

**A SERIES IN MEDICINAL EFFECTS OF WILD PLANTS OF SAUDI
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**2a- EFFECT OF WATER EXTRACT OF *Cassia senna* ON THE
SPONTANEOUS ACTIVITY OF LOCUST FOREGUT AND
HINDGUT MUSCLES**

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**BIOLOGY DEPARTMENT, FACULTY OF APPLIED SCIENCES,
UMM AL-QURA UNIVERSITY, MAKKAH, P.O.BOX 3711, SAUDI
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*The abstract of this paper was presented in international symposium on
Herbal Medicine, King Fahad Hospital, Jeddah, Saudi Arabia, 1997*

***Allcorrespondence should be addressed**

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**Key Words: Locust (*Locusta migratoria*), Foregut, Hindgut, Muscle
Contracture, Water Extract (Aqueous Water), *Cassia senna*,
Spontaneous Activity (Spt.Act).**

ABSTRACT: The present study showed that foregut and hindgut spontaneous activities of locust (*Locusta migratoria*) differed and the intact foregut was more active than the intact hindgut. This could be due to inherent differences in their muscle structure and innervation systems. It may be concluded that aqueous extract of *C. senna* at lower doses caused enhancement in muscle responses. However, at higher doses it inhibited

both fore- and hindgut natural activities and induced muscle contractions. This could be due to anthrone glycosides / sennoside components or both of them altering electrolyte transport *via* cell membrane which will affect involuntary muscle responses. In addition, *C. senna* aqueous extracts may act as a stimulant laxative on muscles naturally activated, whereas, it may slow the hindgut motility. Moreover, the effect of Mg^{2+} -ions may be counteracted by Ca^{2+} -ions. The release transmitted by electrical and mechanical process requiring influx of Ca^{2+} . *C. senna* aqueous extract is shown to interact with 5-HT and initially enhances the effect of 5-HT but it gradually decreased it. This may suggest that senna may act on the same receptors and may have an antagonistic effect on 5-HT at high doses.

INTRODUCTION

Cassia senna (*C. senna*) is a leguminous wild plant growing in mountains and valleys of Southern Hijaz in Saudi Arabia (Migahid, 1978). It is also found growing between the rocks and sandy soil in many mountains and valleys of Makkah (Meelad, 1983 & 1987). Furthermore, it was also found in Sinai desert, Egypt, Sudan and India in similar habitats (Hussain, 1979). There are many Arabic local names for senna plant such as Sanamakky, Ishriq, Sanah and Al-Sana Al-Haramea (Meelad, 1987). Ibnghaem Al-Gawzeyah (1957) recorded medicinal attributes of

aqueous extracts of the leaves of *C. senna*; being used as laxative and remedy for scabies and itching. Recent studies indicate that various leaf extracts of this plant contain anthraquinone glycosides “Sennoside A, B, C and D”, which is a laxative agent, as well as some tannins, sterols, mucilages (Al-Masry, 1975; Hussain, 1979) and various ions such as; Na⁺, K⁺, Ca²⁺ and Mg²⁺ (Patel, *et al*, 1980; Meelad, 1983).

Ablordeppey and Ayim (1983) reported that the preparations of *C. acutifolia* and *C. podocarpa*, used as laxatives in West African traditional medicine were based on plant extraction by boiling in water, removal of free anthraquinones by extraction, hydrolysis of the glycosides with HCl-FeCl₃, and extraction with ethanol. The extraction was evaporated, the residue dissolved in alkaline solution (pH 9), and the absorbance detection at 500 nm. However, in this present study *C. senna* aqueous extract was used as being used in Saudi Arabia traditional medicine, with little modification, and was based on dried leave aqueous extractions after heated the water at 60 °C then *C. senna* leaves were added. The aqueous extract was filtered and left to cool down, then used without additions of chemicals or alcohol. Water extract was directly applied on the suspended tissues in the organ bath to record its effect in term of muscle contractions.

