Data Article

Data on the mechanisms of antidiarrhoeal activity of methanol leaf extract of Combretum hypopilinum Diels (Combretaceae): Involvement of opioidergic and (α₁ and β)-adrenergic pathways

Mubarak Hussaini Ahmad, Abdulkadir Umar Zezi, Sherifat Bola Anafi, Zakariyya Alhassan, Mustapha Mohammed, Rabi'u Nuhu Danraka

Department of Pharmacology and Therapeutics, Ahmadu Bello University, Zaria, Kaduna State, Nigeria

School of Pharmaceutical Sciences, Universiti Sains Malaysia, Pulau Pinang, Malaysia

Department of Clinical Pharmacy and Pharmacy Practice, Ahmadu Bello University Zaria, Kaduna State, Nigeria

Article history:
Received 27 December 2020
Revised 9 May 2021
Accepted 12 May 2021
Available online 17 May 2021

Keywords:
Adrenergic pathway
Antidiarrhoeal activity
Antidiarrhoeal mechanisms
Combretum hypopilinum
Opioidergic pathway

Abstract

This article describes the dataset for the elucidation of the possible mechanisms of antidiarrhoeal actions of methanol leaves extract of Combretum hypopilinum (Diels) Combretaceae in mice. The plant has been used in traditional medicine to treat diarrhoea in Nigeria and other African countries. We introduce the data for the antidiarrhoeal activity of the methanol leaf extract of Combretum hypopilinum at 1,000 mg/kg investigated using charcoal meal test in mice with loperamide (5 mg/kg) as the standard antidiarrhoeal agent. To elucidate the possible mechanisms of its antidiarrhoeal action, naloxone (2 mg/kg), prazosin (1 mg/kg), yohimbine (2 mg/kg), propranolol (1 mg/kg), pilocarpine (1 mg/kg) and isosorbide dinitrate (150 mg/kg) were separately administered to different groups of mice 30 minutes before administration of the extract. Each mouse was

DOI of original article: 10.1016/j.jep.2020.113750
* Correspondence author at: Department of Pharmacology and Therapeutics, Ahmadu Bello University, Zaria, Kaduna State, Nigeria.
E-mail address: mubarakhussainiahmad@gmail.com (M.H. Ahmad).
Social media: Twitter (M.H. Ahmad)

https://doi.org/10.1016/j.dib.2021.107155
2352-3409/© 2021 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)
dissected using dissecting set, and the small intestine was immediately removed from pylorus to caecum, placed lengthwise on moist filter paper and measured the distance travelled by charcoal relative to the length of the intestine using a calibrated ruler in centimetre. Besides, the peristaltic index and inhibition of charcoal movement of each animal were calculated and recorded. The methods for the data collection is similar to the one used to investigate the possible pathways involved in the antidiarrhoeal action of *Combretum hypopilinum* in mice in the research article by Ahmad et al. (2020) “Mechanisms of Antidiarrhoeal Activity of Methanol Leaf Extract of *Combretum hypopilinum* Diels (Combretaceae): Involvement of Opioidergic and (α1 and β)-Adrenergic Pathways” (https://doi.org/10.1016/j.jep.2020.113750) [1]. Therefore, this datasets could form a basis for in-depth research to elucidate further the pharmacological properties of the plant *Combretum hypopilinum* and its bioactive compounds to develop standardized herbal product and novel compound for management of diarrhoea. It could also be instrumental for evaluating the plant’s pharmacological potentials using other computational-based and artificial intelligence approaches, including predictive modelling and simulation.

© 2021 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)

---

**Specifications Table**

| Subject | Pharmacology, Toxicology and Pharmaceutical Science |
|---------|-----------------------------------------------------|
| Specific subject area | Natural products and Drug discovery |
| Type of data | Figure |
| How data were acquired | We collected the data from our experimental work using charcoal meal test in mice by measuring the total length of small intestine and distance travelled by the charcoal meal. The peristaltic index and percentage inhibition of the charcoal movement were calculated and recorded [2]. |
| Data format | Raw data, Analyzed data |
| Parameters for data collection | Measuring the total length of small intestine and distance moved by charcoal meal and calculation of the peristaltic index and percentage inhibition of the charcoal movement |
| Description of data collection | We collected the data from our experimental work to determine the intestinal antimitotility and probable mechanisms of antidiarrhoeal activity of methanol leaf extract of *Combretum hypopilinum* Diels (Combretaceae) using the intestinal transit test in mice. The mice were dissected using dissecting set; their small intestines were removed from pyloric sphincter to ileocecal junction and placed lengthwise on moist filter paper. The distance travelled by the charcoal meal in relation to the total length of the small intestine using a calibrated ruler (cm). Besides, the peristaltic index and percentage inhibition of charcoal meal movement for each animal were calculated and recorded |
| Data source location | Department of Pharmacology and Therapeutics, Faculty of Pharmaceutical Sciences, Ahmadu Bello University, Zaria, Kaduna state, Nigeria |
| Data accessibility | The data is available with the article |
| Related research article | Ahmad, M. H., Zezi, A. U., Anafi, S. B., Alhassan, Z., Mohammed, M., Danraka, R. N. (2020). Mechanisms of Antidiarrhoeal Activity of Methanol Leaf Extract of *Combretum hypopilinum* Diels (Combretaceae): Involvement of Opioidergic and (α1 and β)-Adrenergic Pathways. *Journal of Ethnopharmacology*, 113750. https://doi.org/10.1016/j.jep.2020.113750 |
Value of the Data

