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# EFFECT OF WATEERMWLON JUICE (CITRULLLUS LANATUS) ON THE LOCOMOTOR ACTIVITY OF SPRAGUE DAWLEY RATS

**BY**

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**SCHOOL OF BASIC MEDICAL SCIENCES**

**COLLEGE OF MEDICINE**

**UNIVERSITY OF BENIN**

**BENIN CITY**

**SUPERVISED BY:**

**DR. MRS. R. O. AIKPITANYI-IDUITUA**

**NOVEMBER 2025**

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**BMS2106205**

**A PROJECT SUBMITTED TO THE DEPARTMENT OF PHYSIOLOGY IN PARTIAL FUFILLMENT OF OF THE REQUIREMENTS FOR THE AWARD OF BARCHELORS OF SCIENCE (B. Sc) DEGREE IN PHYSIOKLOGY**

**NOVEMBER 2025**

# CERTIFICATION

This is to certify that this project work on "EFFECT OF WATEERMWLON JUICE (CITRULLLUS LANATUS) ON THE LOCOMOTOR ACTIVITY OF SPRAGUE DAWLEY RATS" was carried out by UMUKORO ELVIS, with matriculation number: BMS2106205; in partial fulfilment for the Award of Bachelor of Science (B.Sc) Degree in the Department of Physiology, School of Basic Medical Sciences, College of Medical Sciences, University of Benin, Benin City, Edo State.

UMUKORO ELVIS
(STUDENT)

DATE

DR. MRS. R. O. AIKPITANYI-IDUITUA
(PROJECT SUPERVISOR)

DATE

PROF. O. K. UCHE
(HEAD OF DEPARTMENT)

DATE

PROF. S. A. ONASANWO
(EXTERNAL EXAMINER)

DATE

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To my dearest friend, **MA JOIE,** the BOYS OF INSHALLAH and to all my friends and colleagues who offered assistance, encouragement, or even a listening ear during the stressful moments of this work, I say thank you. Your companionship and teamwork made this journey more meaningful.

Finally, I acknowledge everyone who contributed in one way or another to the success of this project. May God bless you all abundantly.

# DEDICATION

This project is dedicated to God Almighty, the source of my strength, wisdom, and inspiration.

It is also dedicated to my beloved parents and family, whose love, prayers, and sacrifices have been my constant support.

Lastly, I dedicate this work to every student and researcher striving to contribute to scientific knowledge and improve human health through research.

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# Contents

# CHAPTER ONE:

# INTRODUCTION

## 1.1 BACKGROUND OF THE STUDY

Watermelon (Citrullus lanatus) is a tropical fruit renowned for its hydrating qualities and rich nutritional content. It contains vital micronutrients such as vitamins A, B6, and C, as well as minerals and phytochemicals like lycopene and L-citrulline. These bioactive compounds possess significant antioxidant and anti-inflammatory properties that contribute to maintaining normal physiological function and protecting body systems from oxidative damage. Several studies have reported that natural fruit extracts, including watermelon juice, can enhance behavioral responses and regulate biochemical and hematological indices under oxidative or inflammatory stress conditions (Perkins-Veazie & Collins, 2021; Olayemi et al., 2020).

Oxidative stress and inflammation are interconnected physiological disturbances that contribute to tissue injury, aging, and disease development. An imbalance between reactive oxygen species (ROS) production and the body's antioxidant defenses can result in cellular damage affecting major organs, particularly the brain and circulatory system (Adebayo et al., 2019). Such pathological conditions often impair locomotor performance and alter blood and immune parameters. Therefore, evaluating the influence of watermelon juice—a naturally antioxidant-rich beverage—offers valuable insights into dietary interventions that may alleviate oxidative damage and preserve normal physiological functions.

## 1.2 STATEMENT OF THE PROBLEM

Excessive production of reactive oxygen species (ROS) leads to oxidative stress, which contributes to tissue injury and behavioral dysfunction. Phenylhydrazine (PHZ) is a well-established oxidative stress inducer commonly used to model hemolytic anemia and oxidative toxicity in experimental animals (Abdalla et al., 2019). It generates free radicals that cause red blood cell destruction and impair neural and muscular activities. Despite the availability of synthetic antioxidants, there remains limited experimental evidence on the protective effects of plant-derived natural antioxidants—particularly watermelon juice—on locomotor activity and inflammation in animal models.

## 1.3 AIM OF THE STUDY

This study aimed to investigate the effect of watermelon juice on locomotor activity in phenylhydrazine-treated Sprague-Dawley rats.

## 1.4 SPECIFIC OBJECTIVES

1. To evaluate the effects of phenylhydrazine on locomotor performance and inflammatory ratios.
2. To determine whether watermelon juice administration enhances locomotor activity following oxidative damage.
3. To compare the efficacy of watermelon juice with ascorbic acid, a standard antioxidant.

## 1.5 SIGNIFICANCE OF THE STUDY

This study highlights the potential of watermelon juice as a nutraceutical with significant antioxidant and anti-inflammatory properties. Findings from this work could promote the recognition of watermelon juice as a viable natural supplement for reducing oxidative stress and improving physiological and behavioral health. Furthermore, it will add to the growing body of scientific knowledge supporting the therapeutic benefits of plant-based antioxidants in mitigating stress-induced alterations in behavior and hematological

x

function.

