

MYOSTIMULATING EFFECT OF *SESAMUM RADIATUM* AQUEOUS LEAF EXTRACT IN ISOLATED GUINEA-PIG *TAENIA CAECI* CONTRACTILE ACTIVITY

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Abstract

This study was carried to examine the effects of the aqueous leaf extract of *Sesamum radiatum*, a laxative plant on the contractile activity of *Taenia caeci*, an intestinal smooth muscle. Strips of *Taenia caeci* were rapidly removed from guinea-pig and were suspended between two L-shaped stainless steel hooks in a 10 ml organ bath with Mac Ewen solution. The isometric contractile force of the *Taenia caeci* strips were recorded by using a strain gauge. *S. radiatum* aqueous leaf extract (ESera) is a spasmogenic substance. This myostimulant effect is characterized by the increase of the rhythm and the amplitude of isolated guinea-pig *Taenia caeci* smooth muscle in normal solution and by the development of contracture in modified solution and in solution without calcium. A similar effect was observed with ACh which caused a graded increase of the contractile activity of *Taenia caeci*. The effects induced by ESera and ACh were reversed in the presence of atropine. The spasmogenic effect induced by ESera could justify partially the use of *S. radiatum* as laxative in traditional medicine.

Key words: *Sesamum radiatum*, acetylcholine, *Taenia caeci*, contractile activity

Background

Commonly named "Sésame noir" in French and "Black sesame" in English, *Sesamum radiatum* Schum. & Thonn. is a plant of the family of Pedaliaceae. In Côte d'Ivoire, this plant species grows on the whole territory and even on the lands and around habitations (Adjanohoun and Aké-Assi, 1979). The plant is often used by populations to facilitate childbirth (Bellomaria and Kacou, 1995; N'Guessan, 2000) and to take care of sprains (Gautier-Beguine, 1992). The leaves are also used as laxative (Kerharo and Adams, 1974) and as antidote to heal stings of scorpions (Gautier-Beguine, 1992).

We undertook the survey of the biologic effects of the aqueous leaf extract of *S. radiatum* (ESera). Those works showed that *S. radiatum*, according to the classification of Diezi (1989), is a toxic plant (Konan, 2008). The lethal doses 50 % (LD₅₀) were 166 ± 8 mg/kg b.w. by the method of Miller and Tainter (1944) and 184.2 ± 12 mg/kg b.w. by the method of Dragsted and Lang (1957). However, this toxicity could not constitute a handicap to its therapeutic use because any pharmacodynamic substance is relatively toxic (Lüllmann *et al.*, 1998). The phytochemical screening of the leaves revealed the presence of saponins, quinones, catechic tannins, sterols, terpenes, polyphenols, flavonoids and reducing compounds (Konan, 2008; Konan *et al.*, 2008). The aqueous leaf extract (ESera) induced a dose-dependent hypotension resulting from cardiodepression and vasorelaxation (Konan *et al.*, 2006). The vascular relaxation was endothelium-dependent and mainly involves nitric oxide (NO) pathway (Konan *et al.*, 2008). The hypotension induced by ESera was favourable to childbirth (Konan *et al.*, 2008). ESera has a uterotonic action. This uterotonic effect was characterized by the increases of the basal tone, force and frequency of contractions of the isolated uterine smooth muscle of pregnant rat (Konan, 2008). These results would be in favour of its use in traditional medicine to facilitate childbirth.

S. radiatum is a laxative plant (Kerharo and Adams, 1974). It has been demonstrated that the medicinal plants possessing laxative property could trigger an acceleration of the intestinal transit (Kamgang *et al.*, 2001; Méité *et al.*, 2010). This acceleration of the peristaltic movements is partly due to the increase of the intestinal contractile activity. In this study, we examined the effects of the aqueous leaf extract (ESera), compared with those of acetylcholine (ACh) on the contractile activity of *Taenia caeci* isolated from guinea-pig.

Materials and methods

Plant

Sesamum radiatum Schum. & Thonn. (Pedaliaceae) was collected in October 2005 from farms specialized in growing plants for scientific or medicinal purposes. The leaves of *S. radiatum* were verified to be identical sample at the National Herbarium Centre of Côte d'Ivoire at Cocody University in Abidjan. Voucher specimen were preserved and

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catalogued in the same herbarium (Voucher specimen n° 8948, *Sesamum radiatum* L. of 17 June 1966 and *Sesamum radiatum* voucher n° 11616 of June 1974 in Dabou). This pantropical plant was authenticated by a Botany expert, Prof. Aké-Assi Laurent of the National Herbarium Centre, UFR-Biosciences, University of Cocody, in Abidjan, Côte d'Ivoire.