• The datasets provided in this article describe the intestinal antimotility action of the plant *Combretum hypopilinum* Diels (Combretaceae) to establish its folkloric antidiarrhoeal claim and its probable mechanisms of action; hence, highlighting the antidiarrhoeal action and possible participation of opioidergic and adrenergic systems in the antidiarrhoeal activity of the plant as a basis for its use in traditional medicine against diarrhoea.

• Valuable pharmacological information of the *Combretum hypopilinum* on intestinal motility has been provided, which could serve as a basis for further pharmacological studies by researchers working on natural products to study the specific target of its action, and develop a standardized herbal product for use against diarrhoeal disease.

• The dataset is available for researchers for studies aiming to carry out artificial intelligence-based experiments, including modelling and simulation.

1. Data Description

This data in brief article provided dataset generated from the investigation of the possible mechanisms of antidiarrhoeal activity of methanol leaf extract of *Combretum hypopilinum*. We investigated different pathways (opioiergic, adrenergic, cholinergic and L-arginine nitric oxide systems) associated with the mechanisms of antidiarrhoeal action of the plant following pre-treatment with different drugs (naloxone, prazosin, yohimbine, propranolol, pilocarpine, and isosorbide dinitrate).

Fig. 1 summarized the data for the charcoal movement relative to the total length of the small intestine from the various pathways investigated in the form of a boxplot. The attributes are listed and described in Figs. 2–7 of the related research article (Ahmad et al., 2020). The mean peristaltic index and percentage inhibition of the charcoal movement of all the animals (n=5) in the various pathways are reported in Figs. 2–7.

2. Experimental Design, Materials and Methods

2.1. Collection and identification of the plant materials

The leaves of *Combretum hypopilinum* were obtained from the Galadimawa, Giwa Local Government Area, Kaduna State, Nigeria. The plant was identified by comparison with voucher specimen (012063) already deposited at the Herbarium Section of the Department of Botany, Ahmadu Bello University, Zaria, Kaduna State, Nigeria. The plant’s name was confirmed from http://www.theplantlist.org on 29th January 2020.

2.2. Experimental animals

Adult Wistar rats (120-160g) of both sexes were obtained from the experimental animal house facility of the Department of Pharmacology and Therapeutics, Ahmadu Bello University, Zaria, Kaduna State, Nigeria. The animals were housed in standardized polypropylene cages at a stable temperature (22 ± 3 °C), relative humidity (30–70%) and a 12-hour light and 12-hour dark cycle. They were allowed to have access to a commercial standard rodent pellet diet (Vital feed, Jos, Nigeria) and water ad libitum. The experimental procedures were approved by Ahmadu Bello University Ethical Committee on Animal Use and Care (approval number: ABUCAUC/2020/40) and conducted in accordance with the guidelines for the Care and Use of Laboratory Animals as published by the United State National Institute of Health (NIH Publication No. 85–23, revised 1996).
Fig. 1. Boxplots of the (a) Opioidergic Pathway, (b) \(\alpha_1\)-adrenergic Pathway, (c) \(\alpha_2\)-adrenergic Pathway, (d) \(\beta\)-adrenergic Pathway, (e) Cholinergic Pathway, (f) L-arginine Nitric Oxide Pathway of Antidiarrhoeal Activity [(i) Length of small Intestine, (ii) Distance Traveled by the Charcoal meal] of Methanol Leaf Extract of *Combretum hypopilinum* Diels (Combretaceae). For each treatment, \(n = 5\) mice. DW (10) = Distilled Water (10 ml/kg), MECH (1000) = Methanol Leaf Extract of *Combretum hypopilinum* (1000mg/kg), LOP (5) = Loperamide (5mg/kg), NAL (2) = Naloxone (2mg/kg), MOP (10) = Morphine (10mg/kg), PRA (1) = Prazocin (1mg/kg), YOH (2) = Yohimbine (2 mg/kg), PROP (1) = Propranolol (1 mg/kg), PLC (1) = Pilocarpine (1mg/kg), ATR (5) = Atropine Sulphate (5 mg/kg), ISD (150) = Isosorbide Dinitrate (150 mg/kg).
2.3. Chemicals and drugs