## 1.6 SCOPE OF THE STUDY

This research focused on male Sprague-Dawley rats subjected to phenylhydrazine-induced oxidative stress. Behavioral parameters, particularly locomotor activity, were assessed using the open-field test. The experimental duration comprised 21 days of treatment following a 2-week acclimatization period.

# CHAPTER TWO:

# LITERATURE REVIEW

## 2.1 OVERVIEW OF WATERMELON AND ITS PHYTOCHEMICAL COMPONENTS

Watermelon (Citrullus lanatus), belonging to the Cucurbitaceae family, is notable for its high water composition (approximately 92%) and abundance of beneficial phytochemicals. The red pigment, lycopene, is a carotenoid known for its potent antioxidant capacity. Other key bioactive constituents include citrulline, β-carotene, flavonoids, and essential vitamins, all of which contribute to the fruit's physiological benefits (Perkins-Veazie & Collins, 2021). These compounds promote oxidative balance by neutralizing free radicals and modulating enzymatic antioxidants such as catalase, superoxide dismutase, and glutathione peroxidase.

L-citrulline, a non-essential amino acid found in significant quantities in watermelon, supports nitric oxide synthesis and vascular health. Its conversion to L-arginine enhances nitric oxide bioavailability, facilitating vasodilation and improved blood flow (Moinard et al., 2015). Lycopene has been shown to cross the blood–brain barrier, exerting neuroprotective effects through the inhibition of lipid peroxidation and neuronal apoptosis (Gonzalez et al., 2019). Regular consumption of watermelon is associated with reduced oxidative damage, enhanced exercise recovery, and improved cardiovascular health (Edwards et al., 2020). These benefits stem from its antioxidant capacity and ability to promote efficient circulation, both of which contribute to optimal physiological performance.

## 2.2 OXIDATIVE STRESS AND ITS PHYSIOLOGICAL IMPLICATIONS

Oxidative stress arises when reactive oxygen species (ROS) generation surpasses the body's intrinsic antioxidant defense mechanisms. This imbalance causes damage to lipids, proteins, and DNA, leading to cellular dysfunction and pathological conditions (Adebayo et al., 2019). Phenylhydrazine-induced oxidative stress primarily targets erythrocytes, resulting in hemolytic anemia and tissue hypoxia (Ojo et al., 2021). Such disruptions can impair locomotor behavior due to altered neuromuscular coordination and diminished energy metabolism.

32 Numerous studies have demonstrated the impact of oxidative stress on the central nervous system, linking it to motor and cognitive impairments. The administration of antioxidant-rich plant extracts has been found to mitigate these effects by neutralizing ROS and preserving neuronal function (Fitzpatrick et al., 2018).

## 2.3 BEHAVIORAL ASSESSMENT USING THE OPEN FIELD TEST

9 The open field test (OFT) is a widely used experimental model for assessing locomotor activity, exploratory behavior, and anxiety in rodents. Key parameters—such as total distance moved, line crossings, rearing frequency, and time spent in the center zone—provide quantitative data on motor performance and curiosity (Simola et al., 2008). Reduced locomotion in animals exposed to oxidative stress reflects central nervous system dysfunction, while improvement following treatment indicates potential neuroprotective or anxiolytic effects of the tested compound.

## 2.4 WATERMELON JUICE AND ANTIOXIDANT ACTIONS

Watermelon juice has received considerable scientific attention due to its antioxidant and anti-inflammatory activities. Compounds such as lycopene and citrulline act synergistically to counteract oxidative damage by scavenging reactive oxygen species and inhibiting pro-inflammatory cytokines (Li et al., 2021). Experimental findings by Edwards et al. (2020) demonstrated that watermelon supplementation decreased oxidative biomarkers and enhanced cardiovascular health in animal models. Similarly, Olayemi et al. (2020) reported that antioxidant-rich fruit extracts improved behavioral and hematological outcomes in rats subjected to oxidative stress. These studies collectively suggest that watermelon juice is a potent natural antioxidant capable of mitigating oxidative injury and supporting physiological stability.

# CHAPTER THREE:

# MATERIALS AND METHODS

## 3.1 EXPERIMENTAL ANIMALS

Fifty-two adult male Sprague-Dawley rats weighing 170–210 g were used for this study. They were obtained from the Department of Anatomy Animal House, University of Benin, and maintained under standard laboratory conditions (12-hour light/dark cycle, controlled temperature, and unrestricted access to feed and water). All experimental procedures complied with institutional ethical guidelines for the care and use of laboratory animals.

## 3.2 ACCLIMATIZATION

Animals were allowed two weeks of acclimatization before the experiment. During this period, they were monitored for normal behavior and health stability.

## 3.3 EXPERIMENTAL DESIGN

Rats were randomly divided into four groups (n = 15 per group except from control):

| Groups | Name | Treatment (/day) | Number of rats |
|---|---|---|---|
| Group A | Control (Positive) | Distilled water | 7 |
| Group B | Phenylhydrazine | Distilled Water | 15 |
| Group C | Phenylhydrazine Watermelon | 1ml/100g Citrullus Lanatus | 15 |
| Group D | Phenylhydrazine Ascorbic acid | 1ml/100g Ascorbic Acid | 15 |

Group A (Control): Received distilled water throughout.

Group B (PHZ + Water): Administered phenylhydrazine for 3 days, followed by distilled water for 21 days.

