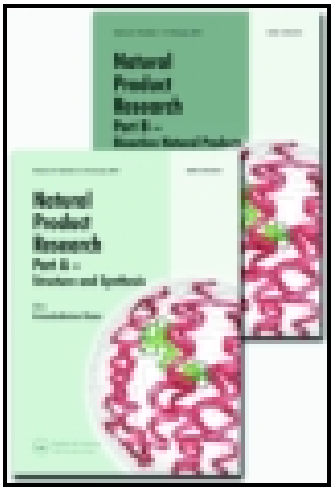

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SHORT COMMUNICATION

Antispasmodic effect of *Ocimum selloi* essential oil on the guinea-pig ileum

Sylvia D.F. Souza[a], Carolina S.L. Franca[a], Edenilson S. Niculau[b], Larissa C.B. Costa[c], José E.B. Pinto[c], Péricles B. Alves[b] and Rosilene M. Marçal[a]*

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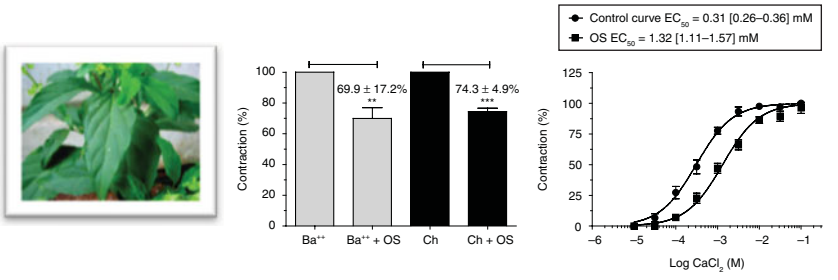

Ocimum selloi is an herbal species popularly used in Brazil as antispasmodic. Herein, we report the antispasmodic effect of *O. selloi* essential oil (OS) in segments of guinea-pig ileum. OS did not reduce the tonus of the ileum. In contrast, OS reduced the contraction induced by carbachol (100 μM), $BaCl_2$ (0.03 M) and low- and high-K^+ concentrations (25 and 60 mM, respectively). OS shifted the concentration–response curve for calcium to the right in a parallel manner. GC/MS analysis showed that OS consists mostly of methyl chavicol (97.57%). These results suggest that OS antispasmodic effect is mediated through calcium channel blockade. In addition, OS effect and mode of action could be accounted for methyl chavicol.

Keywords: *Ocimum selloi*; spasmolytic; methyl chavicol

1. Introduction

Ocimum selloi Benth (Lamiaceae), an herbal species, is largely used in Brazil as antispasmodic and for treating gastrointestinal disorders such as abdominal colic and diarrhoea (Moraes et al. 2002). In agreement with popular usage, *O. selloi* essential oil (OS) showed to reduce diarrhoea and abdominal pain in mice (Franca et al. 2008). Diarrhoea and abdominal pain are commonly related to powerful contractions of intestinal smooth muscles, and they can be alleviated by drugs that induce smooth muscle relaxation such as antispasmodics (Chey et al. 2001). Despite the folkloric use and the effects in mice, the antispasmodic effect of *O. selloi* has not been investigated before. Therefore, this study aimed to investigate the antispasmodic effect of OS. The mechanisms underlying OS intestinal effect have also been investigated.

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2. Results and discussion

OS composition has been reported to be highly dependent on the accession (Grayer et al. 1996). The major compounds commonly detected in OSs are methyl chavicol, trans-anethole, cis-anethole and caryophyllene (Moraes et al. 2002). In the present study, the GC/MS analysis revealed that OS contains 97.57% of methyl chavicol (Table 1). This finding indicates that the pharmacological effects detected for OS can be accounted for methyl chavicol. For this reason, the results were plotted as both OS and methyl chavicol concentration–response curves (Figure 1).

In the guinea-pig ileum, OS (1–0.5 mg/mL) did not modify the intestinal tonus, suggesting that OS, at usual doses, do not modify the intestinal peristalsis (data not shown). In contrast, and interestingly, OS (10 μg/mL) significantly reduced the intestinal spasmodic contractions induced by high concentrations of carbachol and $BaCl_2$ ($p < 0.01$ and $p < 0.001$ for carbachol and Ba^{++}, respectively; Figure 1(a)). The enteric nervous system plays an important role on intestinal peristalsis. In some pathological conditions, the exacerbation of neurotransmitters released by the enteric nervous system can increase receptors activation and lead to smooth muscle spasmodic contractions. This pattern of contraction is similar to those induced by high barium and carbachol concentrations in the present study (Furness 2008). Carbachol, a muscarinic cholinergic agonist, causes smooth muscle contractions through M_2 and M_3 muscarinic cholinergic receptors activation. Ba^{++}-induced contractions are known to be related to K^+ channels blockade. Therefore, these data indicate that OS reduces contractions induced by both receptor-specific and non-specific spasmogens. This pattern of antispasmodic effect is commonly mediated through calcium channel blockade or potassium channel opening (Karaki et al. 1997).

It is well known that potassium channel openers selectively relax the contractions induced by low-K^+ concentration while Ca^{++} antagonists inhibit both low- and high-K^+-induced contractions (Lawson & Cavero 1989; Karaki et al. 1997). OS (1–0.5 mg/mL) reduced in a concentration-dependent way the tonic phase of the low- and high-K^+-induced contractions (Figure 1(b),(c), respectively). These results strongly suggest that OS acts as a Ca^{++} channel blocker.

