

Evaluation of the Effect of the Aqueous Extract of the Recipe of the Leaves of *O. Grastissium* and the Steam Bark of *T. Superba* on Acetic Acid-Induced Spasms in Wistar Rats

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Received October 01, 2023; Revised November 02, 2023; Accepted November 10, 2023

Abstract Intestinal spasms are violent contractions that occur in the intestine. Aside from treatment with conventional medications, certain medicinal plants are widely used alone or in combination in traditional congolese medicine to treat spasms. This study aims to evaluate the antispasmodic effects of an aqueous extract of the recipe made from the leaves of *O. grastissimum* and the bark of *T. superba*. The spasms were induced 1 hour after administration of the aqueous extract by intraperitoneal injection of 1% acetic acid; the duration of the experiment varied from 30, 60 and 90 minutes. Then, the animals were sacrificed after anesthesia with ethyl ether, the peritoneum was rinsed with 0.9% NaCl, the peritoneal fluid obtained in order to measure prostaglandins (PGE₂ and PGF₂), as well as oxidative stress parameters. The aqueous extract at the doses (125, 250 and 500 mg/kg) used has an antispasmodic effect which resulted in a significant reduction ($p < 0.001$) in the number of spasms. The antispasmodic effects were confirmed by a significant decrease ($p < 0.001$) in prostaglandins PGE₂ and PGF₂ for their involvement in the pain induction mechanism of acetic acid. Furthermore, a significant reduction ($p < 0.001$) in the parameters of oxidative stress induced by the intraperitoneal injection of acetic acid was observed. The results showed that the aqueous extract of the recipe has significant antispasmodic activity and could justify the traditional use of the recipe in abdominal pain.

Keywords: spasms, antispasmodic, *O. grastissimum* *T. superba*, recipe

Cite This Article: Boukongo R. P., Elion Etou RDG, Mambeke H. M., Etou Ossibi AW, Morabandza C. J, and Abena AA, "Evaluation of the Effect of the Aqueous Extract of the Recipe of the Leaves of *O. Grastissium* and the Steam Bark of *T. Superba* on Acetic Acid-Induced Spasms in Wistar Rats." Research in Plant Sciences, vol. 11, no. 1 (2023): 22-28. doi: 10.12691/plant-11-1-4.

1. Introduction

Intestinal spasms can be defined as violent voluntary or involuntary contractions that occur in the intestine [1]. They are the cause of several disorders including inflammatory bowel disease [2]. Experimentally, the reproductive model of these involuntary or voluntary contractions is comparable to that caused by an intraperitoneal injection of acetic acid. Indeed, spasms induced by acetic acid are due to the release of chemical mediators such as serotonin, histamine, bradykinin, prostaglandins (PGE₂ and PGF₂) and substance P [3]. Furthermore, these spasms induced by acetic acid are accompanied by irritation and lesions in the peritoneum reflecting a form of inflammation. This inflammation

could be the cause of the production of reactive oxygen species following the multiple reactions generated by the body. The treatment of spasms involves the use of antispasmodics, which constitute a group of medications that act differently in the gastrointestinal tract. The potential benefits and harms of antispasmodics depend on their mode of action [4]. This group is made up in particular of anticholinergics, calcium channel blockers and muscolotropic agents [4], but also other drugs such as analgesics such as paracetamol which is a reference molecule, inhibiting abdominal spasms by preventing the production of prostaglandins by inhibiting cyclooxygenase 3 (COX 3) enzymes [5]. It turns out that certain prostaglandins PGE₂ and PGF₂, for example those involved in the inflammatory process, are responsible for abdominal spasms [6]. However, the use of antispasmodics is associated with limited availability, side