Group C (PHZ + Watermelon Juice): Administered phenylhydrazine for 3 days, followed by watermelon juice (1 ml/100 g body weight) for 21 days.

Group D (PHZ + Ascorbic Acid): Administered phenylhydrazine for 3 days, followed by ascorbic acid (1 ml/100 g body weight) for 21 days.

## 3.4 PREPARATION AND ADMINISTRATION OF WATERMELON JUICE

Fresh watermelons were washed, peeled, and juiced using a manual press. The juice was filtered and administered orally via a gavage at a dose of 1 ml per 100 g body weight daily for 21 days.

## 3.5 OPEN FIELD TEST FOR LOCOMOTOR ACTIVITY

The open field apparatus measured 60 × 60 × 40 cm. Each rat was placed in the center of the field, and locomotor parameters (total distance moved, line crossings, rearing frequency, and time spent in the center) were recorded for 5 minutes.

## 3.6 BLOOD COLLECTION

At the end of treatment, animals were anesthetized lightly, and blood was collected via cardiac puncture for general physiological assessment.

## 3.7 STATISTICAL ANALYSIS

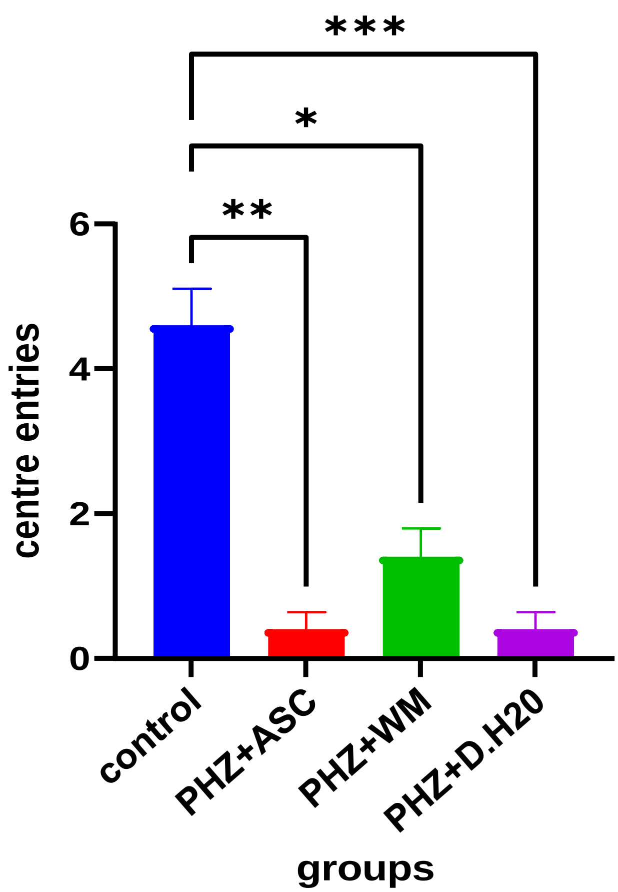
Data were analyzed using GraphPad Prism version 10. Values were expressed as mean ± SEM, and group differences were determined using one-way ANOVA followed by Tukey's post hoc test. Statistical significance was set at $p < 0.05$.

# CHAPTER FOUR:

# RESULTS

## 4.1 EFFECT OF WATERMELON JUICE ON LOCOMOTOR ACTIVITY

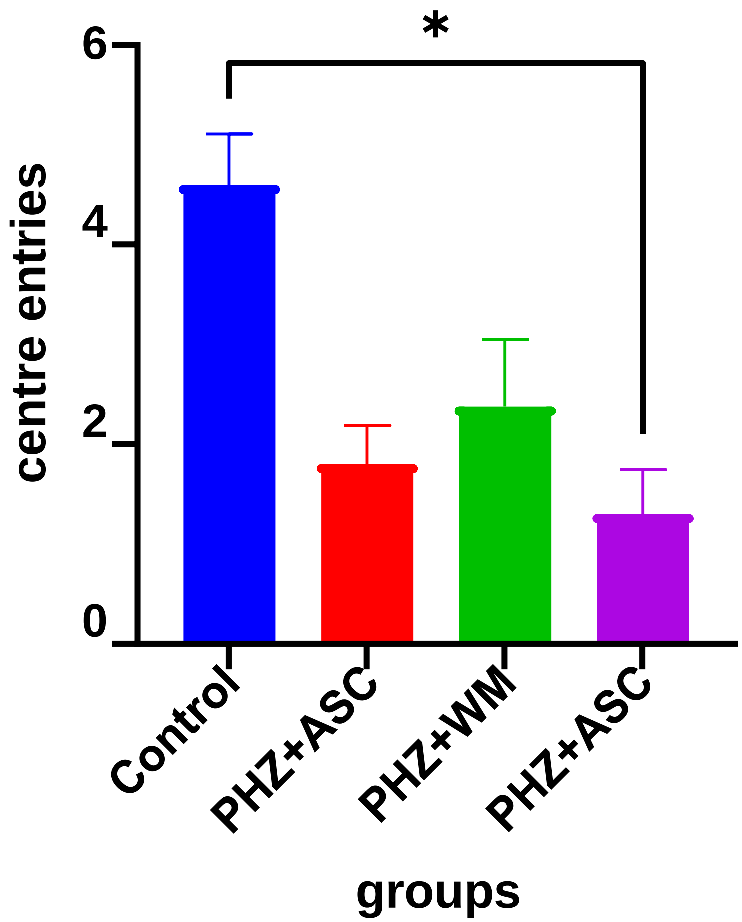
CENTRE ENTRIES (WEEK 1)




Bar chart representation of center entries at the first week of the experimental period.