Preparation of the aqueous leaf extract (ESera)

The collected leaves were dried at room temperature (Temperature: $27 \pm 3^\circ\text{C}$). The powdered leaves (100 g) were first macerated for 24 hours in *n*-hexane to remove chlorophyll and other hexane soluble substances. The residue was dried and extracted by vigorous magnetic shaking in bi-distilled water for 24 hours. After two hours extraction and filtration, the filtrate was concentrated by evaporation ($50 \pm 5^\circ\text{C}$) of the solvent in a drying oven. The extract (ESera) (yield) obtained was stored at 4°C until use (Konan et al., 2008).

Animals

Guinea-pigs (*Cavia porcellus*), of both sexes weighing between 350 g and 400 g were obtained from the Animal House of Laboratory of Nutrition and Pharmacology of UFR-Biosciences at Cocody University in Abidjan (Côte d'Ivoire). The guinea-pigs were housed at a constant room temperature with a light/dark cycle of 14/10 hours. The animals were fed and given water *ad libitum*.

Preparation of *Taenia caeci* strips

After sacrifice of animals, by cervical dislocation, a median laparotomy was done. The *Taenia caeci* was rapidly removed, and after being freed from connected tissue, it was cut into longitudinal strips (6-7 mm of length). The *Taenia caeci* strips were immediately placed in a Mac Ewen solution (at room temperature) of the following composition [(mM): NaCl: 130; KCl: 2.5; CaCl_2 : 2.4; NaH_2PO_4 : 1.18; NaHCO_3 : 11.9; MgCl_2 : 0.24; glucose: 2.2). The solution was kept at a temperature of 35°C and saturated with 95 % O_2 and 5 % CO_2 , yielding a pH of 7.4.

Recording of the contractile activity of *Taenia caeci* strips

The preparations were suspended between two L-shaped stainless steel hooks in a 10 ml organ bath with Mac Ewen solution at 37°C (pH = 7.4). Each preparation was connected by a silk thread to a force transducer FT30 HSE (Hugo Sachs Elektronik, Freiburg, Germany). This strain gauge was connected to an amplifier D 79232 (HSE, Freiburg, Germany), connected to a diagram recorder Rikadenki (HSE, Freiburg, Germany). The isometric force was transcribed on recording paper at a speed of 2.5 mm/min. After the equilibration period of 60 min, the time necessary for stabilization of the contractile movements, the concentrations to be tested were injected directly into the organ bath containing the oxygenated physiological solution.

The *Taenia caeci* strips were exposed to ESera and ACh separately. These substances were added to the organ bath cumulatively (Gilani et al., 2010). To study the influences of atropine (ATR), the preparations were pre-treated to this substance for 30 min before the applications of the extract and acetylcholine. To assess whether the spasmogenic activities of the test substances were through calcium channel, the tissue (*Taenia caeci* strip) was allowed to stabilize in normal Mac Ewen solution, which was then replaced with Ca^{++} -free solution containing EGTA (30 μM) for 30 min to remove Ca^{++} from the tissue. The Ca^{++} -free solution was obtained with the salts used to prepare normal Mac Ewen solution but without CaCl_2 . To confirm this hypothesis, High- K^+ solution (70 mM) containing EGTA (30 μM) was used to depolarize the preparations (Farre et al., 1991). High- K^+ solution was obtained by substituting 70 mM NaCl with KCl.

Chemicals used

Acetylcholine (ACh), atropine (ATR) and ethyleneglycol-bis(aminoethyl ether) *N,N,N',N'*-tetraacetic acid (EGTA) were purchased from Sigma Chemical Company (St Louis, MO, USA).

Ethics

Experimental procedures and protocols used in this study were approved by ethical committee of Health Sciences, University of Cocody-Abidjan. These guidelines were in accordance with the internationally accepted principles for laboratory use and care (National Research Council, 1996; Mosihuzzaman and Choudhary, 2008).

Statistical analysis

Data were expressed as means $\pm$ SEM obtained from η separate experiments. Statistical analysis and graphics were carried out using the software GraphPad InStat and GraphPad Prism 4 (San Diego, California, USA), respectively. Statistical analysis of the results was determined by using the unpaired Student's *t*-test. $p < 0.05$ was considered as indicative of significance.

Results

Effects of the *S. radiatum* aqueous leaf extract on *Taenia caeci* contractile activity

The aqueous leaf extract of *S. radiatum* (ESera) was tested on fragments of *Taenia caeci* with increasing concentrations ranging from 1×10^{-5} $\mu\text{g/ml}$ to 50 $\mu\text{g/ml}$. ESera increased the contractile activity of the isolated *Taenia caeci* of guinea-pig (Table 1). This effect of ESera on the isolated *Taenia caeci* of guinea-pig was concentration-dependent with EC_{50} value (95 % confidence limits) of 0.11 $\mu\text{g/ml}$.

