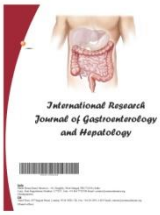

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Evaluation of the Hepatotoxic Potential of Methanol Leaf Extract of *Menta piperitha* Using Animal Model

C. D. Ubani [a*], A. K. Amah [b], C. C. Ofoegbu [c] and D. C. Ejiofor [b]

[a] Department of Human Physiology, College of Medicine and Health Science, Abia State University, Uturu, Nigeria.
[b] Department of Human Physiology, Faculty of Basic Medical Sciences, Imo State University, Owerri, Nigeria.
[c] Faculty of Science, Central Washington College Campus of University of America Enugu, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The aim of this research work was to evaluate the hepatotoxic potential of methanol leaf extract of *M. piperita*. Freshly harvested leaf of *M. piperita* was dried at room temperature and afterwards ground to fine powder. 500 g of powdered plant sample was soaked in 70% methanol for 72 hr. This was followed by the filtration of the extract which was subsequently concentrated. Twenty five adult male wistar rats were divided into five groups of five rats. **Group I** (normal control) was fed rat chow and water only. **Group II** was administered with 100 mg/kg body weight (b.w) of extract orally, **Group III** was administered with 200 mg/kg bw of extract orally, **Group IV** was administered with 400 mg/kg bw of extract orally, **Group V** was administered with 600 mg/kg bw of extract orally. Administration of extract lasted for 14 days after animals were sacrificed and blood sample collected. Biochemical analysis was determined using standard procedures. The results obtained from this study revealed a non-significant (P>0.05) difference in the activity of Alanine transaminase (ALT), Aspartate transaminase (AST) and alkaline phosphatase (ALP) of rats administered with the extract compared with the normal control (30.00±1.01 IU/L), (32.02±1.01 IU/L) and (20.50±0.04 IU/L) respectively. Similar observation was made on Total and Conjugated Bilurubin as well as on the weight of the liver harvested from the rats. In conclusion, it could be deduced from this study that methanol leaf extract of *M. piperita* is not hepatotoxic.

**Corresponding author: E-mail:ubadinkpa@gmail.com*

Keywords: Mentha piperita; hepatotoxic; alanine transaminase; bilurubin.

1. INTRODUCTION

"The liver is an embodiment of several cell types originating from embryo and hepatocytes, biliary epithelial cells (cholangiocytes), stellate cells, Kupffer cells, and liver sinusoidal endothelial cells each of which has unique set of functions that cooperatively regulate hepatic function at multiple levels. Human health fails when the function and morphological integrity of the liver is compromised" [1]. "The liver is known to perform many physiological functions and these include macronutrient metabolism, blood volume regulation, immune system support, endocrine control of growth signaling pathways, lipid and cholesterol homeostasis as well as the breakdown of xenobiotics etc" [1].

Mentha piperita commonly known as peppermint is a hybrid mint, a cross between water mint and spearmint. Although it is indigenous to the Middle East and Europe, the plant is vastly cultivated across the globe. Occasionally, it is found in the wild with its parent species [2]. The plant survives in moist, shaded locations and grows optimally with adequate water supply. Being a hybrid, it is usually sterile, producing very few seed and reproduces almost by vegetative means, spreading quickly by underground runners [3].

Medicinal plants will continue to play crucial role in the health sector [4]. The use of medicinal plants in developing countries in the treatment of diverse human diseases has been widely acknowledged [5]. Notably, the leaf of *Mentha piperita* is employed in the treatment of common cold, inflammation of the mouth, pharynx as well as gastrointestinal tract disorders such as nausea, vomiting, diarrhea, cramps, flatulence and dyspepsia [6,7]. It is has antioxidant, antimicrobial, antiviral, anti-inflammatory, and anti-carcinogenic properties [8]. Although research efforts had revealed the effect of some members of the *Lamiaceae* family on the liver, there is paucity of data on the effect of *Mentha piperita* consumption on the liver..

2. MATERIALS AND METHODS

2.1 Collection of Plant Material

Mature leaf of *Mentha piperita* was harvested from a farm in Uturu community in Abia State. The leaf was taken in a dark polythene bag to the herbarium unit of the Department of Forestry, Michael Okpara University of Agriculture Umudike, Abia State for identification and authentication.