The chemicals and drugs used for the study include methanol, chloroform, naloxone hydrochloride, prazosin hydrochloride, yohimbine hydrochloride, propranolol hydrochloride, pilocarpine hydrochloride were all sourced from Sigma Aldrich Chemical Co. USA. Other chemicals used include castor oil (Bell and Sons, Southport PR9 AL, England), acacia gum powder (Evans...
**Fig. 2.** Effect of naloxone on the antidiarrhoeal activity of methanol leaf extract of *Combretum hypopilinum* using intestinal transit test in mice

**Fig. 3.** Effect of prazosin on the antidiarrhoeal activity of methanol leaf extract of *Combretum hypopilinum* using intestinal transit test in mice

**Legend:**
- **Peristaltic index (%)**
- **Inhibition of Charcoal movement (%)**

**Key:**
- DW = Distilled Water
- MECH = Methanol leaf extract of *C. hypopilinum*
- NAL = Naloxone
- MECH = Methanol leaf extract of *C. hypopilinum*
- LOP = Loperamide
- n = 5
Medical Lt Speke, Liverpool), medicinal charcoal (Ultracarbon powder-Merck KGaA Darmstadt, Germany), distilled water, loperamide (Imodium®, Jansen Pharmaceuticals, Pakistan), and isosorbide dinitrate (Isordil®) (MEDA Manufacturing Gmbh, Germany).

2.4. Extraction of the plant material

The leaves of *Combretum hypopilinum* were cleaned, air-dried in a shaded environment and intermittently weighed until a constant weight was obtained. The plant material was pulverized into a powdered from using pestle and mortar. The powdered leaves (1 kg) were extracted with 2.5 L of 70% v/v methanol using soxhlet apparatus for 72-hours. The extract was concentrated to dryness by removing the solvent on a water bath set at 45 °C. The dried extract was stored in a tightly labelled container for the subsequent experiments.

2.5. Investigation of the antidiarrhoeal activity

Castor oil-induced intestinal transit test in mice as previously described by Di Carlo et al. [2] was adopted. Fifteen mice were fasted for 18 hours, randomly divided into three groups and orally administered distilled water (10 ml/kg), MECH (1,000 mg/kg), and loperamide (5 mg/kg). Thirty minutes post-treatments; castor oil (0.5 ml) was orally administered to each
mouse. Thirty minutes after castor oil administration, 0.5 ml charcoal meal (10% activated charcoal suspension in 5% acacia) was administered to each mouse by oral gavage. Thirty minutes after charcoal administration, the mice were anaesthetized using chloroform and euthanized by cervical dislocation. The abdomen of each mouse was dissected and removed the small intestine from pyloric sphincter to ileo-caecal junction. The small intestine was placed lengthwise on moist filter paper, and the distance travelled by the charcoal relative to the total length of the intestine was measured in centimetre using a calibrated ruler. The peristaltic index and percentage inhibition of charcoal movement were also calculated and recorded using the following formula:

\[
\text{% Peristaltic index of charcoal meal} = \frac{\text{distance travel by charcoal meal (cm)}}{\text{total length of the small intestine (cm)}} \times 100
\]

\[
\text{% inhibition of charcoal movement} = \frac{A - B}{A} \times 100
\]

A = Mean movement of charcoal meal in the negative control group
B = Mean movement of charcoal meal in the test group

2.6 Elucidation of the possible mechanism of antidiarrhoeal activity

To elucidate the possible mechanisms of antidiarrhoeal activity of MECH, the pathways and antagonists/agonist used were as follows:

Fig. 5. Effect of propranolol on the antidiarrhoeal activity of methanol leaf extract of Combretum hypopilinum using intestinal transit test in mice

DW = Distilled Water, MECH = Methanol leaf extract of C. hypopilinum, PRO = Propranolol, MOR = Morphine, n=5.
Fig. 6. Effect of pilocarpine on the antidiarrhoeal activity of methanol leaf extract of Combretum hypopilinum using intestinal transit test in mice.