The force and the frequency of the contractions as well as the basal tone increased. In the absence of ESera, the contractile force was estimated as 718.75 ± 9.4 mg. It reached 802.25 ± 11.1 mg ($p < 0.001$) and 1775.8 ± 18.38 mg ($p < 0.001$) when ESera was used respectively at 1×10^{-5} $\mu\text{g/ml}$ and 50 $\mu\text{g/ml}$. Those augmentations of contractile force corresponded to respective increases of 11.64 ± 1.6 % ($p < 0.001$) and 147.23 ± 3.67 % ($p < 0.001$) compared to the control. The concentrations of ESera (1×10^{-5} $\mu\text{g/ml}$ to 5×10^{-3} $\mu\text{g/ml}$) did not modify the frequency of contractions of the strips of *Taenia caeci*. But beyond 5×10^{-3} $\mu\text{g/ml}$, an increase of the frequency of the contractions was observed. Thus, at the concentration of 0.1 $\mu\text{g/ml}$, the frequency was increased from 8 ± 1.77 % ($p < 0.01$) and the rate attained 35 ± 2.57 % ($p < 0.001$) for the concentration of 50 $\mu\text{g/ml}$.

The basal tone was only affected by high concentrations like the frequency. Indeed, the low concentrations of ESera (1×10^{-5} $\mu\text{g/ml}$ to 0.1 $\mu\text{g/ml}$) did not change the basal tone. However, when high concentrations were used, an elevation of the basal tone was recorded. The contractile force was evaluated to 12.5 ± 1.06 mg ($p < 0.001$) and 97.5 ± 6.67 mg ($p < 0.001$) respectively following the application of ESera at 1 $\mu\text{g/ml}$ and at 50 $\mu\text{g/ml}$.

Contractile responses of *Taenia caeci* smooth muscle induced by acetylcholine

The addition of increasing concentrations of ACh into the organ bath caused a concentration-dependent increase of the contractile activity of the fragments of *Taenia caeci* (Table 2). That myostimulant action of the ACh was characterized by the elevations of the contractile force, the rate of contractions and the basal tone. The recorded initial contractile force was 762.5 ± 10.86 mg. When ACh was used at 55×10^{-8} nM, the measured contractile force was 954.25 ± 20.27 mg ($p < 0.001$) giving an increase of 25.07 ± 1.25 % ($p < 0.001$). This increase of the amplitude of the contractions was progressive and reached the value of 2125 ± 11.98 mg ($p < 0.001$) with the high concentration of 0.55 nM corresponding to a rate of increase of 178.86 ± 3.28 % ($p < 0.001$). The calculated EC_{50} (95 % confidence limits) was 55×10^{-6} nM. The rate of the contractions and the basal tone remained unaltered when low concentrations (55×10^{-8} nM to 55×10^{-5} nM) were used. For high concentrations ranging from 55×10^{-4} nM to 0.55 nM, the elevations of these two parameters were observed. ACh at 55×10^{-4} nM caused increases of 12.5 ± 1.06 % ($p < 0.05$) for the rate of contractions and 12.5 ± 0.99 mg for the basal tone. These increases were more important at the high concentration of 0.55 nM. To this concentration, the basal tone raised to 125 ± 12.03 mg ($p < 0.001$) while the frequency of contractions was increased from 57 ± 3.28 % ($p < 0.001$).

Inhibitory effects of atropine on ESera-induced and ACh-induced contractile responses in guinea-pig *Taenia caeci* strips

Atropine (ATR), antagonist of the muscarinic receptors, suppressed the stimulating action of ESera on the isolated *Taenia caeci* of guinea-pig (Figure 1A). In absence of the ATR, ESera, at 0.5 $\mu\text{g/ml}$, increased the force of contractions to 62.88 ± 1.5 %. In presence of ATR at 35×10^{-6} nM and at 35×10^{-2} nM, the contractile force induced by ESera increased respectively from 56.43 ± 1.09 % ($p < 0.01$) and 1.29 ± 0.33 % ($p < 0.001$). The inhibitory effect of ATR on ESera-induced contractions on the isolated *Taenia caeci* smooth muscle of guinea-pig was concentration-dependent.

