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Research Article

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Comparative Analysis of the Antihypertensive Effects of Red Palm Oil and Pumpkin Seed Oil in Nω-Nitro-L-arginine Methyl Ester-Induced Hypertensive Rats

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Abstract

Background: Hypertension is a prevalent cardiovascular disease with global health implications. Dietary interventions with local Nigerian food items offer promise in hypertension management, but the comparative effects of Red Palm Oil (RPO) and Pumpkin Seed Oil (PSO) are underexplored. This study investigated the effects of RPO and PSO supplementation on hypertension in male Wistar rats, focusing on onset of action and effectiveness.

Methods: Thirty-six male adult Wistar rats were divided into six groups: Control, RPO without hypertension induction, PSO without hypertension induction, RPO after hypertension induction, PSO after hypertension induction and hypertension induction without supplementation. Hypertension was induced using Nω-Nitro-L-arginine methyl ester over three weeks, followed by five weeks of intervention. Blood pressure and weight were monitored weekly. RPO and PSO supplementation in normotensive rats showed no significant body weight changes.

Results: By week 4, hypertensive groups showed a significant weight reduction compared to normotensive groups. Both RPO and PSO reduced systolic blood pressure compared to hypertensive controls (162.17 ± 2.3 *vs*. 136.40 ± 0.75, 134.20 ± 1.53 mmHg). RPO showed earlier efficacy by week 5, while PSO's effect was significant by week 7. Both oils reduced diastolic blood pressure by week 6 (147.00 ± 9.04 *vs*. 96.00 ± 4.53, 93.00 ± 3.99 mmHg) and lowered mean arterial pressure (145.00 ± 1.34 *vs*. 109.00 ± 2.49, 115.67 ± 1.48 mmHg).

Discussion and Conclusion: Supplementation with Red Palm Oil (RPO) or Pumpkin Seed Oil (PSO) did not significantly affect heart weight index compared to the normal control group. Additionally, there were no significant differences between RPO and PSO when compared with the control and when compared within each condition. However, hypertension induction led to a significant change in heart weight index compared to the normal control group.

Keywords: Hypertension, Red Palm Oil (RPO), Pumpkin Seed Oil (PSO), Blood pressure, Cardiovascular health

Introduction

Hypertension, commonly known as high blood pressure, is a chronic medical condition characterized by a sustained elevation of systemic arterial blood pressure [1].

The measurement of blood pressure involves two parameters: systolic and diastolic. Systolic measures the force exerted on artery walls when the heart beats, while diastolic measures the force when the heart is resting between beats [2]. Blood pressure is typically measured in millimeters of mercury (mmHg) using an instrument called a sphygmomanometer in humans [3].

The condition can be divided into two main categories. Primary or essential hypertension has no identifiable cause, though it is closely linked to genetics, age, diet and lifestyle, representing about 90-95% of cases [4]. On the other hand, secondary hypertension arises from an identifiable underlying condition or medication [5]. In Nigeria, hypertension prevalence varies significantly among different demographics. Research by Akinlua et al., indicates a prevalence ranging from 0.1% to 17.5% in children, 2.1% to 47.2% in adults, 6.2% to 48.9% in men and 4.8% to 43% in women, reflecting the diverse impact of this condition across age and gender groups [6]. Globally, the burden of hypertension is substantial, affecting approximately 1.28 billion adults [7].

Understanding the risk factors associated with hypertension is crucial for prevention and management. Genetic predispositions, dietary habits, obesity, physical inactivity, tobacco use and underlying chronic conditions like kidney disease and diabetes contribute significantly to its development. If left unmanaged, hypertension can lead to severe health complications such as cardiovascular events, including heart attacks and strokes, as well as vascular conditions like aneurysms and heart failur. Addressing hypertension requires a multifaceted approach, including lifestyle modifications, pharmacological interventions and public health initiatives aimed at raising awareness and promoting early detection and treatment [8,9].

Dietary interventions are key in managing hypertension, providing an effective and easily accessible way to lower high blood pressure and decrease the risk of heart disease. With hypertension becoming more common and costly to treat, it's crucial to focus on dietary changes as a top priority for reducing these health risks. Diet serves as a modifiable risk factor for hypertension, wielding considerable influence over blood pressure regulation through its intricate interplay with metabolic pathways, vascular function and neurohormonal mechanisms [10]. The recognition of dietary patterns as key determinants of cardiovascular health underscores the pivotal role of nutrition in modulating blood pressure trajectories and mitigating cardiovascular risk [11].