Most studies on *C. senna* extract, so far, have been conducted on human and other mammalian (Vogel, 1975; Ablordeppey & Ayim, 1983). In order to extend our knowledge about the bioactivity of this medicinal plant, the present study is carried to investigate the effect of *C. senna* aqueous extract on the spontaneous activity (Spt.act) of locust (*Locusta migratoria*) foregut and hindgut visceral muscles.

MATERIALS AND METHODS

Collection of plant leaves: Leaves of *C. senna* (were taken from top, middle and bottom of the plant) of twenty different shrubs growing in different areas (mountains and valleys) of Makkah region, Saudi Arabia, were collected. The leaves were dried in the electric oven at 70 °C for 24 hours before being ground to a fine powder in an electric food grinder (Moulinex).

Aqueous extract of leaves powder: Approximately 10 g of leaves powder was added to 200 ml of distilled water and heated at 60 °C for a period of one hour on a water bath then filtered.

Muscle preparations: Adult locusts of both sexes, reared in a laboratory culture, were used in the present study. The insect colony was maintained at 27 °C and fed daily on green barley or grass with water supplied *ad libitum*. The present study followed same procedures of Mutwally and Jamel Al-Layl

(1992) in term of dissection both muscles, saline preparations and method protocols, which were used to maintain the muscles *in vitro*.

Three different volumes of 0.25, 0.5 and 1 ml (representing approximately 12.5, 25 and 50 mg of dried powder) were chosen to established low and high dose effect of the extract on the contractile activity of the muscles. Senna extract was directly added to the muscles, which were suspended in the organ bath.

RESULTS

Separate additions of (0.25, 0.5 and 1 ml) *C. senna* aqueous extract of mountain samples decreased normal activities of locust hindgut visceral muscles and slightly enhanced that of the foregut (Figure 1). It also lowered the base line tension of foregut muscle and slightly caused muscle contractions. One ml addition of senna aqueous extracts induced large contraction of foregut muscle and it became more active than the control. On the other hand, the hindgut Spt.act was inhibited gradually as the doses of the aqueous extract increased. Both muscles resumed their normal activities after washout with normal saline and became more active (Figure 1). Similarly, separate additions of senna aqueous extracts (0.25, 0.5 and 1 ml) of valley samples dropped the base line tension and decreased Spt.act of foregut muscle, while the addition of 1 ml aqueous extract induced clear

contractions accompanied with small twitches. In addition, the inhibitory effect of this aqueous extract was stronger on hindgut muscle. Upon returning to normal saline, foregut muscles resumed their activities faster than the hindgut muscles (Figure 2).

The cumulative additions of *C. senna* extract of mountain sample inhibited the foregut muscle natural activities gradually, while 3 time additions 1ml each, the aqueous extract dropped the base line tension and severely inhibited foregut Spt.act. On the other hand, hindgut muscle natural activities were abolished with cumulative additions of *C. senna* extracts. After washout with normal saline, both muscles returned to normal state (Figure 3). The natural activities of both compartments of locust guts were severely inhibited with cumulative additions of *C. senna* extract of valley samples. The base line tensions of foregut muscles were lowered, while 3 time additions 1 ml each, of the extract caused large contracture. All muscles returned to normal state after washing with normal saline (Figure 4).

In Figure 5, Spt.act of both locust visceral muscles of locust gut were increased with serotonin (5-HT) treatments ($10^{-5}M$, $10^{-4}M$ and $5 \times 10^{-4}M$). At low concentrations, 5-HT dropped foregut muscles base line tensions, but at high concentrations, it induced muscle contractures. After washing with

normal saline both visceral muscles resumed thenormal activities. Although, pre-treatment of locust foregut with *C. senna* extract of both samples inhibited Spt.act, lowered base line tension and enhanced the excitatory effect of 5-HT. The effect of senna extract of the mountain sample on 5-HT was stronger than those from that of valley. In addition, post-treatment of locust foregut with *C. senna* extract of mountain sample increased the effect of 5-HT while those from the valley sample decreased it. The foregut muscles retained to normal activities faster after washing with normal saline (Figure 6).