Figure 1B is the graphic representation of the effect of ACh on the strips of *Taenia caeci* pre-treated with ATR. ACh (1×10^{-5} nM), used alone, provoked an augmentation of contractile force of 89.16 ± 0.65 %. When ACh was put in the organ bath after ATR (35×10^{-6} nM and 35×10^{-2} nM), the increase of the contractile force was reduced. ATR inhibited the effect of ACh in a concentration-dependent manner. The increase of the contractile force induced by ACh was reduced from 89.16 ± 0.65 % to 78.38 ± 0.39 % ($p < 0.01$) and finally to 6.75 ± 0.42 % ($p < 0.001$) when ATR was used at respective concentrations of 35×10^{-6} nM and 35×10^{-2} nM.

Effects of *S. radiatum* aqueous extract and acetylcholine on *Taenia caeci* strips in calcium-free solution

The rhythmic and spontaneous contractions of the intestinal preparations observed under control conditions were not observed in the calcium-free solution, whereas the basal tone was maintained. ESera provoked the elevation of the basal tone of the fragments of *Taenia caeci* as well in presence as in absence of EGTA (specific chelator of Ca^{++}) (Figure 2A). It was contracture. ESera, administrated at 0.5 $\mu\text{g/ml}$ in the calcium-free solution (0 Ca^{++}), elicited a contracture that reached a value of 175 ± 12.22 mg after 20 min. The previous addition of EGTA (30 μM) in this Ca^{++} -free solution did not suppress the contracture effect of ESera. This contracture was estimated at 125 ± 13.95 mg after a period of 24 min.

The addition of ACh (1×10^{-5} nM) in the Ca^{++} -free solution triggered a contracture that was estimated after 12 min to 325 ± 15.63 mg. This contracture was maintained in presence of EGTA used at 30 μM . The application of ACh on the *Taenia caeci* strips pre-treated with the EGTA, provoked an increasing contracture that, after 16 min, was evaluated to 187.5 ± 10.65 mg (Figure 2B).

Influences of *S. radiatum* extract and acetylcholine on *Taenia caeci* preparations in high- K^{+} calcium-free solution

As in the previous solution, ESera induced the contracture of *Taenia caeci* strips placed in the High- K^{+} (70 mM) calcium-free solution that is a depolarizing physiological solution (Figure 3A). In these conditions, ESera (0.5 $\mu\text{g/ml}$) caused

Table 1: Effects of *Sesamum radiatum* aqueous leaf extract on the contractile activity of *Taenia caeci* smooth muscle isolated from guinea-pig

ESera ($\mu\text{g/ml}$)	Basal tone (mg)	Contractile force (mg)	Increase of CF (%)	Increase of RC (%)
0 (Control)	-	718.75 $\pm$ 9.4	-	-
1 $\times 10^{-5}$	-	802.25 $\pm$ 11.66 ***	11.64 $\pm$ 1.6	-
5 $\times 10^{-5}$	-	947.92 $\pm$ 34.41 ***	36.63 $\pm$ 2.25 ***	-
5 $\times 10^{-3}$	-	1181.3 $\pm$ 17.87 ***	64.49 $\pm$ 3.35 ***	-
0.1	-	1356.3 $\pm$ 19.13 ***	88.84 $\pm$ 3.54 ***	8 $\pm$ 1.77 **
1	12.5 $\pm$ 1.06 ***	1697.8 $\pm$ 15.22 ***	136.39 $\pm$ 3.51 ***	12.5 $\pm$ 1.06 ***
10	37.5 $\pm$ 4.15 ***	1895 $\pm$ 21.96 ***	163.87 $\pm$ 4.52 ***	22 $\pm$ 2.44 ***
50	97.5 $\pm$ 6.67 ***	1775.8 $\pm$ 18.38 ***	147.23 $\pm$ 3.67 ***	35 $\pm$ 2.57 ***

The *S. radiatum* aqueous leaf extract (ESera) applied in a range of concentrations from 1 $\times 10^{-5}$ $\mu\text{g/ml}$ to 50 $\mu\text{g/ml}$ cause the increase of the contractile activity of the isolated *Taenia caeci* smooth muscle. The contractile force (CF), the basal tone (BT) and the rate of contractions (RC) are increased in concentration-dependent manner. Data shown are mean $\pm$ S.E.M. (n = 6). **p < 0.01; ***p < 0.001

Table 2: Effects of acetylcholine on the contractile activity of *Taenia caeci* smooth muscle isolated from guinea-pig

