Research Article

The Effect of Ethanoic Extract of Xylopiaaethiopica (UDA) on Pain Sensitivity of Female Wistar Rats

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Abstract

Background: In African traditional medicine, the dried pods of Xylopia aethiopica are frequently used to manage different human ailments. In Nigeria, it is consumed in soups after childbirth to aid in wound healing, pain relief, uterine recovery, and lactation. The study investigates the impact of Xylopia aethiopicafruit extract on pain sensitivity using Wistar rats.

Methods: Twelve female Wistar rats were divided into two groups (Group 1 - Control and Group 2 -100mg/kg Xylopia aethiopicaextract-fed) and received standard rat chow and water for fourteen days following which pain sensitivity was assessed using a hot plate. The results were presented as Mean and Independent Student T-test was utilized for statistical analysis with significance determined at P≤0.05. Increased pain tolerance indicated reduced sensitivity.

The escape latencies of both groups were 5secs and 8 secs respectively. Group 2 demonstrated a noteworthy increase in pain tolerance compared to Group 1 (P = 0.003). This experimental study indicates that the ethanoic extract of Xylopia aethiopicafruit has analgesic properties.

Conclusion: The result of this study provides support for the use of dried Xylopia aethiopicapods in pain management across some communities in Southern Nigeria.

Keywords: Pain Sensitivity, Xylopia aethiopica, Hot plate test.

Introduction

Xylopia aethiopica, commonly known as Negro Pepper, holds distinct names within different Nigerian tribes. Among the Igbo tribe in the South-Eastern Region, it's called Uda, while the Yorubas in the South-West refer to it as Eeru Alamo. In the Northern region, the Hausa Tribe knows it as Chimba. This aromatic tree can grow to heights of 15–30 meters and have diameters of 60–70 centimeters. It's indigenous to lowland rainforests and moist fringe forests in the savanna zones of Africa, particularly in the West, Central, and Southern regions, as indicated by Godam et al. in 2021 and Erhirhie EO et al. in 2014[1].

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Figure 1: Dried and fresh Xylopiaaethiopica fruit with stems and leaves

Source: Ahamefula. A. Ahuchaogu, et.al, "Chemical Constituents of Methanol Fruit Extract of Xylopia aethiopica by GC-MS and FT-IR Spectroscopy", ARC Journal of Pharmaceutical Sciences, 6(1), pp. 14-24. DOI: http://dx.doi.org/10.20431/2455-1538.0601003

The term X. aethiopica originates from the fusion of two words with Greek and Ethiopian roots: Xylopia (derived from the Greek word "xylonpikron" denoting 'bitter wood') and aethiopica (from Ethiopian origin, its meaning understood). According to Burkhill[2] (1985), X. aethiopica holds numerous applications. For instance, the wood from this tree is widely used in constructing huts and boats. The fruit serves as a valuable spice in African culinary traditions, enhancing local dishes like Hausa koko, isi-ewu, and Obeata, as observed by Tairu, Hofmann, and Schieberle[3] in 1999.

X. aethiopicais a useful medicinal plant with Central Nervous System activities including neuroprotection and anti-inflammatory properties (Biney et al., 2016)[4]. Agbarukwu et al.[5] (2017) reported the used of X. aethiopica for management of rheumatism, headache, neuralgia, colic pain, bronchitis, and asthma. In traditional medicine, X. aethiopica is used for soups during post-delivery care (for discharge of placenta) (*ibid*) and for uterine contraction (post-delivery) together with T. tetraptera(Durugbo et al, 2013)[6].

Pain constitutes an uncomfortable emotional sensation that can manifest with or without physical tissue harm. It's characterized by descriptors such as sharp, dull ache, or shooting, and can elicit responses like crying and even fainting. Pain emerges from either an actual or potential injury to the body, often explained by its origin, such as the fiery sensation from a burn or the cramping resulting from muscle contraction. Pain falls into two categories: acute or chronic. Acute pain is transient and intense, often having a clear cause. Initially, it might be localized before potentially spreading. Typical treatment involves medication. On the other hand, chronic pain is persistent, with varying levels of severity. It extends over prolonged periods and poses greater challenges in management, frequently necessitating specialized professional attention. (Sembulingam, 2012)[7]

Materials and Method

A. Collection, Identification and Preparation of Plant Materials

As part of a Neurobehavioral investigation, the experiment took place from February to April 2023 at the Animal Farm situated within the College of Health Sciences at the University of Port Harcourt. Dried Xylopia aethiopica pods were acquired from a local market in Obio-Akpor Local Government Area, Rivers State. To ensure the plant's authenticity, Dr.Ajuru from the Department of Plant Science and Biotechnology at Rivers State University, Nigeria, verified it. The pods underwent drying and grinding, eventually becoming a powder. Following a method outlined by Abubakar et al.[8] in 2020, the extraction process utilized maceration. Additional pulverization of the pods into fine powder was accomplished using a laboratory manual blender. The extracted powders were quantified and recorded. Each sample's powder was soaked in 70% ethanol for three days, intermittently stirred, and filtered on the third day. Post-extraction, the micelle was separated from the menstruum through water bath-assisted evaporation.