Result shows a statistically significant difference in center entries at the first week of the experimental period

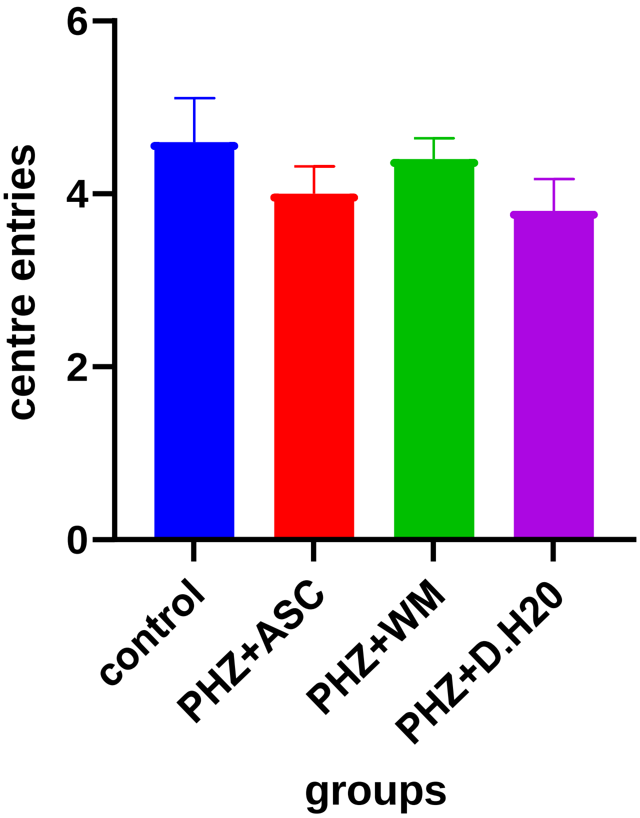
CENTRE ENTRIES (WEEK 2)




Bar chart representation of center entries at the second week of experimental period.

Result shows a statistically significant increase in center entries across at the second week experimental period as compared to the control

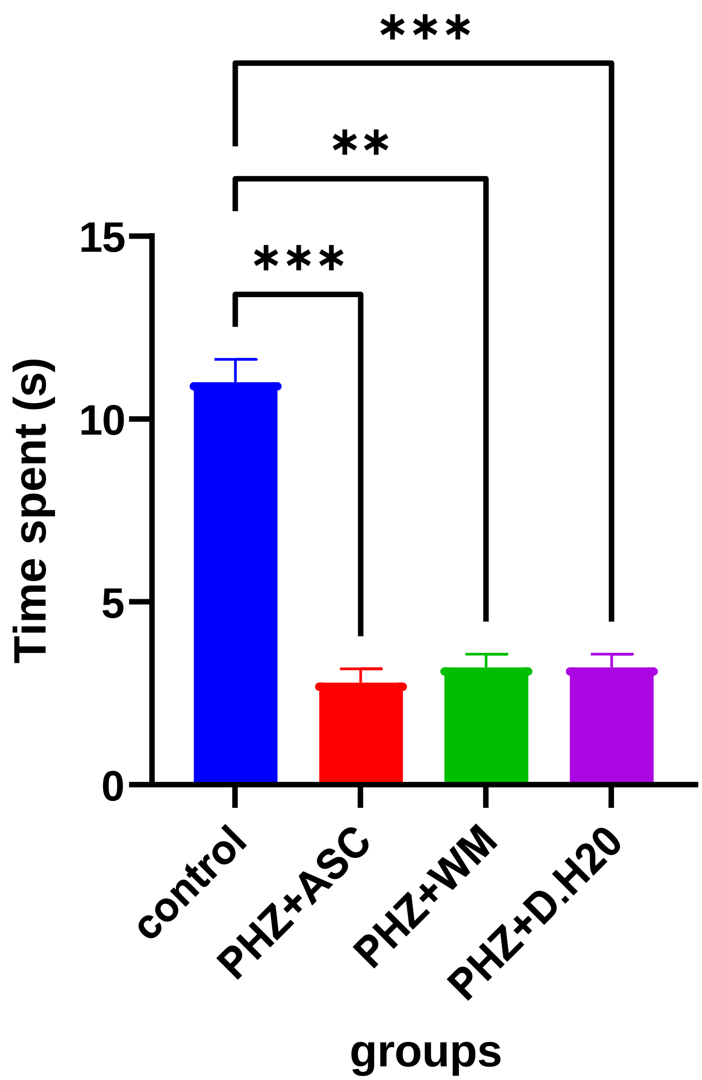
CENTRE ENTRIES (WEEK 3)




Bar chart representation of center entries at the third week of the experimental period.

