



Archives of Ecotoxicology

Journal homepage: <https://office.scicell.org/index.php/AE>



Acute toxicity study of ethanolic extract of *Psidium guajava* and *Ficus sur* leaves in albino rats

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Article info

Received 10 July 2025
Revised 30 September 2025
Accepted 5 November 2025
Published online 31 December 2025

Short Communication

Keywords:

Acute toxicity;
Psidium guajava;
Ficus sur;
Ethanolic extract;
Albino rats; LD₅₀;
Traditional medicine;
Safety profile.

Abstract

The leaves of *Psidium guajava* and *Ficus sur* are important sources of bioactive compounds, traditionally valued for their medicinal properties and increasingly investigated for their pharmacological and therapeutic potential. Safety assessment of herbal extracts is necessary to determine their medicinal potential. This study evaluates the acute toxicity of an ethanolic extract of *Psidium guajava* and *Ficus sur* leaves in albino rats to ascertain its safety profile. The Organisation for Economic Co-operation and Development (OECD) standards were employed to assess acute toxicity. Phase I rats were administered dosages of 10, 100, and 1000 mg/kg, whereas Phase II rats were administered doses of 1,600, 2,900, and 5000 mg/kg. The albino rats were allocated randomly to each group. Following oral treatment of the extract, the animals were observed for toxicity, behavioural alterations, and physiological markers over a period of 14 days. The mathematical technique was employed to ascertain the median lethal dose (LD₅₀). No fatalities were seen at the maximal dosage of 5000 mg/kg that was evaluated. No obvious adverse effects were observed across the different dosage groups, based on the behavioural and physiological assessments. No evidence of toxicity was found, since the LD₅₀ was established at 2154.07 mg/kg. The ethanolic extract of *Ficus sur* leaves and *Psidium guajava* exhibited no adverse effects and demonstrated a favourable safety margin, suggesting its potential for future pharmacological research. The data on the safety profile of ethanolic extracts of *Psidium guajava* and *Ficus sur* leaves provide valuable insights that enhance understanding of their medicinal potential and support future research toward developing safe and effective herbal therapeutics.

1. Introduction

Traditional medicine has relied on medicinal plants to treat a wide range of illnesses and conditions for generations. Two plant species, *Ficus sur* and *Psidium guajava*, have a long history of usage in folk medicine due to their purported therapeutic qualities. The guava, or *Psidium guajava*, is a species of plant in the Myrtaceae family. Originally native to the tropical regions of South and Central America, this plant is now cultivated worldwide, including in Asia and Africa (Orwa et al., 2009). Among the many traditional uses for the herb in folk medicine is the alleviation of gastrointestinal issues including dysentery, respiratory infections, and diarrhoea (Iwu, 2014). However, *Ficus sur* is actually a species of plant that belongs to the Moraceae family (Ogidi et al., 2025a). Traditional medicine practitioners in Nigeria and other West African countries often make use of this tropical plant (Burkill, 2004). In traditional medicine, the herb has a number of uses, such as treating skin diseases, diarrhoea, and malaria (Iwu, 2014). Antimicrobial, anti-inflammatory, and antioxidant activity have been observed in the ethanol extract of *Psidium guajava* leaves (Oguoma et al., 2025; Okara et al., 2025; Ogidi & Omu, 2025; Ogidi & Joshua, 2024; Pereira et al., 2023; Adesida &

Farombi, 2012). Pereira et al. (2008) observed or noted that the plant's extract can suppress the growth of a range of microbes including fungi and bacteria. Additionally, they exhibit anti-inflammatory properties by preventing the synthesis of pro-inflammatory cytokines. Researchers have found that phenolic components, such as flavonoids and phenolic acids, are responsible for the antioxidant action of *Psidium guajava* extracts (Adesida & Farombi, 2012).

Similarly, Asase et al. (2012) and Okaneko-Out & Okorosaye-Orubite (2017) found that an ethanol extract of *Ficus sur* leaves has antioxidant, anti-inflammatory, and antibacterial properties. Asase et al. (2012) found also that the plant's extracts can suppress the growth of a range of microorganisms, including fungi and bacteria. Additionally, they exhibit anti-inflammatory properties by preventing the synthesis of pro-inflammatory cytokines. Phenolic chemicals, including as flavonoids and phenolic acids, are believed to be responsible for the antioxidant action of *Ficus sur* preparations (Okaneko-Out & Okorosaye-Orubite, 2017).

Toxicity studies has been carried out in various plants and polyherbal formulations (Ogidi et al., 2025b, 2024, 2022; Ogoun et al., 2022a, b). However, there a paucity of data on the acute toxicity profiles of *Psidium guajava* and *Ficus sur*, despite

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their putative medicinal potential. In order to ascertain the hazards and benefits of using plant extracts, acute toxicity studies are crucial (OECD, 2008, 2001). This research set out to determine whether or not an ethanol extract of *Psidium guajava* and *Ficus sur* leaves was acutely poisonous to rats. This study's findings will shed light on the acute toxicity profiles of *Ficus sur* and *Psidium guajava* extracts, which is crucial for ensuring their safe use in traditional medicine..