ACh (nM)	Basal tone (mg)	Contractile force (mg)	Increase of CF (%)	Increase of RC (%)
0 (Control)	-	762.5 $\pm$ 9.4	-	-
55 $\times 10^{-8}$	-	954.25 $\pm$ 20.27 ***	25.07 $\pm$ 1.25 ***	-
55 $\times 10^{-6}$	-	1350 $\pm$ 21.99 ***	77.04 $\pm$ 1.3 ***	-
55 $\times 10^{-5}$	-	1575 $\pm$ 24.05 ***	106.56 $\pm$ 1.32 ***	-
55 $\times 10^{-4}$	12.5 $\pm$ 0.99	1725 $\pm$ 15.12 ***	126.31 $\pm$ 1.32 ***	12.5 $\pm$ 1.06 *
55 $\times 10^{-3}$	37.5 $\pm$ 3.90 ***	1837.5 $\pm$ 10.83 ***	141.13 $\pm$ 2.24 ***	25 $\pm$ 3.43 ***
55 $\times 10^{-2}$	97.5 $\pm$ 6.78 ***	1975 $\pm$ 10.64 ***	159.19 $\pm$ 2.52 ***	40 $\pm$ 3.69 ***
0.55	125.5 $\pm$ 12.03 ***	2125 $\pm$ 11.98 ***	178.86 $\pm$ 2.57 ***	57 $\pm$ 3.28 ***

Acetylcholine (ACh) employed in a range of concentrations from 1 $\times 10^{-7}$ $\mu\text{g/ml}$ to 0.1 $\mu\text{g/ml}$ induced a progressive increase of the contractile force (CF), the basal tone (BT) and the rate of contraction (RC) of the isolated *Taenia caeci* smooth muscle. Data shown are mean $\pm$ S.E.M. (n = 6). *p < 0.05; ***p < 0.001

a contracture that, 24 min after application, was valued at 137.5 ± 14.29 mg. This contracture even persisted in presence of EGTA ($30 \mu\text{M}$) and was estimated to 95.17 ± 6.19 mg, this 28 min after the addition of ESera.

Similar effects were observed when the fragments of *Taenia caeci* were placed in the High- K^+ calcium-free solution. In that solution, the administration of the ACh (1×10^{-5} nM) caused a contracture. The force of the contracture was 162.5 ± 8.74 mg 12 min after the addition of this substance. Here also, the EGTA ($30 \mu\text{M}$) did not suppress this contracture induced by ACh. In presence of this chelator of Ca^{++} , ACh always caused an increase of the basal tone. Sixteen minutes (16 min) following the addition of ACh in this High- K^+ calcium-free solution containing EGTA ($30 \mu\text{M}$), this contracture reached 137.5 ± 7.89 mg (Figure 3B).

Discussion

The *Sesamum radiatum* aqueous leaf extract (ESera) increased the contractile activity of the *Taenia caeci*, an intestinal smooth muscle of guinea-pig. ESera could have a myostimulant action. This myostimulant effect of ESera was characterized by the increase of the rhythm, the basal tone and the force of the contractions of *Taenia caeci* muscle in normal solution and by the development of a contracture in depolarizing solutions.