On the contrary, pre-treatment of locust hindgut with *C. senna* extract of mountain sample decreased Spt.act more than that of the valley sample. In addition, 5-HT treatments induced muscle contractures and their excitatory effect were clearly enhanced with *C. senna* extract of valley sample than those from mountain sample. The post-treatment of *C. senna* extract of both samples inhibited the effect of 5-HT. The hindgut muscles Spt.act treated with *C. senna* extract of valley sample retained to their normal activities faster than those of mountain sample after washing with normal saline (Figure 7).

DISCUSSION

Effect of senna extracts on the spontaneous activity of the locust gut

Locusta migratoria foregut and hindgut differed in their muscle structures, innervations and Spt.act. The intact foregut was more active than the intact hindgut. (Mutwally & Jamel Al-Layl, 1992). Mutwally (1990) reported that locust foregut has reasonably homogenous longitudinal muscles and well-developed circular muscles, whereas, the hindgut longitudinal muscles are exceptionally well developed compared with the circular muscles (Dunbar, 1980). The locust foregut was naturally active and shows continuous small amplitude rhythms, whereas the hindgut shows cycles of strong contraction interrupted by often quite considerable periods of quiescence. This could be due to the exceptionally well-developed longitudinal muscles (Oldfield & Huddart, 1982; Mutwally & Jamel Al-Layl, 1992).

In *Locusta*, these normal activities (Spt.act) and the EC-coupling of both gut divisions are dependent upon influx of $[Ca^{2+}]_o$ which will induced $[Ca^{2+}]_i$ release (Bianchi, 1969; Huddart, 1975; Huddart, 1985; Irvine, 1986; Mutwally, 1990 & 1994). Mutwally (1994) showed that natural activities of both sections of locust gut in the absence of $[Ca^{2+}]_o$ were severely inhibited, and on returning to normal saline both muscles resumed their natural activities. The results of this study are in agreement with above observations.

Mel'nikova, *et al* (1978) concluded that the fruit values (obtained after threshing of the mature fruits and removal of seeds) of *C. acutifolia* had a high laxative activity in mice. Lower efficacy of the whole fruits compared to the fruit values was due to the seeds, which reportedly do not contain anthracene derivatives. The present study used aqueous extract of leaves of mature *C. senna*, which clearly shows strong inhibitory actions on Spt.act of locust muscles.

Possible effects of glycosides contained in senna extract

El-Gengaihi, *et al* (1975) reported that the percentage of anthraquinone [84-65-1] glycosides in senna decreased with the increase in area and age of leaves and pods, the decrease being sharp at maturity. Hesse (1971) reported that senna extract contains other compounds, which allow normal sleeping rhythm and are useful in the prophylaxis of drug abuse (suicides by sleeping tablets). Gritsanapan (1983) reported that sixteen species of *Cassia* in Thailand contain several anthraquinone compounds, which are used as purgative and laxative drugs, such as aloe-emodin, chrysophanic acid, emodin, physion, sennosides *etc.*

Andre (1967) concluded that the laxative compositions of senna were useful in treatment of chronic and occasional constipation, cholitis *etc.*, the dose was 0.25 - 2 spoonfuls of powder leaves with coffee daily.

Hardcastle and Wilkins (1970) reported that intraluminally administered senna glycosides, but the incubation of senna with faeces did not change the motility of the human colon or *Escherichia coli* stimulated the colon to contract. The peristalsis was similar to that stimulated by rheinanthrone (I) which affected colon by contact stimulation.

The undesirable side-reactions of senna overdose were regarded to the higher effect of primary glycosides also to breakdown products of the sennoside, particularly anthrone glycosides, which irritate the intestinal mucosa (Richter, 1966). The present studies goes in harmony with previous results of Andre (1967), and the inhibitory effect of senna extract on locust muscles were dose-dependent. This action was stronger on the hindgut muscles. Moreover, the effect of aqueous extract of *C. senna* of mountain sample stimulated the foregut muscle to contract, but the inhibitory effect was strong when the valley sample were used, this could be due to cations and contents concentration of both samples. After washing with normal saline, both muscles resumed their normal activities faster and stronger than control, this may be due to ionic compositions and may also to flushes of anthrone glycosides / sennosides components.