effects [4], and higher health costs. Hence many populations are forced to resort to the leaves and bark of medicinal plants presumed to have antispasmodic properties for treatment. These plants can be used alone or in combination in a recipe where certain plants will potentiate the expected effect or serve as an excipient [7]. In traditional medicine, the leaves of *O. gratissimum* are used in the treatment of upper respiratory tract infections (colds, coughs, bronchitis), ear infections, and stomach aches. The pulp of *O. gratissimum* for rubbing people suffering from rheumatism or localized edema (Bouquet, 1969). On the other hand, herbal tea from the steam bark of *T. superba* is prescribed as an anti-dysenteric agent; it is made to drink to women who are sterile or threatened with miscarriages or who have ovarian problems. In the Sangha, the bark of *T. superba* is believed to have emetic or expectorant properties: alone or in a mixture, this drug is used to treat broncho-pneumonic conditions. The Bekwil use the maceration of the bark of *T. superba* against swelling and generalized pain [8]. *T. superba* is traditionally used in the southern and central regions of Cameroon in the treatment of diabetes and cardiovascular disorders [9,10]. Previous scientific studies carried out separately have attributed anti-malarial [11], anti-nociceptive and anti-inflammatory properties to the aqueous extract of *O. gratissimum* leaves [12]. Olusegun et al, (2008) [13] demonstrated that the aqueous extract of *O. gratissimum* leaves significantly decreased hemoglobin (Hb), hematocrit (PCV), red blood cells (RBC), white blood cells (WBC) and other hematological parameters in wistar rats. In addition, the aqueous and hydroethanolic extract of *O. gratissimum* leaves have anticonvulsant and antioleptic effects [14]. In addition, the essential oil has antioxidant properties [15,16], antimalarial [17,18], antimicrobial [19-22]; insecticide [23,24]. Previous scientific studies have shown that the aqueous extract of the steam bark of *T. superba* has healing (Atto et al., 2022), anti-inflammatory and antipyretic properties in rats (N'dia Kouadio et al., 2021), antidiarrheal (Bamisaye et al., 2012), antioxidant and antibacterial (Kougnimon et al., 2018). Aqueous extract of *T. superba* prevents glucose-induced hypertension in rats (Ngolemba 2011). In addition, the methanolic extract of steam bark has gastroprotective properties (Chukwuma et al., 2022). However, in the literature, we did not find any data on the antispasmodic effect of the recipe made from *O. gratissimum* leaves and *T. superba* steam bark. Thus, our study aims to contribute to the enhancement of the recipe made from the leaves of *O. gratissimum* and the bark of *T. superba* also used against abdominal spasms.

2. Methodology

2.1. Plant Material

The leaves of *O. gratissimum* and the steam barks of *T. superba* were used. Several plant leaves of the same species *O. gratissimum* growing in the same place and steam barks of *T. superba* were collected in July 2021 in the locality of Mossendjo, Department of Niari (Congo). Botanical identification of the plant material was done by

Mousamboté, botanist systematist of Higher Normal School of Agronomy and Forestry (HNSAF) and confirmed at the herbarium of the National Institute for Research in Exact and Natural Sciences (NIRENS) in which a collected sample was compared to a reference samples n° 8012 for *O. gratissimum* and n°6025 for *T. superba* respectively. After identification, the plant material was dried at room temperature ($27 \pm 50^\circ\text{C}$) for 14 days in the Laboratory of Pharmacodynamics and Experimental Physiopathology (L2PE), and then pulverized with a mortar. The powder obtained was used to prepare the aqueous extract of the recipe. The aqueous extract for the recipe of *O. gratissimum* leaves and *T. superba* bark was prepared by maceration at 10 %. 12.25 g of *O. gratissimum* leaf powder and 12.5 g of *T. superba* bark powder were mixed in 500 mL of distilled water. Then, the mixture was left to macerate under a magnetic stirrer for 24 hours. After filtration using cotton wool, the maceration obtained was evaporated at a temperature of 65°C using an evaporator (Buchi R-100-11593665) in order to obtain a dry extract. The dry extract obtained was used for pharmacological tests.