2. Material and methods

2.1 Collection and preparation of plant extract

The freshly picked leaves were sourced from a location in Amassoma, Bayelsa State, Nigeria, which is renowned for its profusion of the *Ficus sur* and *Psidium guajava* plant. The plant was identified by a Prof. Inetiminebi Arrow Ogidi from the Department of Plant Science at Niger Delta University in Bayelsa State, Nigeria. The voucher specimen with the numbers are NDUP/24/11 and NDUP/24/12 for *Ficus sur* and *Psidium guajava* respectively which were housed in the Herbarium Unit of Niger Delta University, which is situated on Wilberforce Island in Bayelsa State, Nigeria. The department is a component of the pharmacology faculty. The leaves were collected in large quantities and allowed to dry in a shaded area at room temperature for a period of two weeks. They were then reduced to a coarse powder. The powder, weighing 500 grams, was dissolved in 2 liters of methanol and left to stand for 72 hours, stirring occasionally. The extract was filtered with a cheese cloth and a rotary evaporator used to evaporate the filtrate at 50°C. Distilled water was added to the dry residue as needed to make it liquid again.

2.2 Acute toxicity studies (LD₅₀) of the extract

The acute toxicity test was carried out using the method described by Lorke (1983), and the experiment was conducted in two distinct phases (Table 1).

Table 1 Experimental design for oral administration of *Psidium guajava* and *Ficus sur* ethanolic extracts in rats.

Phase	Administration Method	Dose (mg/kg)	Number of Rats per Group	Fasting Condition	Observation Schedule
Phase 1	Oral administration of ethanolic extract	10, 100, 1000	3	Overnight fast	Monitored continuously for the first hour, every 4 hours thereafter, and then hourly for the next 24 hours
Phase 2	Oral gavage of ethanolic extract	1600, 2900, 5000	3	Overnight fast	Monitored continuously for the first hour, every 4 hours thereafter, and then hourly for the next 24 hours

The formula below was used to compute the LD₅₀:

$$LD_{50} = \int a \times b$$

Where, a = least dose that caused mortality and b = highest dose that did not cause mortality.

2.3 Ethics approval and consent to participate

The research and ethics committee of the Biochemistry Department at Bayelsa Medical University's Faculty of Basic Medical Sciences in Yenagoa, Bayelsa State, Nigeria, gave their stamp of approval to this work (Reference Number: FBMS/AD/BCH/REC/29/03).

3. Results

3.1 Acute toxicity studies (LD₅₀)

Tables 2 and 3 summarise the results of the acute toxicity. After the first hour of therapy, the animals' overall behaviour was monitored continuously for another hour, then intermittently for four hours, and finally hourly for the following twenty-four hours. At doses of 10 mg/kg, 100 mg/kg, and 1000 mg/kg in phase I, and 1600 mg/kg, 2900 mg/kg, and 5000 mg/kg in phase II, the studied plant extract (*Ficus sur* and *Psidium guajava* leaves) was orally administered without treatment-related adverse symptoms or mortality. These animals showed no signs of temperature, impaired food intake, cutaneous effects, water consumption, or behavioural changes associated with the plant extracts, the LD₅₀ of the study was 2,154.07 mg/kg.

Table 2 General appearance and Behavioral observations of acute toxicity study for Phase I treated groups

S/N	PHASE I	GROUP I 10MG/KG	GROUP II 100MG/KG	GROUP III 1000MG/KG
1.	Body Weight	152g, 157g, 150g	161g, 158g, 164g	157g, 150g, 159g
2.	Daily Observation	NST	NST	NST
I.	Behavioral changes	N	N	N
II.	Breathing	N	N	N
III.	Skin effects	NE	NE	NE
IV.	Water consumption	N	N	N
V.	Impairment in food intake	N	N	N
VI.	Temperature	N	N	N
VII.	Drowsiness	NP	NP	NP
VIII.	Urination	NE	NE	NE
IX.	Diarrhea	NP	NP	NP
X.	Eye color	NE	NE	NE
3.	Digestion	NO	NO	NO
4.	LD ₅₀	ND	ND	ND

Key: NO: Not Observed, NST: No signs of toxicity, N: Normal, NE: No effects, NP: Not present, ND: No death

Table 3 General appearance and Behavioral observations of acute toxicity study for Phase II treated groups

S/N	PHASE II	GROUP I 1600MG/KG	GROUP II 2900MG/KG	GROUP III 5000MG/KG
1.	Body Weight	155g	158g	163g
2.	Daily Observation	NST	ST	ST
I.	Behavioral changes	N	N	N
II	Breathing	N	N	N
III	Skin effects	NE	NE	NE
IV	Water consumption	N	N	N
V	Impairment in food intake	N	N	N
VI	Temperature	N	N	N
VII.	Drowsiness	NP	NP	NP
VIII.	Urination	NE	NE	NE
IX	Diarrhea	NP	NP	NP
X	Eye color	NE	NE	NE
XI	Digestion	NO	NO	NO
3.	LD ₅₀	ND	ND	ND