In order to further investigate the OS mode of action, the effect of OS on the contractions induced by $CaCl_2$ was evaluated. In smooth muscles, calcium chloride causes a concentration-dependent contraction and calcium antagonists shift to the right the calcium chloride concentration–response curves in a parallel manner (Karaki et al. 1997). In this set of experiments, OS (250 μg/mL) caused a rightward shift, in a parallel manner, in the Ca^{++} dose–response curves (Figure 1(d)). The calcium channel blocker verapamil was used as a positive control (Figure 1(e)). These findings reinforce the idea that OS acts as a Ca^{++} channel blocker. In addition, it supports the hypothesis that OS acts as a competitive calcium antagonist (Lawson & Cavero 1989; Bauer et al. 1991).

3. Conclusions

In summary, our findings support the hypothesis that OS does not modify the intestinal peristalsis, exhibits antispasmodic effect and acts as a competitive calcium antagonist. The effect

Table 1. Chemical composition of OS (GC/MS).

RI	Compound	%
1194	Methyl chavicol	97.57
1419	β-Bicyclogermacrene	0.64
1495	Bicyclogermacrene	0.64

Note: RI, relative retention index calculated against *n*-alkanes, applying the Van den Dool equation; %, compound percentage.

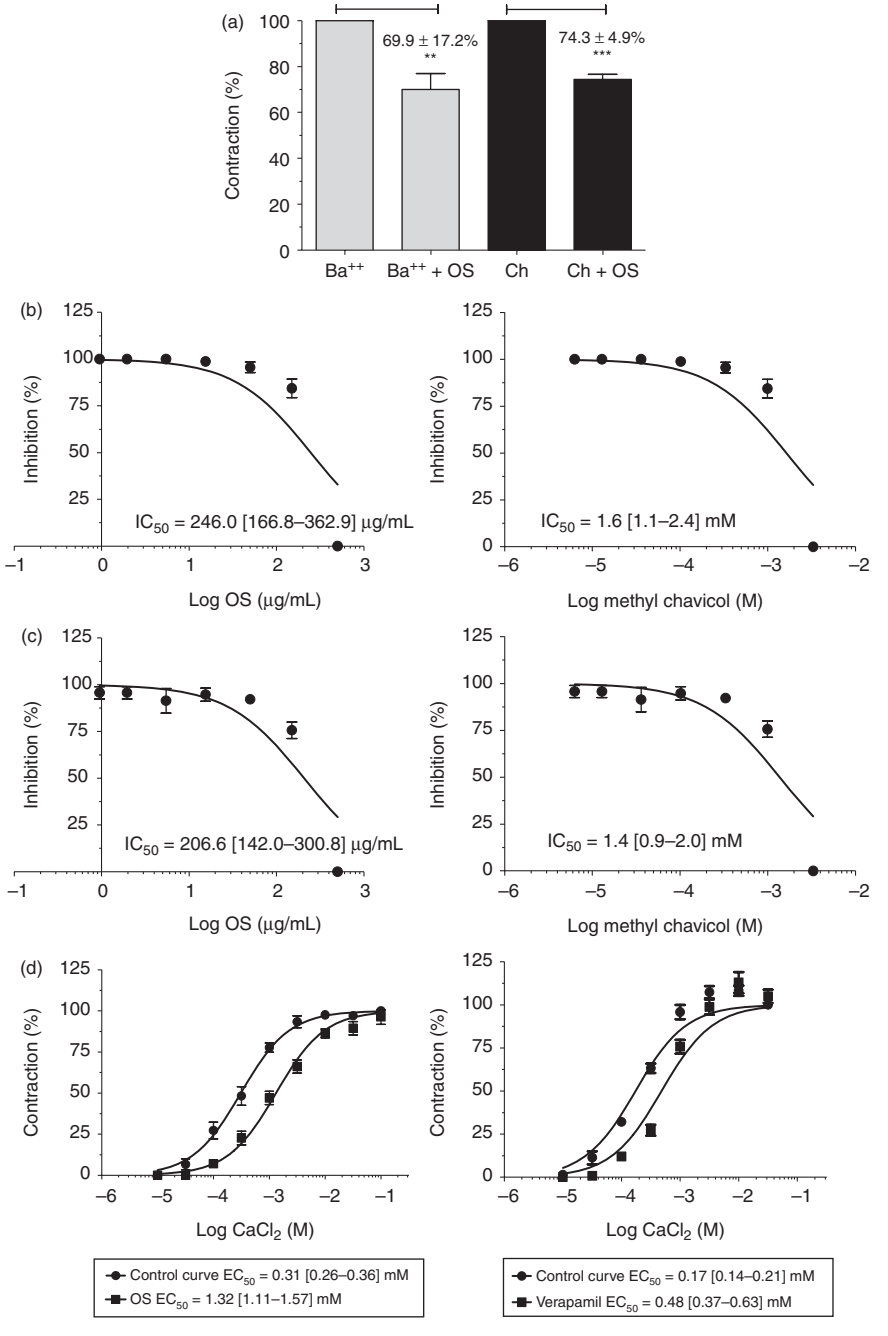

Figure 1. Effect of OS (or methyl chavicol) on the contraction induced by (a) Ba^{++} and carbachol (Ch), (b) KCl 25 mM and (c) KCl 60 mM. (d) Effect of OS and verapamil on the contraction induced by $CaCl_2$. The panels a and d show paired experiments. In the graphs, each point represents mean ± SEM. EC_{50} and IC_{50} are shown as mean [confidence interval] in the panels b–d. $n = 6–9$. Student's *t*-test for paired data: $^{**}p < 0.01$, Ba^{++} control group versus Ba^{++} + OS; $^{***}p < 0.001$, Ch control group versus Ch + OS. The effects were expressed as OS or the related methyl chavicol content in OS.

and mode of action can be accounted for methyl chavicol. This study provides a mechanistic base for *O. selloi* popular use as antispasmodic.

Supplementary material

Experimental details related to this article are available online.

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