2.2 Sample Preparation

Leaf of *Mentha piperita* was washed with clean tap water, dried at room temperature after which it was ground with an electric blender. To get fine powder, the obtained powder was sieved. For 72 hours, 500 g of powdered plant material was soaked in 2 L of 70% methanol and stirred intermittently. The extract was filtered and the filtrates concentrated.

2.3 Collection of Animals

Adult male wistar rats weighing 100-200 g were obtained from the animal house of the Department of Science Laboratory Technology, Akanu Ibiam Federal Polytechnic, Unwana Afikpo, Ebonyi State. The rats were kept in plastic cages and were allowed access to food and water *ad libitum*. They were acclimatized for two weeks prior to commencement of experiment.

2.4 Lethal Dose 50

This was carried out according to Lorke's method [9]. At the start of the experiment, rats were divided into three groups of three rats per group and were administered with 10 mg, 100 mg and 1000 mg of the extract per kg body weight orally. They were observed for 24 hr for signs of toxicity, including death. In the absence of observable toxicity, the second phase was initiated and involved three rats which were divided into three groups of one rat per group and were administered with 1600, 2900 and 5000 mg/kg of extract respectively. The animals were observed for 48 hr.

2.5 Experimental Design

Twenty-five mature male rats were separated into five groups, each with five rats.

Group I: Normal control fed with only rat chow and water *ad libitum.*
Group II: was administered with 100 mg/kg b.w of methanol extract of *M. piperitha* orally.

Group III: was administered with 200 mg/kg b.w of methanol extract of *M. piperitha* orally
Group IV: was administered with 400 mg/kg b.w of methanol extract of *M. piperitha* orally
Group V: was administered with 600 mg/kg b.w of methanol extract of *M. piperitha* orally

2.6 Collection of Blood Sample

Rats were administered with the extract daily for a period of two weeks after which they were sacrificed and blood sample collected, centrifuged and serum generated stored for use.

2.7 Evaluation of Serum Hepatomarkers

The colorimetric method was employed to determine the activity of Alanine transaminase (ALT), alkaline phosphatase (ALP), aspartate transaminase (AST), bilirubin in the serum using the Randox Diagnostic Kits (USA). Pyruvate solutions of varied concentrations were used to prepare standard curve from which AST activity was computed as described according to [10] Alanine transaminase (ALT) assay was carried out as was described by AST except that 200 Mm DL-Alanine replaced L-Aspartate in the procedures.

2.8 Statistical Analysis

Results were expressed as mean ± standard deviation. The data were analysed using analysis of variance (ANOVA). The difference in mean was compared using Multiple Range Test. $P<0.05$ was considered significant.

3. RESULTS

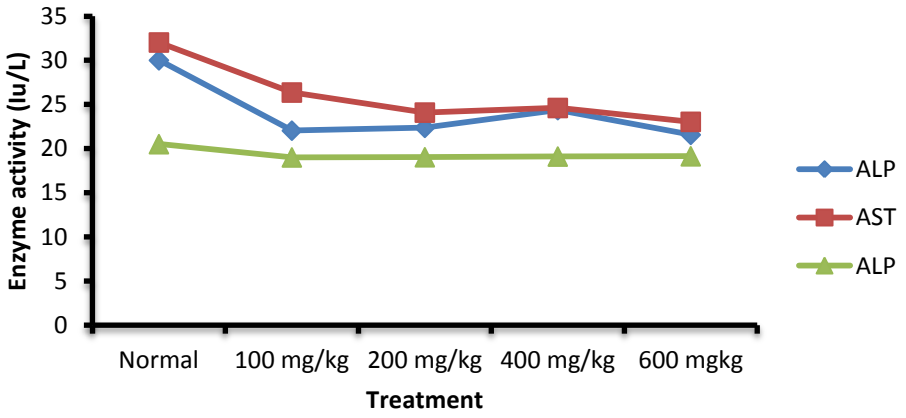

Fig. 1. Activity of Liver enzymes in rats administered with methanol leaf extract of *Mentha piperita*