Result shows a statistically significant difference in center entries at the third week of the experimental period

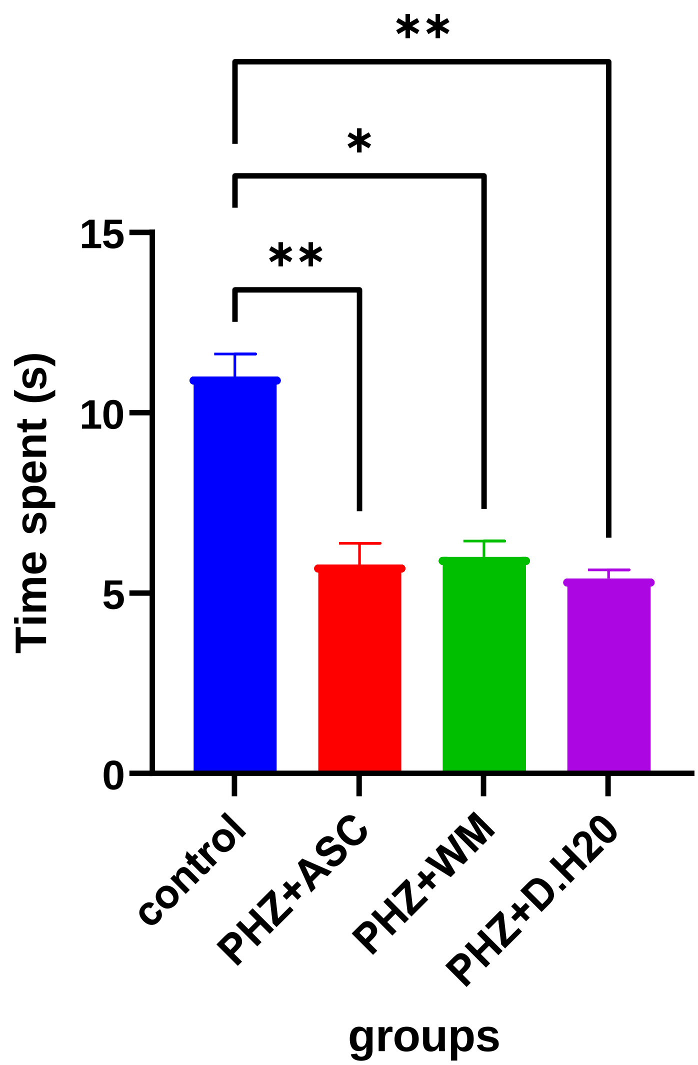
TIME SPENT (S) IN CENTRE ENTER (WEEK 1)




Bar chart representation of time spent in center at the first week of the experimental period.

Result shows a statistically significant difference in time spent in center at the first week of the experimental period

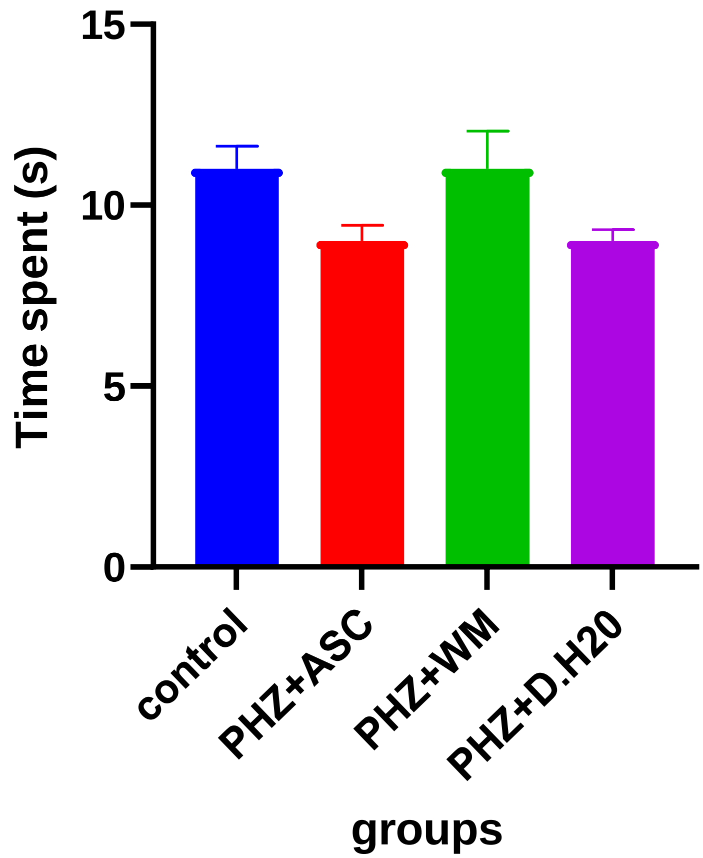
TIME SPENT (S) IN CENTRE ENTER (WEEK 2)




Bar chart representation of time spent in center at the second week of the experimental period.

Result shows a statistically significant difference in time spent in center at the second week of the experimental perio

TIME SPENT (S) IN CENTRE ENTER (WEEK 3)