2.2. Animal Material

Albino rats (150 -200g) of either sex aged 3 months were used. These animals were provided to us by the animal house of the Laboratory of Pharmacodynamics and Experimental Physiopathology (L2PE) of the Faculty of Science and Technical of the Marien Ngouabi University. They were fed with a standard food and with running water. They were acclimatized during one week before experimentation and were housed under standard conditions (12 h light and 12 h dark) and at the temperature of $27 \pm 1^\circ\text{C}$. The rules of ethics published by the International Association for the Study of Pain have been considered [31].

2.3. Evaluation of the Antispasmodic Effect of the Aqueous Extract

The spasm was induced by 1% acetic acid in the peritoneum according to the method described by Deraedt et al, (1980) [32]. Thus, 5 groups of 15 rats each fasted for 24 hours were formed and treated with different doses of distilled water (control group, 1mL/100g), paracetamol (reference molecule, 250 mg/kg) and aqueous extract of the recipe at increasing doses of (125, 250 and 500 mg/kg) 1 hour before the intraperitoneal injection of the aqueous solution of 1% acetic acid. After the injection of the aqueous solution of acetic acid at 1%, each group was subdivided into three (03) sub-groups of 5 rats each. Animals were placed individually in observation cages. The spasms (Abdominal Writhing) developed by the animals of the three (03) sub-groups of the different products administered were monitored for 30, 60 and 90 minutes. Then, all the animals from the different sub-groups were sacrificed respectively at 30, 60 and 90 minutes by cervical dislocation. In order to reach the peritoneal cavity of rats, a dermal incision was made. The peritoneal cavity of the rats was rinsed using 2 ml of sterile 0.9% NaCl. The washing solution is then aspirated in order to recover the exudate which has formed there for

the assay of the prostaglandins PGE₂ and PGF₂, as well as the assay of the oxidative stress parameters in particular: Malondialdehyde (MDA), Reduced Glutathione (GSH), Superoxide dismutase (SOD), Glutathione peroxidase (GPx) and Catalase (CAT).

2.4. Statistical Analysis

All values were expressed as mean $\pm$ standard error of the mean (SEM). An analysis of variance using Excel version 2016 software followed by Student-Fischer t test "t" was performed. The significance level was set at $p < 0.05$.

3. Results

3.1. Effect of the Aqueous Extract on the Spasm Induced by Peritoneal Injection of 1% Acetic Acid

Peritoneal injection of acetic acid induces abdominal spasms in rats. Tables 1 and 2 respectively show the effect of the extract on spasm and the percentage inhibition of spasms induced by intraperitoneal injection of 1% acetic acid. It emerges from this study that the animals having received the aqueous extract increasing doses (125, 250 and 500 mg/kg) of body weight, as well as those treated with the reference molecule paracetamol (250 mg/kg) significantly reduced ($p < 0.001$) the number of spasms (abdominal

writhing) every minute compared to the control group (Table 1). In addition, a gradual increase in the percentages of spasm inhibition was observed during this study in animals treated with the aqueous extract at increasing doses of (125, 250 and 500 mg/kg), as well as in animals treated with Paracetamol (Table 2).

3.2. Effect of the Aqueous Extract on the Production of Prostaglandins PGE₂ and PGF₂ After Induction of Spasm by 1% Acetic Acid

Tables 3 and 4 present the results of the effect of the aqueous extract on the stimulation of prostaglandin secretion. They show that the aqueous extract at doses (125, 250 and 500 mg/kg) of body weight as well as those treated with paracetamol (reference molecule, 250 mg/kg) significantly decrease ($p < 0.001$) the concentrations of prostaglandin PGE₂ and PGF₂ at 30, 60 and 90 minutes compared to control animals treated with distilled water. At 90 minutes the values of the production of prostaglandins PGE₂ (Table 3) are 185.52 ± 2.98 ; 15.19 ± 0.23 ; 15.51 ± 0.56 ; 14.98 ± 0.50 and 15.33 ± 0.73 respectively for control group, paracetamol and aqueous extract (125, 250 and 500 mg/kg). On the other hand, the values of the production of prostaglandins PGF₂ (Table 4) are 531.19 ± 0.32 ; 68.83 ± 1.49 ; 70.80 ± 5.32 ; 68.37 ± 4.95 and 66.25 ± 1.87 respectively for control group, paracetamol and aqueous extract (125, 250 and 500 mg/kg).

