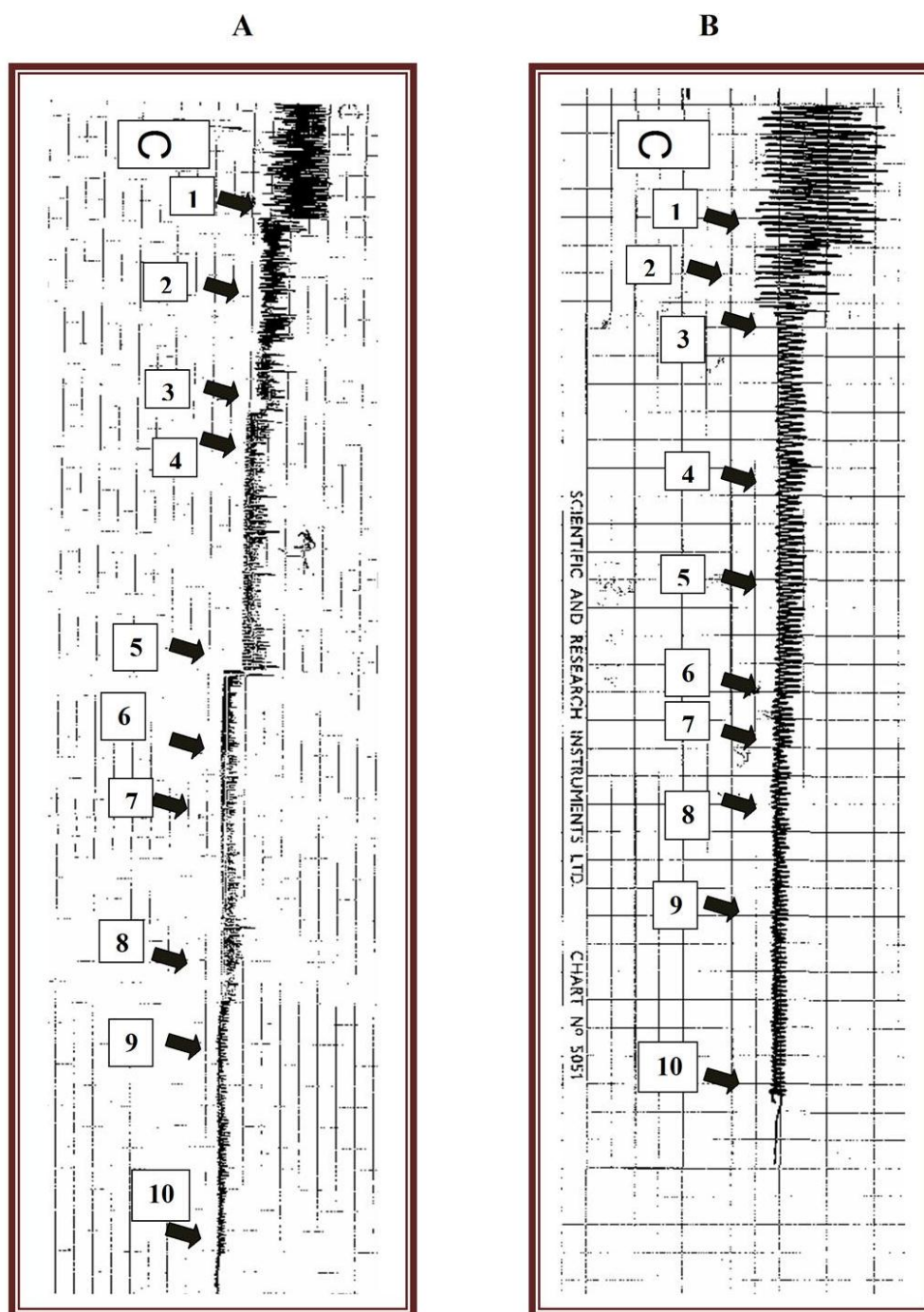


Figure 3: Recording the continuous effect of carob extract on the intestinal motility after added it at (1, 2, 3, 4, 5, 6, 7, 8, 9, 10) ml concentration