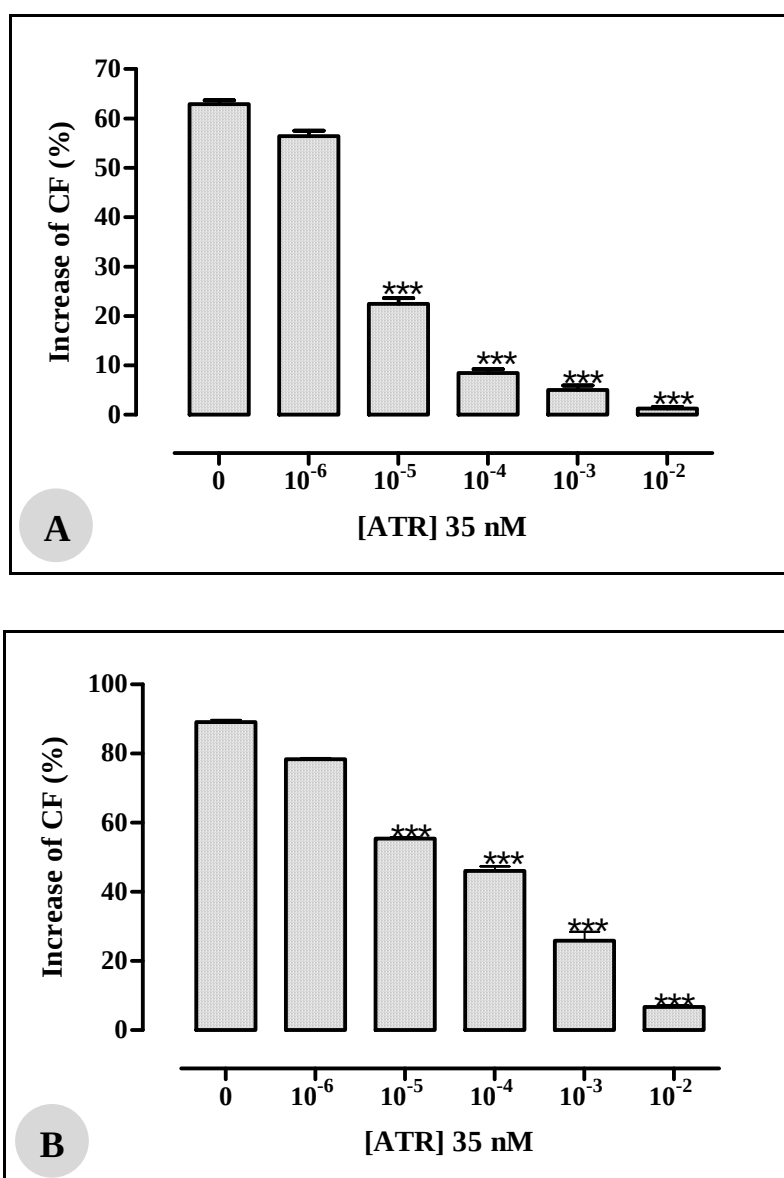


Figure 1: Influence of atropine on the contractile activity of the isolated *Taenia caeci* induced by the test substances. Atropine (ATR) inhibited the effects of *S. radiatum* aqueous leaf extract used at $0.5 \mu\text{g/ml}$ (A) and those of acetylcholine employed at 1×10^{-5} nM (B) on the isolated *Taenia caeci* of guinea-pig in concentration-dependent manner. Data shown are mean $\pm$ S.E.M. (n = 6; *** p < 0.001)

In the modified and calcium-free solutions, the addition of ESera provoked the development of a contracture in presence of EGTA, a specific chelator of Ca^{2+} . According to previous studies (Datté *et al.*, 1996 and 1998; Souza *et al.*, 2002 and 2007), this result permits to suggest that ESera would act on the double entering and intracellular calcium flux. Therefore ESera could be a spasmogenic substance. It would mobilize the calcium that seems to be the determining and inescapable element of the intracellular mechanisms that underlies the contractile activity of the smooth muscles (Somlyo and Somlyo, 1994; Bolton *et al.*, 1999; Hashimoto *et al.*, 2006).