Table 1. Effect of the aqueous extract of the recipe on abdominal spasms induced by intraperitoneal injection of acetic acid in rats

Treatment	Doses	Number of spasms		
		0 - 30 min	0 - 60 min	0 - 90 min
Control group	0.5 ml/100g	27.22 ± 2.27	48.03 ± 0.59	67.50 ± 1.65
Paracetamol	250 mg/kg	12.35 ± 0.35 ***	16.16 ± 0.58 ***	20.13 ± 1.24 ***
	125 mg/kg	13.10 ± 0.83 ***	18.24 ± 0.98 ***	19.34 ± 0.71 ***
Aqueous extract	250 mg/kg	12.64 ± 0.36 ***	17.44 ± 0.65 ***	18.55 ± 0.48 ***
	500 mg/kg	12.81 ± 0.36 ***	16.63 ± 0.60 ***	16.75 ± 0.31 ***

Each value represents the mean $\pm$ ESM. of number of spasms. *** $p < 0.001$, Significant different (Student t-test) versus control group.

Table 2. Inhibition effect of aqueous extract of the recipe on abdominal spasms induced by intraperitoneal injection of acetic acid in rats

Treatment	Doses	Inhibition (%)		
		0 - 30 min	0 - 60 min	0 - 90 min
Paracetamol + Acetic acid	250 mg/kg	63 %	65 %	71 %
	125 mg/kg	58 %	61 %	72 %
Extrait aqueux + Aceti acid	250 mg/kg	62 %	63 %	73 %
	500 mg/kg	58 %	65 %	71 %

Table 3. Effect of the aqueous extract on concentration of prostaglandins PGE₂ after acetic acid-induced abdominal spasms in rats

Treatment	Doses	Concentration (ng/L)		
		0 - 30 Min	0 - 60 Min	0 - 90 Min
Control group	0.5 mL/100g	95.20 ± 0.87	130.58 ± 2.66	185.52 ± 2.98
Paracetamol	250 mg/kg	52.51 ± 3.74 ***	31.29 ± 2.15 ***	15.19 ± 0.23 ***
	125 mg/kg	48.55 ± 1.83 ***	24.32 ± 1.56 ***	15.51 ± 0.56 ***
Aqueous extract	250 mg/kg	46.51 ± 1.15 ***	27.70 ± 1.95 ***	14.98 ± 0.50 ***
	500 mg/kg	52.48 ± 0.81 ***	31.51 ± 0.65 ***	15.33 ± 0.73 ***

Table 4. Effect of the aqueous extract on concentration of prostaglandins PGF2 α after acetic acid-induced abdominal spasms in rats

Traitement	Doses	Concentration (ng/L)		
		0 - 30 Min	0 - 60 Min	0 - 90 Min
Control group	0.5 mL/100g	252.01 $\pm$ 0.87	298.53 $\pm$ 6.46	531.19 $\pm$ 0.32
Paracetamol	250 mg/kg	154.37 $\pm$ 2.36 ***	143.97 $\pm$ 12.96 ***	68.83 $\pm$ 1.49 ***
	125 mg/kg	180.97 $\pm$ 4.32 ***	151.57 $\pm$ 14.40 ***	70.80 $\pm$ 5.32 ***
Aqueous extract	250 mg/kg	166.37 $\pm$ 4.04 ***	149.97 $\pm$ 15.38 ***	68.37 $\pm$ 4.95 ***
	500 mg/kg	160.51 $\pm$ 3.43 ***	145.97 $\pm$ 12.96 ***	66.25 $\pm$ 1.87 ***

Each value represents the mean $\pm$ ESM. of concentration. *** p <0.001, Significant different (Student t-test) versus control group.