Key: NO: Not Observed, NST: No signs of toxicity, N: Normal, NE: No effects, NP: Not present, ND: No death

4. Discussion

The ethanolic extract of *Psidium guajava* and *Ficus sur* leaves demonstrated a favourable safety profile in the acute toxicity assessments, as there were no fatalities observed at the maximum dose of 5000 mg/kg. The extract is deemed virtually non-toxic, with an LD₅₀ value of 2154.07 mg/kg (Loomis & Hayes, 1996). The absence of fatalities at the tested doses suggests that the extract possesses a substantial therapeutic window, which is promising for its prospects in the pharmaceutical sector. No toxicity was observed in Phase I of the trial, which included dosages of 10, 100, and 1000 mg/kg. All treated groups maintained their typical weights, dietary and fluid consumption, and physiological attributes. Prior studies indicate that herbal extracts are safe at low to moderate concentrations, and the absence of side effects at these lower levels corroborates this finding (OECD, 2008). The extract's safety profile is further corroborated by data indicating it does not elicit acute toxic responses at sub-lethal concentrations (Enenebeaku et al., 2021).

Phase II entailed evaluating the impact of increased dosages (1600 mg/kg, 2900 mg/kg, and 5000 mg/kg) to ascertain the presence of any adverse side effects. No fatalities were recorded in these groups; however, minor toxicity symptoms were observed at dosages of 2900 mg/kg and 5000 mg/kg, suggesting

a dose-dependent reaction. While the extract is generally benign, excessive use may result in toxicological effects due to the presence of toxicity at elevated dosages (OECD, 2008). The absence of fatalities, however, supports the notion that the extract is safe for use. Further evidence of the extract's tolerability is the absence of significant physiological impairments such as alterations in respiration, skin conditions, digestion, or urination. In accordance with findings from pertinent herbal toxicity studies (Zhou et al., 2016), no alterations in eye colour, diarrhoea, or lethargy were observed. The extract has been observed to induce minimal physiological stress, supporting its potential medical applications. Furthermore, Tables 1 and 2 indicate that the extract does not adversely affect the central nervous system or the gastrointestinal system. This confirms what another study found: that *Psidium guajava* extract does not have any neurotoxic effects (Rai et al., 2017).

The ethanolic extract of *Psidium guajava* and *Ficus sur* leaves was shown to be safe up to 5000 mg/kg in the acute toxicity testing, which had an LD₅₀ value of 2154.07 mg/kg. The findings lay the groundwork for further studies to determine the safety over the long term, including sub-chronic and chronic toxicity evaluations. These findings provide useful toxicological evidence that supports the historic usage of these plants in ethnomedicine, which is particularly relevant given the

increased interest in plant-based medicinal compounds (Gupta & Sharma, 2021). The effects' bioactive components and their pharmacokinetic characteristics should be the subject of further study.

5. Conclusion

The ethanolic extract of *Psidium guajava* and *Ficus sur* leaves was determined to be safe and non-toxic at a dosage of 5000 mg/kg in the acute toxicity assessment. This is corroborated by the absence of toxicity indicators, behavioural alterations, or fatalities in the treated groups. Another piece of evidence corroborating the extract's safety profile is the calculated LD₅₀ value of 2154.07 mg/kg. Prior studies regarding the safety and non-toxicity of extracts from *Psidium guajava* and *Ficus sur* align with the findings of this research. The absence of adverse effects from the extract on the central nervous system, gastrointestinal tract, or any other physiological parameter suggests its potential for therapeutic application. Further research is necessary to evaluate the extract's chronic toxicity and potential drug interactions. The data presented on the safety profile of the ethanolic extracts of *Psidium guajava* and *Ficus sur* leaves provide valuable insights. These findings contribute to the growing body of knowledge on the medicinal potential of the extracts and may guide future research aimed at developing safe and effective herbal therapeutics.

Consent for publication

Not applicable

Availability of data and materials

The datasets utilized and/or analyzed in the present study are available from the corresponding author upon reasonable request.

Competing Interest

The authors declare to have no competing interests.

Funding

The Institutional Based Research (IBR) in the Department of Biochemistry, Bayelsa Medical University Yenagoa, Bayelsa State, Nigeria, was funded by the Tertiary Education Trust Fund (TETFUND) for this study.

Acknowledgments

We would like to express our gratitude to Mr. Sunday Chukwuma. The Laboratory Technologist who provided support during performance of the job.

Authors' Contribution Details

Concept – O.I.O. Design – O.I.O., T.R.O. Supervision – O.I.O. Materials – O.I.O.; T.R.O. Data Collection and/or Processing – O.I.O.; Analysis and/or Interpretation – T.R.O., O.I.O.; Literature Search – T.R.O.; Writing – O.I.O. Critical Reviews – O.I.O, T.R.O.

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