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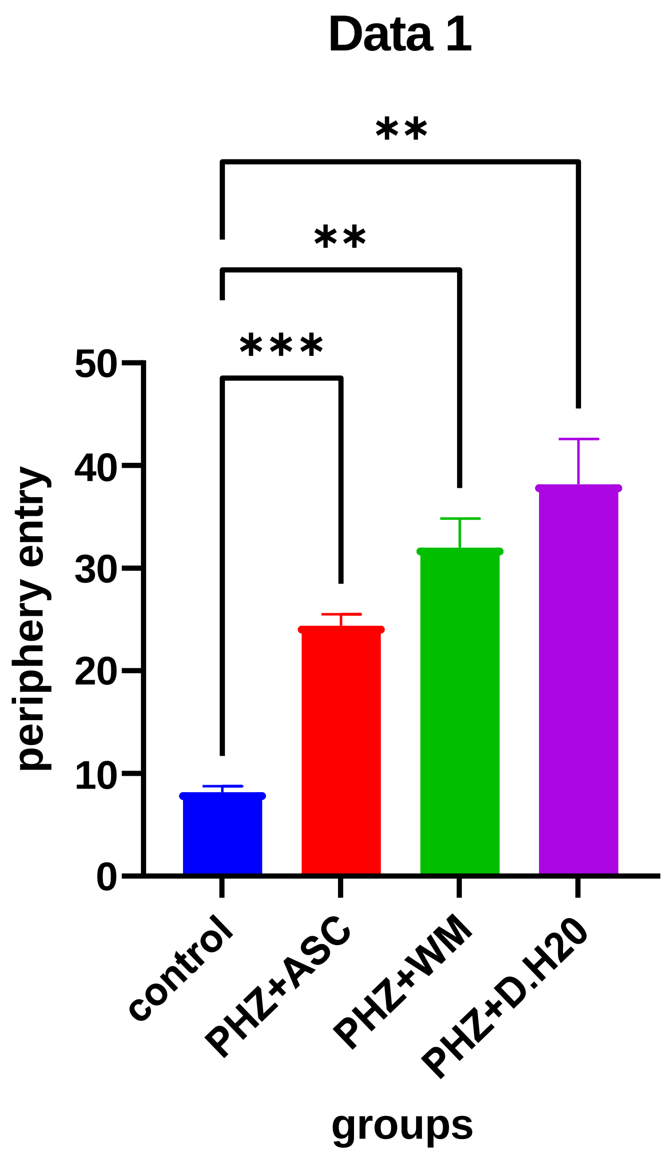
Bar chart representation of time spent in center at the third week of the experimental period.

13 34

Result shows a statistically significant increase in time spent in center at the third week of the experimental period

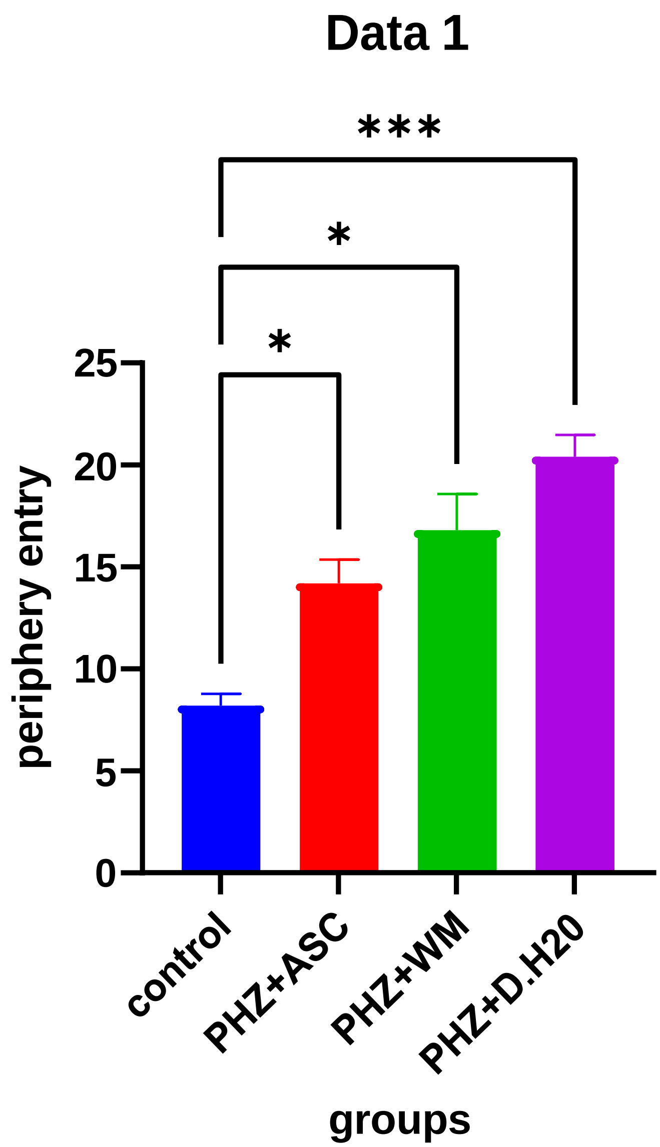
PERIPHERY ENTRIES (WEEK 1)




Bar chart representation periphery entry at the first week of the experimental period.