Vogel (1975) concluded that the extracts of plants such as *Rhamnus frangula* and *senna* caused dose-dependent decreases in gastrointestinal

motility of mammalian. Moreover, ethereal oils such as menthol [89-78-1] and borneol [464-45-9] caused dose-dependent decreases in bile flow. Also, central nervous system (CNS), depressants which increase hexobarbital sleeping-time in mice had unpredictable effects in combination with these oils. The inhibitory effect of *C. senna* aqueous extract on Spt.act of locust both muscle indicated that they might have comparable actions as on mammalian gut tissues.

Possible effects of electrolytes in senna extracts

Lohar, *et al* (1979) reported that a fall in the sennoside content was shown during the rainy season, which was due to the leaching effect of rain. After the rain, the newly sprouted leaves contained a very high percentage of sennosides. The present studies showed that *C. senna* aqueous extracts of valley samples caused a remarkable inhibitory effect than those of mountain samples. These results may be due to anthrone glycosides / sennoside products or combination of them by altering electrolyte transport *via* cell membrane through Na^+/K^+ -transporting ATPase, thus affecting locust gut muscle responses. Moreover, inhibitory responses of the gut muscles may be due to the high contents of cations especially Mg^{2+} present in the senna extract. In addition, Patel, *et al* (1980) recorded that different *Cassia* species have varying levels of cations. Moreover, Meelad (1987) reported that *C.*

senna of Saudi Arabia (Makkah area) contained several cations and anthraquinone compounds, and have similar functions as other *Cassia* species.

Magnesium sulphate, a saline laxative which is poorly absorbed from the digestive tract thus retaining water by osmosis and increases the peristalsis indirectly. This brings a fairly rapid onset of action within 2-3 hours. The effect of Mg^{2+} -ions may be counteracted by Ca^{2+} -ions (Bowman & Rand, 1984). Foster (1990) reported that muscle contraction, which is evoked by electrical and mechanical processes, requires influx of Ca^{2+} . The intensity of contraction depends whether the extracellular fluid is deficient in Ca^{2+} -ion or containing Mg^{2+} . Mutwally (1994; Mutwally, 1997, Under publication) concluded that in locust, Mg^{2+} -ions are competing with Ca^{2+} -ions on their ionic channels located on cell membrane and causing muscle contraction failure even in the presence of the excitatory agent 5-HT. The present observation is in agreement with previous studies, and the inhibitory actions of *C. senna* aqueous extracts may be due to anthraquinone compounds / sennoside products and Mg^{2+} -ions which may interfere with 5-HT-action on muscles cell membrane.

The contents in the small intestine are liquid. The small bowel, caecum and the proximal colon absorb Na^+ , K^+ and Cl^- and most of the

water. The distal colon absorbs Na^+ in exchange for K^+ . Emollient laxatives act by direct softening of the fae, by a lowering of surface tension thereby facilitating the penetration of water (Bowman & Rand, 1984). The locust saline (2 mM) used, in this study, contained all these cations and anion, mentioned above, dissolved in distilled water and adjusted to pH 6.8 at room temperature ($\sim 20 - 25 \text{ }^\circ\text{C}$). Moreover, the addition of senna aqueous extract into the organ bath, all these may stimulate the locust foregut and hindgut muscles motility. It may be concluded that both locust preparations are Ca^{2+} -dependent, and Na^+ - K^+ -ions are essential in initiation of muscle depolarization and muscle contractions (Huddart, 1975; Dunbar, 1980; Mutwally, 1990; 1993 & 1994).

Foster (1990) reported that the stimulant laxatives act by altering water and electrolyte transport as well as stimulating intestinal motility. In addition, bacteria in the colon to the active aglycone metabolize senna extract. The chronic use of laxatives results in an atonic, sluggish bowel and therefore is contra-indicated. Increased colonic or small intestinal propulsive motility and altered electrolyte transport promote defecation (Bowman & Rand, 1984; Foster, 1990).