Table 5. Effect of the aqueous extract on the concentrations of oxidative stress parameters after acetic acid-induced abdominal spasms in rats

Treatment	Doses	Oxidative stress parameters				
		MDA(mmol)	GSH(nMol/L)	SOD(U/mg)	GPx(μ mol of GSH)	CAT(μ mol of H ₂ O ₂ /Min)
Control group + acetic acid	0.5 mL/100g	203.49 $\pm$ 4.78	4.79 $\pm$ 1.12	1.57 $\pm$ 0.11	0.20 $\pm$ 0.00	1.62 $\pm$ 0.01
Paracetamol + acetic acid	250 mg/kg	115.66 $\pm$ 4.00***	7.43 $\pm$ 1.89 ***	1.21 $\pm$ 0.02**	0.09 $\pm$ 0.01***	0.47 $\pm$ 0.07***
	125 mg/kg	113.52 $\pm$ 2.62***	6.88 $\pm$ 1.97***	1.21 $\pm$ 0.03**	0.08 $\pm$ 0.00***	0.49 $\pm$ 0.04***
Aqueous extract + acetic acid	250 mg/kg	115.66 $\pm$ 4.01***	8.49 $\pm$ 2.30***	1.23 $\pm$ 0.00**	0.07 $\pm$ 0.01***	0.45 $\pm$ 0.01***
	500 mg/kg	115.67 $\pm$ 4.00***	8.48 $\pm$ 1.11***	1.21 $\pm$ 0.03**	0.08 $\pm$ 0.00***	0.46 $\pm$ 0.00***

Each value represents the mean $\pm$ ESM of concentration. *** p <0.001, Significant different (Student t-test) versus control group.

3.3. Effect of the Aqueous Extract on the Parameters of Oxidative Stress Induced by Intraperitoneal Injection of Acetic Acid

Table 5 presents the effect of the aqueous extract on the stimulation of the secretion of oxidative stress parameters induced by the intraperitoneal injection of acetic acid. This table shows that the aqueous extract at the doses used (125, 250 and 500 mg/kg) as well as animals treated with paracetamol significantly decrease (p<0.001) in the concentrations of oxidative stress parameters including Malondialdehyde (MDA), Reduced Glutathione (GSH), Superoxide dismutase (SOD), Glutathion peroxidase (GPx) and Catalase (CAT) compared to control animals treated with distilled water.

4. Discussion

Pain is one of the main alerts to an inflammatory disease in the body; it can be of peripheral or central origin depending on the location of the inflammatory focus. Peripheral spasms were induced by acetic acid in order to assess the antispasmodic properties of the aqueous extract in rats. This test was used because of its sensitivity to assess the peripheral antispasmodic effect [33]. Indeed, the spasms caused by intraperitoneal injection of acetic acid are due to the release of chemical mediators such as serotonin, histamine, bradykinin, prostaglandins (PGE 2 α , PGF 2 α) and substance P [3]. Prostaglandins therefore sensitize peripheral nociceptive neurons [34]. In the present study, oral administration of the aqueous extract at increasing doses of (125,250 and 500 mg/kg), as well as the reference molecule (paracetamol at 250 mg/kg) significantly reduced (p <0.001) the number of spasms during 30, 60 and 90 minutes of experimentation this compared to animals having received distilled water. It is recognized that