Result shows a statistically significant increase in periphery entry compared to control at the first week of the experimental period

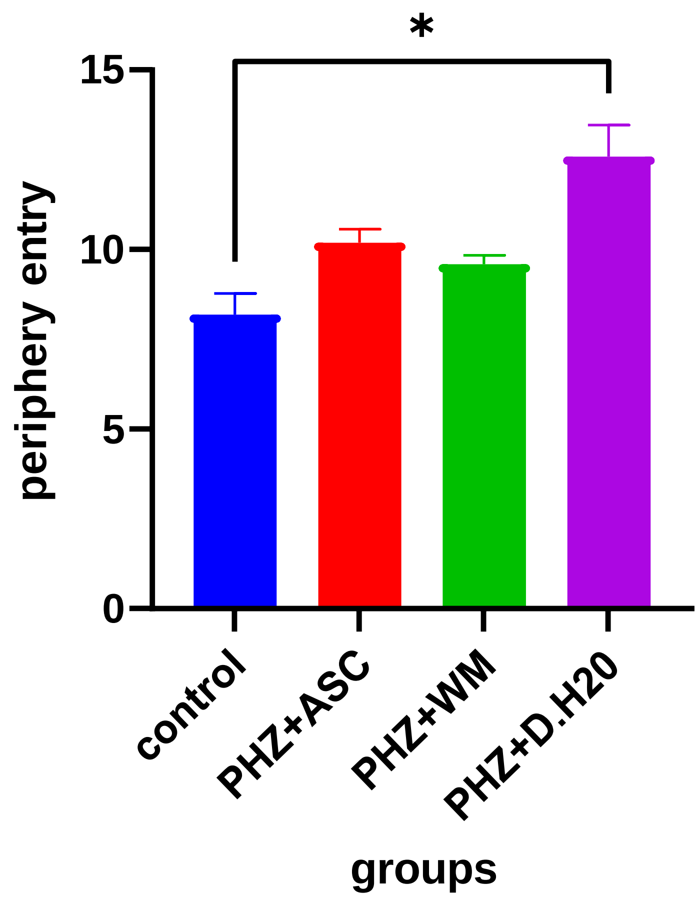
PERIPHERY ENTRIES (WEEK 2)




Bar chart representation of periphery entry at the second week of the experimental period.

Result shows a statistically significant increase in periphery entry compared to control at the second week of the experimental period

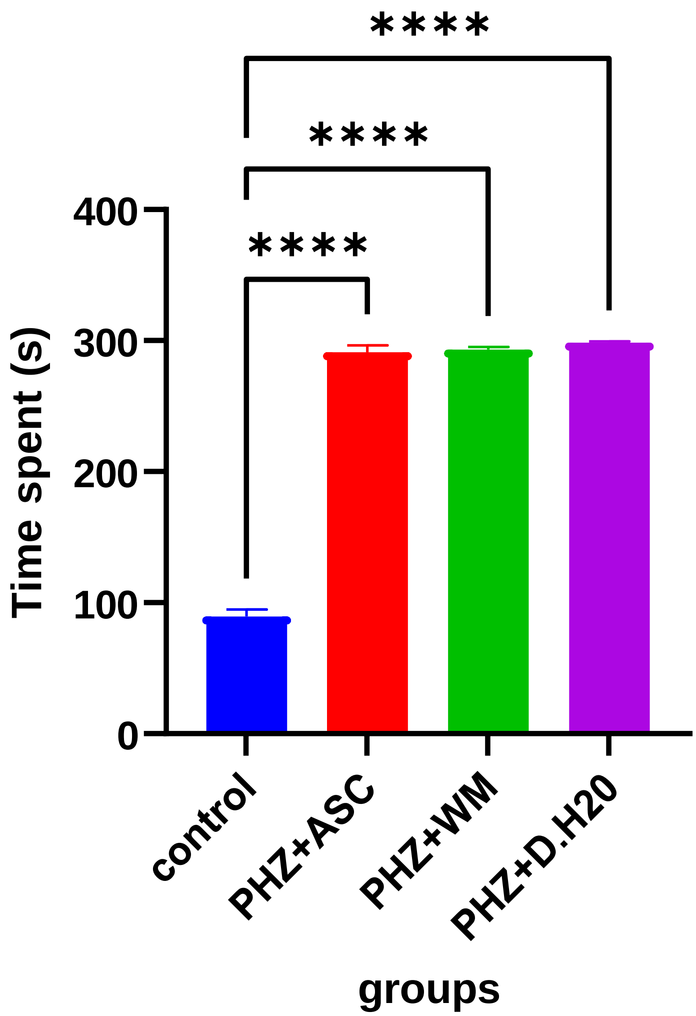
PERIPHERY ENTRIES (WEEK 3)




Bar chart representation of periphery entry at the third week of the experimental period.

Result shows a statistically significant increase in periphery entry compared to control at the third week of the experimental period

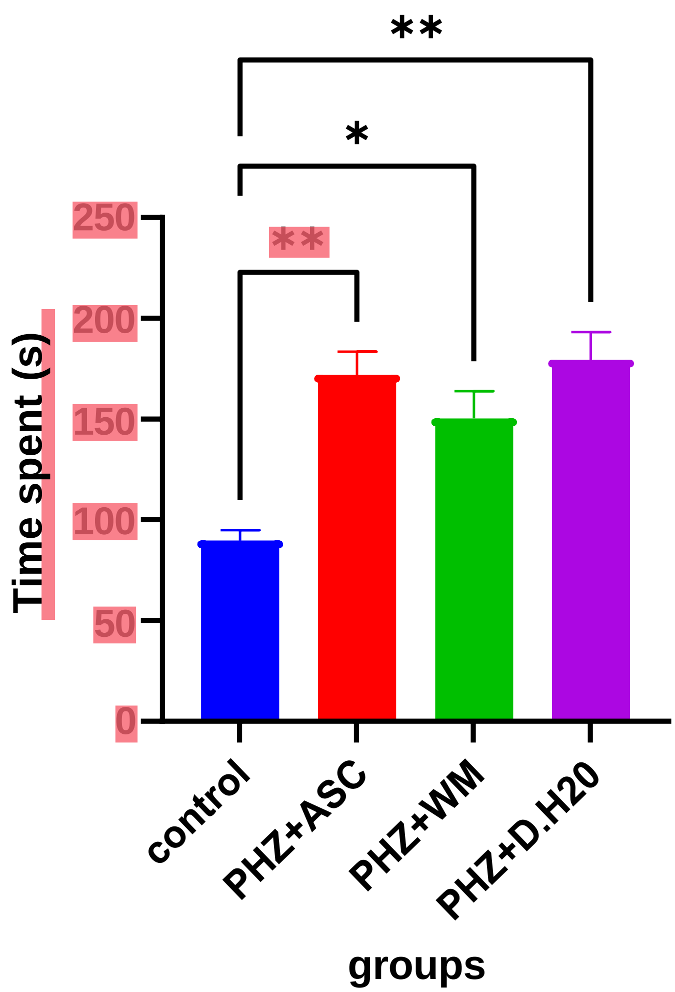
TIME SPENT IN PERIPHERY (WEEK 1)