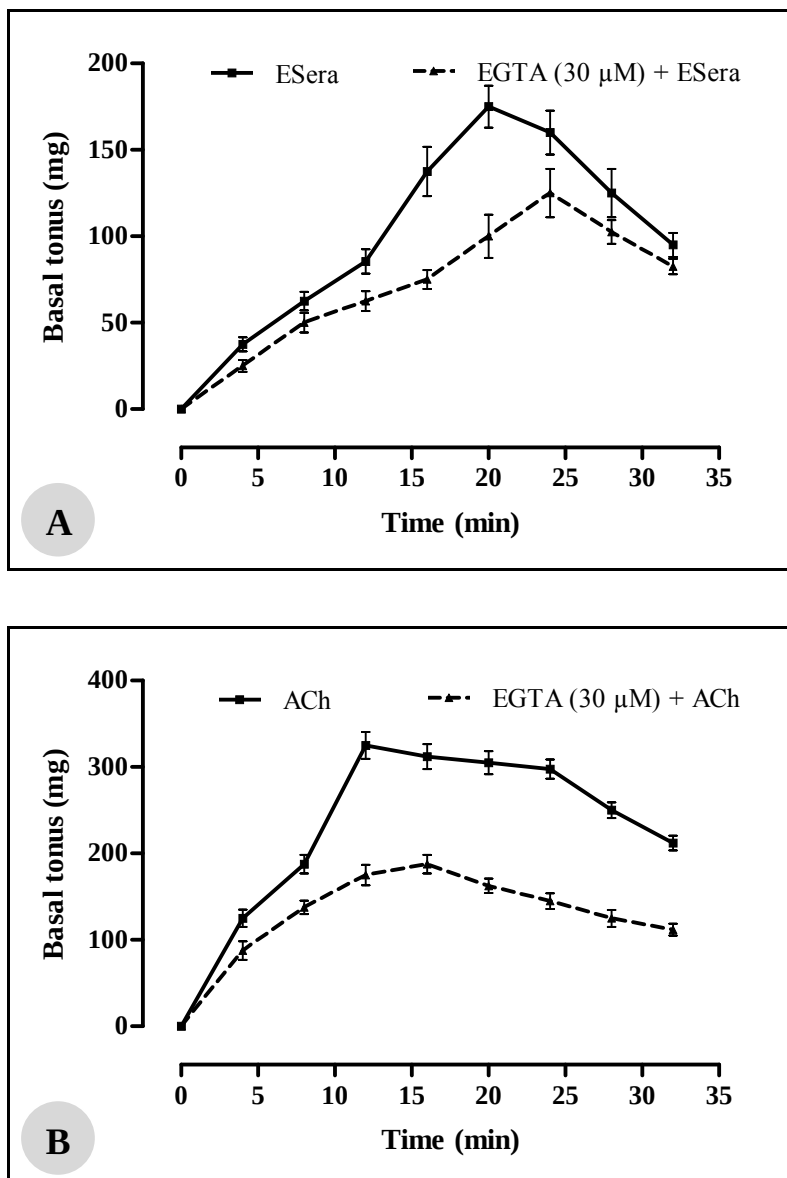


Figure 2: Effect of the studied substances on the contractile activity of the isolated *Taenia caeci* of guinea-pig placed in the calcium-free solution (0 Ca^{++}). Employed alone, the studies substances induced an increase of the basal tone of the isolated *Taenia caeci* smooth muscle. It is a contracture. The addition of EGTA (30 μM) in this solution does not suppress the contracture developed by these substances. **A:** *S. radiatum* aqueous leaf extract (ESera, 0.5 $\mu\text{g/ml}$). **B:** acetylcholine (ACh, 1×10^{-5} nM). Data shown are mean $\pm$ S.E.M. ($n = 6$; $p < 0.05$)

Many other works showed that the contraction of the smooth muscle requires the calcium ions in general and in particular the intracellular calcium (Marthan *et al.*, 1987; Kanmura *et al.*, 1988; Duridoneva *et al.*, 1993). The calcium necessary to the contraction would come from two sources that are the inflow calcium and the liberation of intracellular calcium from the internal reservoirs (Ruttner *et al.*, 1998; Burghardt *et al.*, 1999). The intracellular calcium plays a key role in the development of the slow component of the contractile activity, the basal tone of smooth muscles (Tribe, 2001; Slattery and Morrisson, 2002).