Discussion

This study demonstrate that the senna extract promote intestinal peristalsis movement in a concentration – dependent manner as deduced from an increase in the peristaltic pressure threshold and this result agreement with others study that suggest that senna extract encourage intestinal peristalsis contraction in a concentration – dependent (4). The present of intestine which study showed under control condition regular peristalsis contraction were recorded stayed constant which not influenced by the

addition of (Tyroid solution) , the peristalsis movement was evaluated after administration senna extract on the solution (Tyroid solution) on intestinal segments of rabbits inside the organ bath, this evaluation increase when added another higher concentration until reach 10ml (0.5 gm/L) . The study found that the high concentration of senna extract enhance the intestinal peristalsis movement and this result agree with others study that suggest the patient suffering sever constipation treated with senna which increase the motility of intestine, (16). The

medicinal action of Senna can be attributed mainly to the anthraquinone glycosides, especially sennoside A and B. The breakdown of the anthraquinone glycosides in the digestive tract can occur in two ways. One; The glycosides are not absorbed in the upper gut but are converted by the micro flora of the large intestine into active aglycones, principally rhein anthrone, which exert a laxative effect on the lower part of intestine (8). Alternatively, in the presence of bile and the sugar, the free aglycone can be absorbed into the blood stream and secreted later into the colon. The final result is stimulation of the Auerbach plexus of the intestinal wall resulting in increased intestinal muscle contraction. In addition, its mucilage content decreases absorption of fluid leading to an enhancement of the final laxative action (9). Its action being chiefly on the lower bowel, especially suitable in habitual constiveness. It increases the peristaltic movements of the intestine by its local action upon the intestinal wall (17). Senna is a safe laxative used after surgical operations, after confinement, in the constipation of the feeble, and in many cases of inactive bowels, among infants and children (4).

The effect of *Salvia officinalis* (sage or *Labiatae*) extract on the intestinal motility after added it at (1, 2, 3, 4, 5, 6, 7, 8, 9, 10) ml, at concentration (0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5) gm/L to the organ bath and this concentration lead to an increase of peristalsis movement in a concentration-related manner, while tyrold solution did not affected on peristalsis contraction of isolated segments perfusion of the rabbits small intestine. The action of sage extracts on the tissues of small intestine similar to the action of Senna extracts, there is some evidence that sage oil may exert a centrally mediated antisecretory action, the carminative effect

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تأثير بعض المستخلصات النباتية في حركة التحوي للأمعاء الدقيقة في الأرنب

مها خالد يوسف الجميل ، تهاني عبد العزيز الصندوق

قسم العلوم الأساسية ' كلية طب الأسنان ' جامعة الموصل ، موصل ، العراق

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الملخص

تستخدم بعض المستخلصات النباتية لعلاج حالات الألم المعوي والأمراض المعوية الحادة والمزمنة ، إن استخدام هذه المستخلصات النباتية لها عدة تأثيرات في حركة التحوي للأمعاء الدقيقة وحتى المعدة ، منها تنشيط أو تثبيط حركة التحوي للأمعاء الدقيقة ، أن تثبيط الحركة تحدث نتيجة لفعالية بعض المستخلصات النباتية مثل الخروب (المعروف بالجنجل) ، بينما تنشيط حركة التحوي للأمعاء تنتج عن فعالية أنواع أخرى من المستخلصات النباتية مثل سنا مكي والميرامية .

أن أهم غاية لاستخدام السنا مكي والميرامية هو لعلاج حالات الإمساك الحادة كذلك تستخدم في مستحضرات التحفيز وتخفيف الوزن لفعاليتها الواضحة في زيادة حركة الأمعاء الدقيقة. ولأن تأثيرات هذه المستخلصات النباتية في حركة التحوي للأمعاء غير معروفة بشكل دقيق وعلمي فقد أجريت هذه الدراسة لمعرفة التأثيرات المختلفة لبعض المستخلصات النباتية التي ذكرت في التحضيرات المخبرية للأمعاء الدقيقة خارج الجسم وبطريقة غمر قطع الأمعاء الدقيقة في سائل حمام العضو الخاص بالحيوان (الأرنب) وتسجيل الحركة على جهاز الكايوموكراف.

وقد أظهرت النتائج أن التراكيز الواطئة من المستخلصات النباتية المنشطة (0.05, 0.1, 0.15, 0.2, 0.25) gm/L أدت إلى تعزيز النشاط التقلصي الإيقاعي ، في حين أدى زيادة التركيز (0.3, 0.35, 0.4, 0.45, 0.5) gm/L إلى إحداث زيادة في تعزيز النشاط التقلصي الإيقاعي ، كما أدى إعطاء التركيز العالي 0.5 gm/L بحجم 10 مل إلى النشاط التقلصي الإيقاعي التام . بينما أدى استخدام المستخلصات النباتية المثبطة إلى تثبيط النشاط التقلصي الإيقاعي للأمعاء وبالاغتماد على التركيز .

لوحظ إن زيادة النشاط التقلصي الإيقاعي تكون متشابهة في المستخلص المائي والمستخلص الكحولي لجميع المستخلصات النباتية ولجميع التراكيز مع ملاحظة تفوق النشاط الإيقاعي للعضلات المعاملة بالمستخلص المائي على العضلات المعاملة بالمستخلص الكحولي.