paracetamol prevents the production of prostaglandins by inhibition of cyclooxygenase 3 (COX 3) enzymes. In addition, it would increase the effect of serotonergic neurons. These neurons inhibit pain pathways. By stimulating these neurons, paracetamol would therefore indirectly reduce the sensation of pain. The fact that the aqueous extract of the recipe inhibits the spasms induced by acetic acid suggests that it would act like paracetamol by interference with the mediators involved in the genesis of the spasms induced by the intraperitoneal injection of acetic acid such as the prostaglandins PGE2 α and PGF2 α [3]. Thus, to correlate this hypothesis, the effect of the aqueous extract of the recipe was evaluated on the production of prostaglandins PGE2 α and PGF2 α . The results of this study show a significant decrease (p <0.001) in the concentrations of prostaglandins PGE 2 α and PGF2 α respectively during 30, 60 and 90 minutes of experimentation, in the animals having received the aqueous extract at increasing doses (125, 250 and 500 mg/kg) of body weight, as well as those treated with the reference molecule (Paracetamol) compared to controls treated with distilled water. Indeed, several authors have demonstrated that large quantities of prostaglandins are produced by polymorphonuclear cells of rats, rabbits and humans after stimulation [35,36,37]. Our results corroborate those obtained by Deraedt et al, (1980) [32] who worked on the release of prostaglandins E and F in an algogenic reaction. These authors observed an inhibition of prostaglandin PGE 2 α and PGF2 α concentrations. Furthermore, this inhibition of prostaglandin concentrations by the aqueous extract of the recipe could be explained by the capacity of the continuous secondary metabolites in the aqueous extract of the recipe to interact with certain constituent elements or present in the intraperitoneal fluid. Therefore any interaction between the secondary metabolites constituting the aqueous extract of the recipe and these cells could well justify the inhibition of prostaglandin concentrations. Our results are similar to

those observed by Giroud, (1977) [38] in various models of inflammation in which PGE 2 α was replaced by and PGF2 α during the reduction of the inflammatory reaction, as if PGF2 α counteracted the effects of PGE 2 α . The development of the antispasmodic process could therefore be governed by the ratio between the two types of prostaglandins (E/F) competing at the level of spasm receptors. Just as this rapid reduction in prostaglandin concentrations could be due to severe phagocytosis and could cause the release of lysosomal enzymes such as phospholipase A2, which provide the unsaturated fatty acids precursors of PGs. According to Ford-Hutchinson et al, (1977) [39] and Humes et al, (1977) [40] the most important factor in the production of prostaglandins may be the nature of the substances to be phagocytized, with irritants and agents appearing to be the most favorable. Aside from the inhibitory effect of the aqueous extract of the recipe on the production of prostaglandins PGE2 α and PGF2 α , the antispasmodic effect observed could also involve the inhibition of the release of certain cytokines such as TNF- α and IL-1 β by macrophages and mast cells in the peritoneal cavity [41]. Furthermore, apart from the direct involvement of acetic acid in the release of chemical mediators such as serotonin, histamine, bradykinin, prostaglandins (PGE 2 α , PGF 2 α) and substance P in the induction of spasms; Acetic acid can also cause irritation and lesions in the peritoneum, reflecting a form of inflammation. This inflammation could be the cause of the production of reactive oxygen species following the multiple reactions generated by the body. Hence it seemed necessary to evaluate the effect of the aqueous extract on some parameters of oxidative stress in particular: superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), reduced glutathione (GSH).) and Malondialdehyde (MDA) induced by acetic acid. Superoxide dismutase (SOD) and catalase (CAT) are essential primary antioxidant enzymes that function in the body's defense against toxic products of cellular metabolism. The major function of SOD is to catalyze the disproportionation of the superoxide anion into hydrogen peroxide (H₂O₂) and therefore to reduce the toxic effects due to this free radical [42]. As for catalase, it is an enzyme that converts hydrogen peroxide typically produced by SOD into water and molecular oxygen [43]. The results of our study revealed a significant decrease (P<0.001) in the activity of these two enzymes respectively in animals having received the aqueous extract at increasing doses (125,250 and 500 mg/kg) and the reference molecule (Paracetamol) compared to those treated with distilled water. These results suggest an anti-oxidant effect of the aqueous extract of the recipe. Our results differ from the results obtained by Belhimer, (2013) [44] who worked on the evaluation of the anti-inflammatory and analgesic activity of polyphenolic extracts of some plants at doses (200, 400 and 600 mg/kg) in mice. These authors observed an increase in SOD and CAT. This difference could be explained by the nature of the samples used. Despite this difference, most authors favor the hypothesis according to which the decrease in superoxide dismutase and catalase levels is due to an increase in lipid peroxidation [45,46]. Indeed, in response to oxidative stress, SOD and CAT are regulated in two different ways. In the event of moderate oxidative stress,