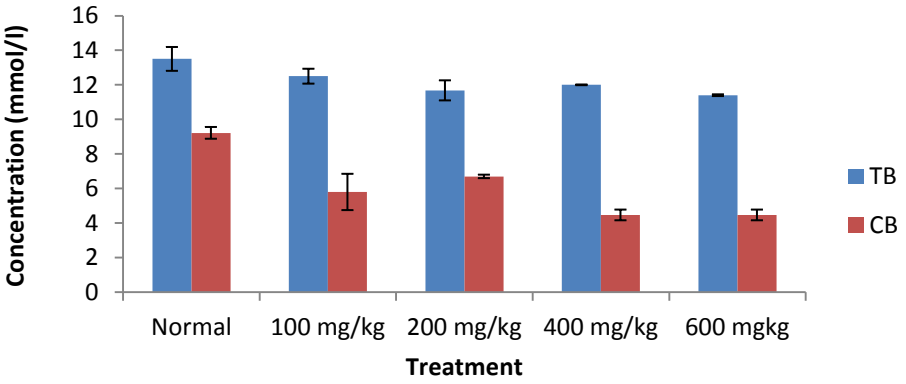

Fig. 2. Serum bilirubin concentration of rats administered with methanol leaf extract of *Mentha piperita*

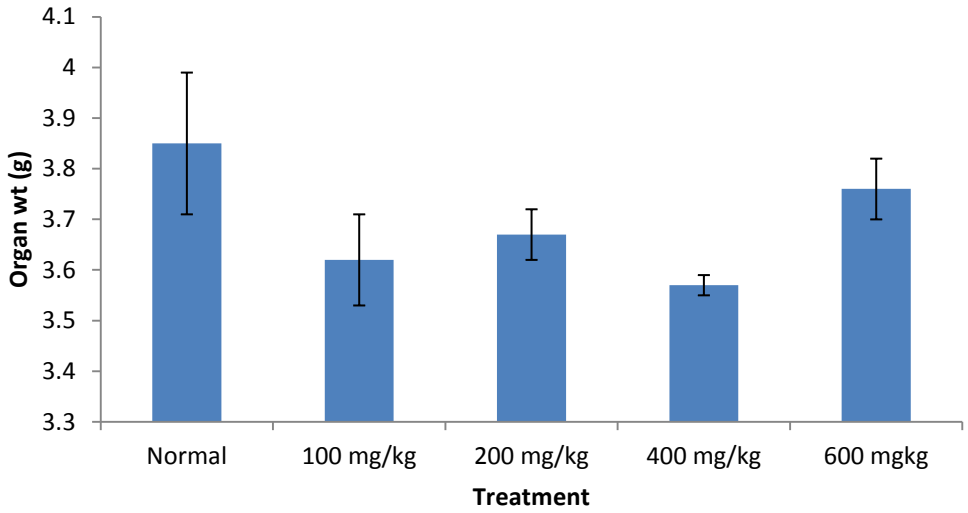

Fig. 3. Weight of liver obtained from wistar rats administered with methanol leaf extract of *Mentha piperita*

4. DISCUSSION

The liver is known to play many physiological functions and these include macronutrient metabolism, blood volume regulation, immune system support, endocrine control of growth signaling pathways, lipid and cholesterol homeostasis and the breakdown of xenobiotics [1]. Thus, when damaged could imply grave consequences. Although known for its potential to detoxify diverse arrays of substances, its integrity could be compromised following exposure to herbal substances. Fig. 1 shows the activity of liver enzymes in rats administered with methanol leaf extract of *Mentha piperita* indicating a non-significant (P>0.05) difference in the activity of Alanine transaminase (ALT), Aspartate transaminase and alkaline phosphatase of rats administered with the extract compared to the normal control (30.00±1.01 IU/L), (32.02±1.01 IU/L) and (20.50±0.04 IU/L) respectively. Similar observation was made on Total and Conjugated Bilurubin as well as the weight of the liver harvested from the rats. The outcome of this study is consistent with the finding of Rajesh et al. [11] which reported a reduced activity of serum hepatomarkers in rats with hepatic lesions administered with 400 mg/kg bw of ethanolic leaf extract of *Mentha arvensis* a member of the *Lamiaceae family* to which *Mentha piperita* belongs. Similarly, essential oil derived from *Mentha spicata* another member of the family restored hepatic health in rats induced with hepatic damage using manganese and lead Mostapha et al. [12].

5. CONCLUSION

In conclusion, this study reveals that methanol leaf extract of *M. piperita* is not hepatotoxic. However, effects on other organs notably the kidney should be studied in order to expand the dearth of information on the aforementioned plant.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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