Possible interaction of senna components with serotonin

The indolalkylamine (serotonin, 5-HT) was found in insect and was implicated in neuromuscular transmission in visceral muscles. Mutwally (1990; 1993 & 1994) reported the presence of 5-HT as the only consistent excitatory agent suggesting the presence of 5-HT-receptor. This observation allows the use of 5-HT as an indicator to study the effect of *C. senna* aqueous extract on locust gut muscles. It was also found that 5-HT excites the foregut and the hindgut of locusts and cockroaches (Brown, 1965; Freeman, 1966; Hiripi & Rozsa, 1973; Mutwally, 1990). In addition, removal of the nervous system from the heart and gut of both cockroach and locust, does not significantly affect 5-HT induced responses (Cook, *et al*, 1969; Huddart, 1985). 5-HT may have an effect on both pre- and post-synaptic junction of the foregut muscles. Foster (1990) reported that the release transmitted by electrical and mechanical process requires influx of Ca^{2+} . Mutwally (1990) considered 5-HT in locust foregut muscles as a normal autonomic transmitter / modulator agent.

Dale and Court (1981) reported that over 20 aminoacids were detected in 9 *Cassia* species seeds. Assane, *et al* (1994) used *C. italica* leaves and pods extract on guinea pigs intestinal motility *in vitro*. They

found that the plant extract stimulates the intestinal contractions in a dose-dependent relation and its contractile activity was comparable to ACh which was acting similarly but inhibited by atropine. In the present study, pre-treatments with *C. senna* aqueous extract inhibited the Spt.act of both sections of the locust gut and lowered the muscle base line tensions, this could be species and muscle structure differences.

In presence of senna extract the excitatory effect of 5-HT was stronger on the foregut muscle. This could be due to changes in water and electrolyte transport as well as activation of intestinal motility by laxative stimulant through cell membrane. In contrast, post-treatments with *C. senna* aqueous extract of both samples inhibited the enhancement of the excitatory effect of 5-HT in both gut muscles, this action was stronger on hindgut muscle. This may be due to interference between *C. senna* aqueous extract and 5-HT action on cell membrane of both gut muscles. Moreover, *C. senna* aqueous extract is shown to interact with 5-HT and initially enhances the effect of 5-HT but it gradually decreased it. This may suggest that senna may act on the same receptors and may have an antagonist effect on 5-HT. After washout with normal saline, foregut muscles retained their normal activities faster than hindgut muscles. This action may be due to fast refilling of intracellular Ca^{2+} -stores, which may confirm that *C. senna* aqueous extract

acted strongly on hindgut muscles. Further studies are needed on this medicinal herb to gain more knowledge about its physiological mechanism.

ACKNOWLEDGMENTS

During the sabbatical leave of the first author (H.M.) part of the experimental work was carried out in the laboratory of Dr. H. Huddart, Department of Biology, Lancaster University, UK. Authors would like to extend their thanks for providing the facilities for this study. The first author is grateful to Dr. T. Mustafa at the Institute of Biology, Odense University, Denmark, for his valuable discussions during the writing of this manuscript.

REFERENCES

- Ablordeppey**, S.Y.S. and Ayim, J.S.K. (1983) Some problems associated with the quantitative analysis of crude hydroxyanthraquinone drugs. *Chem. Abst.*, Vol. 100: 39671c.
- Al-Masry**, H. (1975) Al-Aqrabazin wa almostahdarat alsaydalaniah (Pharmacology and phormaceutic preparations). First Ed., Dar Al-Qualm, Al-Kuwait.
- Andre**, R. (1967) Laxative compositions. *Chem. Abst.*, Vol. 71: 42291s.
- Assane, M.; Nydyema, R.; Bassene, E.; Sere, A. and Gaye, O. (1994) Purgative activity of *Cassia italica*. *Dakar Med.*, Vol. 39 (2): 125-128.