Referring to prior research by Akinloye et al. in 2019[9], the LD50 (lethal dose for 50% of the population) for Xylopia aethiopica was determined as 3,464 mg/kg. As a result, a dose of 100 mg/kg based on body weight was administered for this study.

B. Experimental Animals and Management

A total of twelve Female Wistar rats were obtained from the animal facility within the Faculty of Basic Medical Sciences at the University of Port

Harcourt. These rats were accommodated in cages and maintained within their natural environmental settings. Their sustenance included a regular diet sourced from Flour Mill Port Harcourt. At the onset, their weights spanned from 87g to 103g. Before commencing the experiment, their weights underwent measurement. The research conducted was in alignment with the guidelines set forth by the European Community for the utilization and welfare of laboratory animals, as outlined in the year 1986.

C. Study Design

Twelve female rats were divided randomly into two groups, with each group containing six rats:

1. Group 1 (Control Group): Rats in this group were given distilled water and rat chow for a duration of 14 days.
2. Group 2 (Test Group): Rats in this group were administered 100mg/kg of Xylopia aethiopica along with rat chow and distilled water for a period of 14 days.

D. Determination of Pain Sensitivty

The hot-plate test assesses how test animals are to pain induced by heat. It involves exposing subjects to quick, intense bursts of thermal stimulus. The objective is to measure the time it takes for a response, such as an attempt to escape, assuming that quicker reactions correspond to having a lower threshold for pain. This procedure is conducted by placing rats on a heated surface within a glass enclosure equipped with a foot pedal connected to a timer. The heated surface reaches a temperature of 55°C, and rats are introduced individually within plastic containers. Once the desired reaction is observed, the timer is stopped. If the rat doesn't react within 30 seconds, the test is concluded. The parameter that's measured is the escape latency, which indicates the duration the rat requires to try to move away from the heated surface.

Results and Discussion

The results revealed that on average the rats in Group 1 had an escape latency of 5 secs, while those in Group 2 had a latency of 8secs. Group 2 demonstrated a noteworthy increase in pain tolerance compared to Group 1 (P = 0.003).

Table 1: The Escape Latency of the Wistar Rats in Group 1 and Group 2 During the Hot Plate Test

ESCAPE LATENCY (Secs)		
Seq	**Group 1 -Control**	**GROUP 2 - Fed with 100mg/kg X. aethiopica**
R1	4	9
R2	3	6
R3	6	10
R4	6	7
R5	5	8
R6	6	8
Average	5	8

T-Test of Significance for Pain Sensitivity

Table 2: The Independent Student T-Test of Significance of the Escape Latency of the Wistar Rats in Group 1 and Group 2

Group Statistics					
	Group	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Escape_latency	Control	6	5.0000	1.26491	.51640
	Fed with 100mg/kg of Xylopia aethiopica	6	8.0000	1.41421	.57735

Independent Samples Test										
		Levene's Test for Equality of Variances		**t-test for Equality of Means**						
		F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
									Lower	**Upper**
ESCAPE_ LATENCY	Equal variances assumed	.000	1.000	-3.873	10	.003	-3.00000	.77460	-4.72591	-1.27409

An independent-samples t-test was conducted to determine whether there is a difference in the escape latency between the control group (Group 1) and the group fed with 100mg/kg of X. aethiopica (Group 2). The results indicate a significant difference between Group 1 (M=5.0000, SD=1.26491) and Group 2 (M=8.0000, SD=1.41421), [t (10) = -3.873, p = .003 < .05]. The magnitude of the mean difference was -3.00000, the 95% confidence interval of the difference between means ranged from [-4.72591 to -1.27409] and indicates a difference between the means of the sample. Consequently, we reject the null hypothesis that there is no difference between the sample means.

The outcomes of this test indicated that Xylopia aethiopica extract possesses analgesic properties, consistent with the findings reported by Woode et al., 2012[10], which demonstrated similar results in the tail-flick test and formalin-induced nociceptive test following administration of the extract.

Conclusion

Pain is a significant, uncomfortable, and distressing sensation that has the potential to cause harm to tissues and subsequent damage. In Nigeria, various medicinal plants are frequently employed to reduce sensitivity to pain, thereby enhancing the ability to withstand pain. Xylopia aethiopica is commonly used in different regions, particularly among postpartum women, to accelerate wound healing and expedite the recovery process. This research demonstrates that X. aethiopica contributes to an increased capacity to endure pain and supports the utilization of dried Xylopia aethiopica pods for pain management within certain Nigerian communities.

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