Bar chart representation of time spent in periphery at the first week of the experimental period.

Result shows a statistically significant difference in time spent in center at the first week of the experimental period

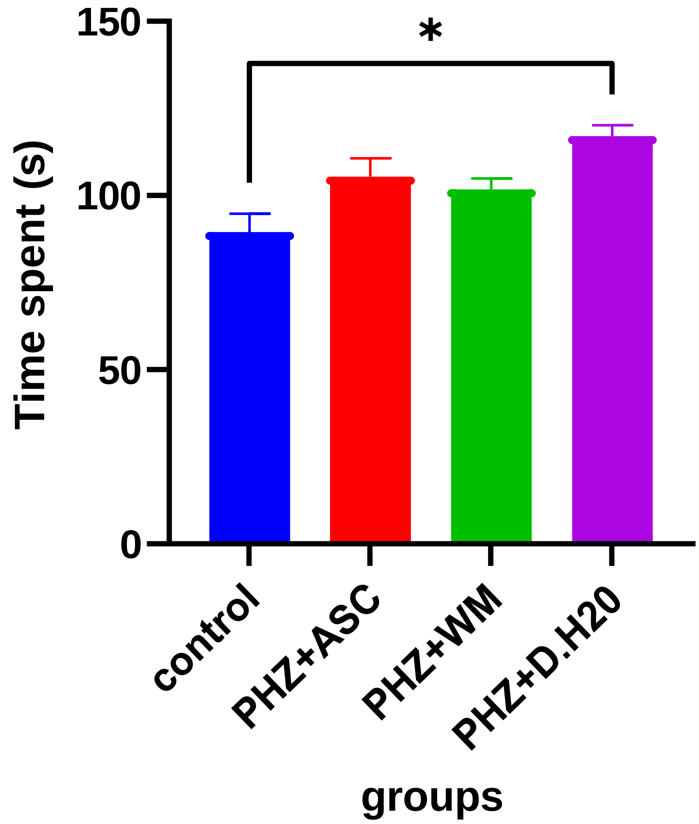
TIME SPENT IN PERIPHERY (WEEK 2)




Bar chart representation of time spent in perphery at the second week of the experimental period.

Result shows a statistically significant difference in time spent in center at the second week of the experimental period

TIME SPENT IN PERIPHERY (WEEK 3)




Bar chart representation of time spent in perphery at the third week of the experimental period.

Result shows a statistically significant difference in time spent in center at the third week of the experimental period

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Phenylhydrazine administration significantly reduced locomotor activity compared to the control group ($p < 0.05$). Rats treated with watermelon juice showed a marked improvement in all locomotor parameters, comparable to those treated with ascorbic acid, suggesting a protective effect against oxidative-induced behavioral deficits.

# CHAPTER FIVE:

# DISCUSSION

The findings of this study indicate that phenylhydrazine-induced oxidative stress impaired locomotor performance, consistent with earlier reports on the neurotoxic impact of ROS (Ojo et al., 2021). Watermelon juice treatment significantly improved locomotor activity, demonstrating its neuroprotective and antioxidant potential.

Lycopene and citrulline in watermelon juice likely acted synergistically to counter oxidative damage and enhance nitric oxide production, which facilitates neural and muscular recovery (Moinard et al., 2015; Gonzalez et al., 2019). The observed similarity between the effects of watermelon juice and ascorbic acid reinforces the efficacy of watermelon as a natural antioxidant source.

These outcomes align with previous studies reporting that natural fruit extracts enhance behavioral outcomes in stressed animal models (Olayemi et al., 2020). Therefore, watermelon juice may serve as a safe and accessible dietary intervention for mitigating oxidative stress–related motor dysfunction.

# CHAPTER SIX:

# CONCLUSION AND RECOMMENDATIONS

## 6.1 CONCLUSION

Watermelon juice improved locomotor activity in phenylhydrazine-induced Sprague-Dawley rats. The findings suggest that its bioactive compounds possess antioxidant and neuroprotective effects that help restore normal behavioral function following oxidative stress.

## 6.2 RECOMMENDATIONS

Incorporate fresh watermelon juice as a dietary antioxidant to promote neuroprotection.

Further studies should evaluate dose-response effects and biochemical parameters.

Exploration of isolated watermelon phytochemicals for targeted therapeutic use is recommended.

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