- Bianchi**, C.P. (1969) Pharmacology of excitation-contraction coupling muscle. *Federation Proceedings*. Vol. 28 no. 5: 1524-1627.
- Bowman**, W.C. and Rand, M.J. (1984) Textbook of pharmacology. Second edition, Blackwell scientific publication. London.
- Brown**, B.E. (1965) Pharmacologically active constituents of the cockroach corpus cardiacum: Resolution and some characteristics. *Gen. Comp. Endocrinol.*, Vol. 5: 387-401.
- Cook**, B.J., Eraker, J. and Anderson, G.R. (1969) The effect of various biogenic amines on the activity of the foregut of the cockroach *Blaberus giganteus*. *J. Insect Physiol.*, Vol. 15: 445-455.
- Dale**, T. and Court, W.E. (1981) Amino acids of *Cassia* seeds. *Chem. Abst.*, Vol. 95: 21281u.
- Dunbar**, S.J. (1980) The morphology and neurophysiology of an insect visceral muscle. (Ph.D. Thesis), Lancaster University. U.K.
- El-Gengaihi**, S.; Agiza, A.H. and El-Hamidi (1975) Distribution of anthraquinones in senna plants. *Chem. Abst.*, Vol. 83: 120720v.
- Foster**, R.W. (1990) Basic pharmacology. Second Ed. Butterworths. London.

- Freeman, M.A.** (1966) The effect of drugs on the alimentary canal of the African migratory locust *Locusta migratoria*. *Comp. Biochem. Physiol.*, Vol. 17: 755- 764.
- Gritsanapan, W.** (1983) Anthraquinone compounds of *Cassia* species growing in Thailand. *Chem. Abst.*, Vol. 101: 207551e.
- Hardcastle, D.J., Wilkins, L.J.** (1970) Action of sennosides and related compounds on human colon and rectum. *Chem. Abst.*, Vol. 74: 123593f.
- Hesse, G.** (1971) Laxative-hypnotic drug combinations. *Chem. Abst.*, Vol. 78: 62189n.
- Hiripi, L. and Rozsa, K.S.** (1973) Fluorimetric determination of 5-hydroxytryptamine and catecholamines in the central nervous system and heart of *Locusta migratoria migratorioides*. *J. Insect Physiol.*, Vol. 19: 1481-1485.
- Huddart, H.** (1975) Comparative structure and function of muscle. Pergamon Press. Oxford.
- Huddart, H.** (1985) Visceral muscle. Chapter 5. In "Comprehensive insect physiology, biochemistry and pharmacology. Vol. 11. Kerkut, G.A. and Gilbert, L.L. (Ed.). Pergamon Press. Oxford.

- Hussain, F.** (1979) *Al-Nabatat Al-tipeia wa ziraatiha wa Mokawinatih* (Medicinal plants, their cultivation and constituents), (Arabic). Al-Doar Al-Arabia for books, Tunisia.
- Ibnghaem Al-Gawzeyah, S.H.** (1957) *Altib Al-Nabawi* (Prophetical Medicine) (Arabic). Dar Ihya Al-Turath Al-Arabia, Beirut.
- Irvine, R.F.** (1986) Calcium transients : Mobilization of intracellular Ca^{2+} . *Br. Med. Bull.*, Vol. 42 no. 4: 369-374.
- Lohar, D.R.L.; Bhatia, R.K.; Garg, S.P. and Chawan, D.D.** (1979) Seasonal variation in the content of sennoside in senna leaves. *Chem. Abst.*, Vol. 90: 148537j.
- Meelad, M.H.** (1983) Some biological effects of gamma irradiation on *Cassia senna*. Ms. Thesis. Department of Biological Sciences. Faculty of Science, King Abdul Aziz University, Jeddah, Saudi Arabia.
- Meelad, M.H.** (1987) Some floristic and chemotaxonomic studies of the flowering plants of Makkah. Ph.D. Thesis. Department of Biological Sciences. University of Salford, Salford, U.K.
- Mel'nikova, N.N.; Yatsyno, A.I. and Shreter, G.K.** (1978) Fruit of *Cassia acutifolia* cultivated in the USSR a new type of drug raw material. *Chem. Abst.*, Vol. 89: 94915q.

Migahid, A.M. (1978) Flora of Saudi Arabia. Second Ed., Vol. 1, Riyadh University, Riyadh, Saudi Arabia.

Mutwally, H.M.A. (1990) The structure, innervation and function of locust foregut visceral muscles. (Ph.D. Thesis). Biological Department, Lancaster University, U.K.