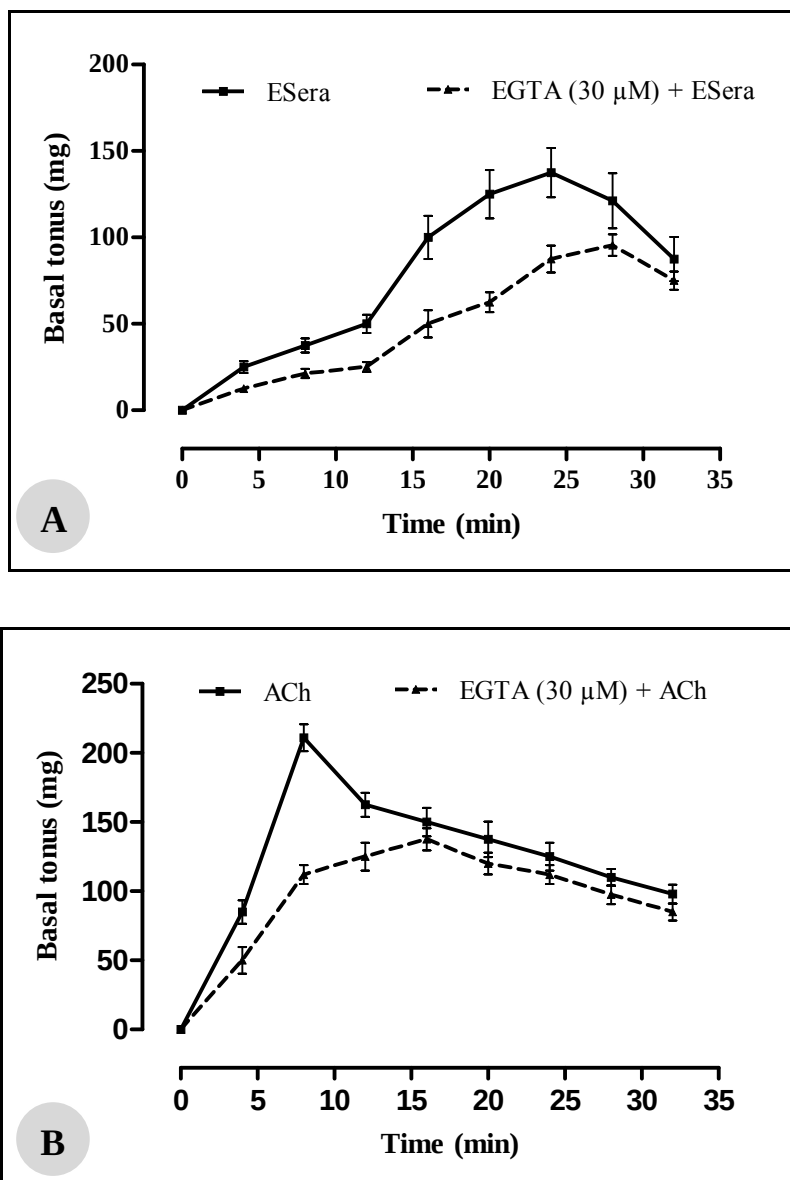


Figure 3: Effects of the test substances on the contractile activity of the isolated *Taenia caeci* of guinea-pig in high- K^+ calcium-free solution (70 mM, 0 Ca^{++}). In the absence of EGTA, the test substances caused the contracture of the isolated *Taenia caeci* smooth muscle. This contracture even persists in presence of the EGTA (30 μ M). **A:** ESera (.5 μ g/ml); **B:** acetylcholine (ACh, 1×10^{-5} nM). Data shown are mean $\pm$ S.E.M. (n = 6; p < 0.05)

The effects of *S. radiatum* (ESera) on the *Taenia caeci* muscle were similar to those of various medicinal plants, among others *Citrus aurantifolia* (Rutaceae), *Khaya senegalensis* (Meliaceae) and *Bridelia ferruginea* (Euphorbiaceae) on the isolated *Taenia caeci* of guinea-pig (Souza *et al.*, 2002 and 2007; Néné-Bi *et al.*, 2009), *Mareya micrantha* (Euphorbiaceae) on the isolated intestine of guinea-pig (Tsai *et al.*, 1995) and *Euphorbia hirta* (Euphorbiaceae) on the isolated intestine of rat (Kamgang *et al.*, 2001).

The myostimulant effects of ESera were similar to those obtained with acetylcholine (ACh). The effects of the ACh recorded varied in the same way with those of many authors (Kamgang *et al.*, 2001; Tribe, 2001; Slattery and Morrisson, 2002; Néné-Bi *et al.*, 2009). These authors noted that the application of the ACh on the isolated intestine of mammals caused an increase of the intestinal contractions. Our results also revealed that a pre-treatment of the strips of *Taenia caeci* with atropine (ATR), a muscarinic cholinergic antagonist, inhibited the myostimulant effects of ESera and ACh. These effects observed as well with ESera as with ACh and suppressed in presence of a cholinergic blocker showed that the *S. radiatum* aqueous leaf extract could contain some cholinergic substances. Indeed, it has been demonstrated that, on the isolated intestine, ATR induces a reduction of the basal tone and the peristalsis, and suppresses the contracture provoked by ACh (Katsung, 2007).

The probable presence of cholinomimetic compounds in the plant extract could explain the usefulness of *S. radiatum* as laxative as indicated by the ethnobotanical information (Kerharo and Adams, 1974).

The intestinal transit is controlled by both neural and myogenic mechanisms (Huizinga *et al.*, 1998). An increase of the contractile activity of the smooth cellular layers in general is responsible for the acceleration of intestinal propulsion. Several mediators and neurotransmitters govern these motor patterns. Acetylcholine is the main excitatory neurotransmitter in the enteric nervous system (Waterman and Costa, 1994). ACh causes through its M3 muscarinic receptors in the intestine an increase of the basal tone with sometimes an increase of the peristaltic contractions.

The spasmogenic activities in plants could be attributed to the presence of plant constituents like terpenoids, sterols, flavonoids, tannins, phenolic compounds and alkaloids (Otshudi *et al.*, 2000). Phytochemical screening of the extract of *S. radiatum* leaves revealed the presence of catechic tannins, alkaloids, flavonoids, sterols, polyphenols and polyterpenes (Konan, 2008; Konan *et al.*, 2008). These constituents may be responsible for the myostimulant activity of *S. radiatum* leaves.

Conclusion

ESera is a spasmogenic substance. It induced an increase of the contractile activity of the isolated intestinal smooth muscle of guinea-pig. It could probably act by the mobilization of the double calcium flux. This spasmodic action could be assigned partly to the presence of cholinomimetic substances in the plant extract. To summarize, our study could justify the use of the leaves of *S. radiatum* as laxative in traditional medicine. However, *in vivo* study should be done to confirm this laxative effect. Further studies of the action mechanism will include the use of reference substances like Castor oil, sodium picosulfate and loperamide. They will not only situate us on the intestinal motility but also on the secretions of water and electrolytes (Na^+ , K^+ , Ca^{2+} and Cl^-) and the quantity of faeces freed.

Abbreviations

ESera: *Sesamum radiatum* leaves aqueous extract; **ACh**: acetylcholine; **ATR**: atropine; **EGTA**: ethyleneglycol-bis(aminoethyl ether) *N,N,N',N'*-tetraacetic acid; **CF**: contractile force; **BT**: basal tonus; **RT**: rate of contraction; **LD₅₀**: lethal dose 50 %; **EC₅₀**: efficient concentration 50 %

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