DW = Distilled Water, MECH = Methanol leaf extract of C. hypopilinum, PIL = Pilocarpine, ATR = Atropine Sulphate, n=5.

a) **Opioidergic**: using naloxone (a nonselective opioid receptor antagonist, 2 mg/kg, s.c) and standard drug loperamide (μ-opioid receptor agonist, 5 mg/kg, p.o)
b) **α₁-adrenergic**: using prazosin (α₁-adrenoceptor antagonist, 1 mg/kg, s.c) and standard drug morphine (10 mg/kg, s.c)
c) **α₂-adrenergic**: using yohimbine (α₂-adrenoceptor antagonist, 2 mg/kg, i.p) and a standard drug morphine (10 mg/kg, s.c)
d) **β-adrenergic**: using propranolol (a non-selective β-adrenergic blocker, 1 mg/kg, i.p) and a standard drug morphine (10 mg/kg, s.c)
e) **Cholinergic**: using pilocarpine (a non-selective muscarinic receptor agonist, 1 mg/kg, s.c) and a standard drug atropine sulphate (a muscarinic receptor antagonist, 5 mg/kg, p.o)
f) **Nitric oxide**: using isosorbide dinitrate (a nitric oxide donor, 150 mg/kg, p.o) and a standard agent morphine (10 mg/kg, s.c)

For each of the mechanistic pathways above, mice were randomly divided into six groups (n=5) as follows:

Group I: Distilled water (10 ml/kg, p.o) alone
Group II: Receptor antagonist/agonist (drugs and doses mentioned above depending on the pathway involved) alone
Group III: MECH (1,000 mg/kg, p.o) alone
Group IV: Pretreated with receptor antagonist/agonist 30 minutes before administration of MECH (1,000 mg/kg) p.o.
Fig. 7. Effect of isosorbide dinitrate on the antidiarrhoal activity of methanol leaf extract of *Combretum hypopilinum* using intestinal transit test in mice

DW= Distilled Water, MECH= Methanol leaf extract of *C. hypopilinum*, ISD= Isosorbide dinitrate, MOR= Morphine, n=5.

Groups V: Standard drug (drugs and doses mentioned above depending on the pathway involved) alone

Group VI: Pretreated with receptor antagonist/agonist 30 minutes before administration of standard (drugs and doses mentioned above depending on the pathway involved) alone.

Thirty minutes after the above treatments, 0.5 ml of castor oil was orally administered to each mouse. Thirty minutes after castor oil administration, charcoal meal (0.5 ml) was orally administered to each mouse. After 30 minutes after charcoal administration, the mice were anaesthetized and their abdomen opened to remove the small intestines from pyloric sphincter to ileo-caecal junction. The small intestines were placed lengthwise on moist filter paper, and the distance travelled by the charcoal along the total length of the intestine was measured using a calibrated ruler. The peristaltic index was also calculated and recorded using the following formula:

\[
\% \text{ Peristaltic index of charcoal meal} = \frac{\text{distance travel by charcoal meal (cm)}}{\text{Total length of the small intestine (cm)}} \times 100
\]

**Ethical Statement**

The experimental protocols of this study were approved by the Ahmadu Bello University Ethical Committee on Animal Use and Care Research Policy (ABUCAUC/2020/40) and conducted following the recommendations from the guidelines for the Care and Use of Laboratory Animals...
as published by the United States (US), National Institute of Health (NIH Publication No. 8023, revised 1978).

CRedit Author Statement

Mubarak Hussaini Ahmad: Conceptualization, Methodology, Investigation, Writing - original draft, Data curation, Visualization; Abdulkadir Umar Zezi: Validation, Supervision, Project administration, Writing - review & editing; Sherifat Bola Anafi: Validation, Supervision, Writing - review & editing; Zakariyya Alhassan: Investigation and Resources; Mustapha Mohammed: Formal analysis, Writing - review & editing; Rabiu Nuhu Danraka: Investigation, Resources.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have, or could be perceived to have influenced the work reported in this article.

Acknowledgements

The authors are thankful to the technical staff of the Department of Pharmacology and Therapeutics, Ahmadu Bello University, Zaria, Nigeria, for their technical support during the conduct of the study. We are also thankful to all members of Young Pharmacists Scholars (YPS), a mentorship forum for their continuous support and guidance.

Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.dib.2021.107155.

References

[1] M.H. Ahmad, A.U. Zezi, S.B. Anafi, Z. Alhassan, M. Mohammed, R.N. Danraka, Mechanisms of antidiarrhoeal activity of methanol leaf extract of combretum hypopilinum diels (Combretaceae): involvement of opioidergic and (α1 and β)-adrenergic pathways, J. Ethnopharmacol. (2020) 113750, doi:10.1016/j.jep.2020.113750.
[2] G. Di Carlo, G. Autore, A.A. Izzo, P. Maiolino, N. Mascolo, P. Viola, … F. Capasso, Inhibition of intestinal motility and secretion by flavonoids in mice and rats: structure-activity relationships, J. Pharm. Pharmacol. 45 (12) (1993) 1054–1059, doi:10.1111/j.2042-7158.1993.tb07180.x.