Mutwally, H.M.A. (1993) The effect of some biogenic amines on the spontaneous activity of locust (*Locusta migratoria*) foregut and hindgut visceral muscles. *J. Egypt Ger. Soc. Zool. Comp. Physiol.*, Vol. 11 (A): 47-56.

Mutwally, H.M.A. (1994) The effect of Mg^{2+} on spontaneous activity of foregut and hindgut muscles of *Locusta migratoria*. *J. Facu. Edu Ain Shams Univ. Press*, Vol. 19: 1-12.

Mutwally, H.M.A. (1997) The effect of Mg^{2+} on K^{+} -contracture and field stimulation responses of foregut and hindgut muscles of *Locusta migratoria*. (Under publication: *Inst. Res. & Revival Islamic Heritage Appl. Sci. & Eng. Res. Center, Makkah, Saudi Arabia*).

Mutwally, H.M.A. and Jamel Al-Layl, K.S. (1992) The effect of cyanobacterial neurotoxin on the locust (*Locusta migratoria*) foregut and hindgut visceral muscles. *J. Egypt Ger. Soc. Zool. Comp. Physiol.*, Vol. 9 (A): 203-220.

Oldfield, A.C. and Huddart, H. (1982) Spontaneous activity of foregut and hindgut of locust (*Locusta migratoria*). 1- Normal activity and the effect of KCl depolarization and glutamate. *Comp. Biochem. Physiol.*, Vol. 37 (C): 298- 302.

Patel, M.R.; Agrawal, Y.K. and Raj, K.P.S. (1980) Varying content of metals in four leafy drugs. *Chem. Abst.*, Vol. 94: 109179g.

Richter, G. (1966) Side effect of senna preparation. *Chem. Abst.*, Vol. 67: 25370s.

Vogel, G. (1975) Predictability of the activity of the drug combinations, Yes or No. *Chem. Abst.*, Vol. 83: 188401x.

دراسات على التأثيرات الطبية للنباتات البرية في المملكة العربية السعودية
2- أثر المستخلص المائي لنبات السنامكي على الانقباضات التلقائية لعضلات المعى
الأمامية والخلفية للجراد الصحراوي

حامد محمد عبد القادر متولي* و محمد محمد حسن ميلاد

قسم الأحياء، كلية العلوم التطبيقية، جامعة أم القرى، مكة المكرمة، ص.ب. ٣٧١١،
المملكة العربية السعودية

الملخص:

أظهرت نتائج هذا البحث الاختلافات الواضحة في الانقباضات العضلية التلقائية الطبيعية لكلا معى الجراد
الأمامية والخلفية حيث كان النشاط العضلي للأمعاء الأمامية أقوى من نشاط عضلات الأمعاء الخلفية، قد يكون هذا
بسبب الاختلافات الجوهرية في التركيب العضلي والتوزيع العصبي لكليهما. كذلك أكدت هذه الدراسة أن الانقباضات
العضلية لكلا معى الجراد تعتمد على أيونات الكالسيوم الخارجية والتي تحفز إطلاق أيونات الكالسيوم الداخلية من
مخازنها .

ومن نتائج هذا البحث، وجد أن إضافة جرعات بسيطة من المستخلص المائي لأوراق السنامكي سببت
زيادة في الانقباضات العضلية الطبيعية لكلا معى الجراد، في حين أنها قد تثبطت عند إضافة جرعات عالية من نفس
المستخلص المائي، هذا يحتمل أن يكون نتيجة لوجود مركبات الانثرون جليكوسيد / سينوسيد أو كلاهما والتي قد تؤثر
على انتقال العناصر المتأينة عبر الغشاء الخلوي مؤثرة على الانقباضات العضلية .