overexpression of SOD and CAT is observed (the case of physical exercise). If oxidative stress persists, SOD and CAT are destroyed and their expression decreases. Paradoxically, an excessive concentration of SOD and CAT can be dangerous because, in this case, they are the basis of an overproduction of hydrogen peroxide [47]. GSH also plays an antioxidant role in synergy with antioxidant enzymes such as glutathione peroxidase (GPx), catalase and superoxide dismutase. Additionally, GSH can react with H₂O₂ and lipid peroxides through the action of glutathione peroxidase (GPx) to remove reactive intermediates through reduction of hydroperoxides [48,49]. In our study a significant decrease (P<0.001) in the level of GSH and GPx was observed in animals treated at different doses (125, 250 and 500 mg/kg) as well as in animals treated with the reference molecule (Paracetamol) compared to animals that received distilled water. The depletion observed during our study could be due to consumption, a decrease in the biosynthesis of GSH and GPx or an increase in the oxidation of GSH during oxidative stress caused by acetic acid responsible for tissue damage. Several authors have shown that tissue damage induced by different stimuli is coupled with significant GSH depletion [50,51]. Likewise, the decrease in GSH can be explained by the fact that faced with this type of stress, the liver is unable to eliminate such an increased concentration of toxic metabolites generated [49]. Lipid peroxidation is a unique oxidative event that can alter many lipid molecules and induce an accumulation of hydrogen peroxide in membranes, which will reduce their fluidity [52,53]. It is determined mainly by measuring the MDA. The increase in MDA levels is the result of the increase in ROS which attack the polyunsaturated fatty acids of the cell membrane and causes lipid peroxidation [54]. Our study revealed a significant decrease (P<0.001) in the MDA level respectively in animals treated with the aqueous extract at increasing doses (125, 250 and 500 mg/kg) of body weight, as well as those treated with the molecule reference (Paracetamol) compared to animals having received distilled water. These results suggest an antioxidant effect of the aqueous extract of the recipe. This antioxidant effect could participate in the reduction of inflammatory lesions induced by acetic acid. This reduction in the MDA level would be attributed to the presence of polyphenols contained in the aqueous extract of the recipe [55]. Indeed, several authors [56,57] have reported that green tea polyphenols can inhibit the formation of EOR by inhibition of the enzyme xanthine oxidase. They also reported that polyphenols exert antioxidant activity by chelating transition metals which can contribute to the formation of free radicals via the Fenton reaction. Polyphenols have an ideal chemical structure for capturing free radicals, so several studies have shown the ability of phenolic compounds to capture free radicals.

5. Conclusion

This study shown that the aqueous extra recipe of leaves of *O. grastissium* and bark of *T. superba* has antispasmodic properties. These properties could be explained by an interference with the mechanism of protaglandin production.

In perspective, we plan to study the effects of organic extracts on loperamide-induced constipation.

ACKNOWLEDGEMENT

The authors thank all those who materially participated in this work; notably the Laboratory of Pharmacodynamics and Experimental Physiopathology (L2PE) of the Faculty of Science and Technical of the Marien Ngouabi University for the technical platform and experimental animals; the National Institute for Research in Exact and Natural Sciences (NIRENS) Herbarium for the identification of the plant species used for this work.

Conflict of Interests

The authors declare that they have no conflict of interest.

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