إضافة المستخلص المائي كان له أثرا مهيجا على عضلات الأمعاء الأمامية إلا أنها تثبطت الانقباضات
الطبيعية للأمعاء الخلفية. كذلك وجد أن تأثير أيونات المغنيسيوم يحتمل أن يتحكم بها أيونات الكالسيوم، وأن التنبهات
المنبعثة عن الموصلات الكهربائية والعضلية تتطلب دخول أيونات كالسيوم والتي قد تثبط في حالة نقص تركيز
الكالسيوم في الوسط الفسيولوجي الخارجي أو عند احتوائه على أيونات المغنيسيوم، كل هذا قد يسبب إخفاقا في
أحداث الانقباضات العضلية وأن تواجد مركب المنشط السيروتونين (5-HT) كذلك وجد أن المستخلص المائي
يحدث تزايدا أوليا في أثر مركب السيروتونين ولكنه سرعان ما يثبط تدريجيا. تقترح هذه النتائج أن المستخلص المائي
للسنامكي يحتمل أنه يؤثر على نفس المستقبلات العصبية والعضلية لمركب السيروتونين وكذلك يحتمل أن يكون له
تأثير مضاد لنفس المركب .

FIGURE LEGEANDES

FIGURE 1: Separate additions of aqueous extract of *C. senna* of mountain samples (250 ml, 500 ml and 1 ml). A) Locust foregut muscles increased their Spt.act. B) Hindgut Spt.act was inhibited. After washout (W) with normal saline both muscles resumed their normal activities faster and stronger. Calibration, tension and time scales applies to all traces (n = 8).

FIGURE 2: Separate additions of *C. senna* extract of valley samples (250 ml, 500 ml and 1 ml) inhibited the Spt.act of both muscles, and lowered that of foregut muscle base line tensions (A). The inhibitory effect was stronger on hindgut muscles (B). After washout (W) with normal saline both muscles resumed their normal activities faster and stronger. Calibration, tension and time scales applies to all traces (n = 8).

FIGURE 3: Cumulative additions of *C. senna* extract of mountain samples (250 ml, 500 ml and 1 ml) dropped foregut muscle base line tensions and inhibited Spt.act of both muscles (A). The inhibitory effect was stronger on hindgut muscles (B). After washout (W) with normal saline both muscles resumed their normal activities faster and stronger. Calibration, tension and time scales applies to all traces (n = 8).

FIGURE 4: Cumulative additions of *C. senna* extract of valley samples (250 ml, 500 ml and 1 ml / valley areas) aqueous extract dropped foregut muscle base line tensions and inhibited Spt.act of both muscles (A). The inhibitory effect was stronger on hindgut muscles (B). After washout (W) with normal saline, foregut muscles returned to normal activity faster and stronger than hindgut muscles. Calibration, tension and time scales applies to all traces (n = 8).

FIGURE 5: Shows the effect of 5-HT (10^{-5} M, 10^{-4} M and 5×10^{-4} M) on foregut (a-c) and hindgut (d-f) muscles Spt.act. At low concentrations, 5-HT enhanced Spt.act and lowered foregut muscle base line tension, while at high concentration it increased Spt.act and caused muscle contractures. After washout (W) with normal saline, foregut muscles resumed their normal activities faster than hindgut muscles. Calibration, tension and time scales applies to all traces (n = 8).

FIGURE 6: Shows the effect of 10^{-5} M 5-HT on foregut muscles (A-control). Although, pre-treatment of locust foregut with *C. senna* extract of mountain (1 & 2) and valley (3) samples (250 ml and 500 ml) dropped foregut muscles base line tension and inhibited their Spt.act, yet they increased 5-HT effect. (B) Similar actions were seen in post-treatment of foregut muscle with *C. senna* additions of both samples (1 & 2). After washout (W) with normal saline, foregut muscles resumed their normal activities faster and stronger than initial control. Calibration, tension and time scales applies to all traces (n = 8).

FIGURE 7: Shows the effect of 10^{-5} M 5-HT on hindgut muscles (A-control). Pre-treatment of hindgut muscle with *C. senna* extract of mountain (1 & 2) and valley (3) samples (250 ml and 500 ml) decreased hindgut Spt.act more than those of valley sample (3). The enhancements of 5-HT were increased with those of the valley samples. The post-treatment of hindgut muscle (B) of *C. senna* extract additions of both samples (1 & 2) inhibited the enhancements of 5-HT additions. After washout (W) with normal saline, foregut muscles resumed their normal activities faster and stronger than initial control. Calibration, tension and time scales applies to all traces (n = 8).