The advent of evidence-based dietary guidelines, grounded in rigorous scientific research and epidemiological evidence, has catalyzed a paradigm shift in hypertension management, steering clinical practice towards a proactive and holistic approach that prioritizes lifestyle modifications and dietary interventions as first-line therapies [12]. These guidelines advocate for dietary patterns rich in fruits, vegetables, whole grains, lean proteins and low-fat dairy products, while limiting sodium intake, saturated fats, trans fats and added sugars, thereby promoting cardiovascular health and blood pressure control [13].

Central to the therapeutic arsenal of dietary interventions are bioactive compounds, phytonutrients, antioxidants and micronutrients endowed with vasodilatory, anti-inflammatory and anti-oxidative properties, which exert beneficial effects on vascular tone, endothelial function, oxidative stress and inflammatory pathways implicated in hypertension pathogenesis [14]. Notable examples include polyphenols, flavonoids, omega3 fatty acids, potassium, magnesium and calcium, found abundantly in plant-based foods, nuts, seeds, fish and dairy products, which confer cardiovascular protection and modulate blood pressure regulation [15].

Red palm oil and pumpkin seed oil are of particular interest due to their unique nutritional compositions and potential cardiovascular benefits [16]. Red palm oil is rich in carotenoids, including beta-carotene, which possess antioxidant properties that counteract oxidative stress on blood vessels, a key factor in hypertension [17]. Additionally, it contains vitamin E, coenzyme Q10 and phytosterols, all of which contribute to vascular health and cholesterol regulation [18]. Pumpkin seed oil is abundant in bioactive compounds such as phytosterols, phenolic compounds, antioxidants, tocopherols and carotenoids [19]. These components offer potential benefits in managing hypertension, diabetes and oxidative stress. By focusing on these dietary interventions and their impact on hypertension, this research contributes to the growing body of knowledge on non-pharmacological approaches to blood pressure management. Understanding the structural changes resulting from these interventions provides a comprehensive view of their effects on the cardiovascular system. In conclusion, this study's objectives are aligned with the urgent need to explore dietary interventions as a means to combat hypertension, a condition with significant public health implications. The research design and methodology detailed in this study will enable a rigorous investigation into the comparative analysis of these dietary interventions, ultimately advancing our understanding of their potential in hypertension management.

Methods

A total of 36 male Wistar rats weighing 120-149 grams and aged 10-11 weeks were obtained from the department of veterinary biochemistry, University of Ibadan. The rats were kept in plastic cages in a well-ventilated house, temperature of 25 ± 2°C, natural light and darkness, with free access to tap water and pellet feed. They were acclimatized for 7 days prior to the experiment. All animals received humane care in compliance with the institution's guideline and criteria for humane care as outlined in the National Institute of Health Guidelines for the care and use of laboratory animals. Ethical approval was obtained from the University of Ibadan- Animal Care and Use Research Ethics Committee with Assigned number: UIACUREC/033-0224/19

Procurement of experimental agents

Sourcing of L-NAME: Nω-Nitro-L-arginine methyl ester (L-NAME), a nitric oxide synthase inhibitor, was procured from Bridge Biotech Ltd with number 1272466. The procurement of L-NAME adhered to stringent quality control measures to guarantee the purity and efficacy of the compound in inducing hypertension in the experimental animals.

Acquisition of pumpkin seed oil: Pumpkin Seed Oil, a potential dietary intervention, with Lot number #S22100201CC1 was sourced from Puritan's Pride, a reputable supplier based in Lagos, Nigeria. The selection of Puritan's Pride for the procurement of Pumpkin Seed Oil was based on their established reputation for providing high-quality nutritional supplements, ensuring the integrity and authenticity of the oil used in the study.

Obtaining red palm oil: Red palm oil, another dietary supplement under investigation, was procured from a local farm in Ile-Oluji, Ondo State. Approximately 3 liters of Red Palm Oil were meticulously prepared at the farm, employing traditional extraction methods. Subsequently, the red palm oil was transported to Ibadan.

Experimental design

A total of 36 male Wistar rats weighing 120-149 grams and aged 10-11 weeks were obtained from the department of veterinary biochemistry, University of Ibadan. They were adapted to laboratory handling for one week and then randomly divided into six groups. The specific interventions are as follows:

Normal control (Group A): Received standard chow without hypertension induction throughout the course of this study.

Red palm oil only (Group B): Initially received standard chow without hypertension induction for 3 weeks, then supplemented with red palm oil. In my study, the red palm oil was used in its liquid state. It was mixed thoroughly with the standard chow at an 85:15g ratio to

ensure uniform distribution and proper intake by the rats for an additional 5 weeks [20].

Pumpkin seed oil only (Group C): Initially received standard chow without hypertension induction for 3 weeks, then administered pumpkin seed oil orally using a gastric gavage tube at a daily dose of 100 mg/kg for an additional 5 weeks after hypertension induction [21].

Hypertension control (Group D): Hypertension was first induced for 3 weeks, then the rats continued to with standard chow.

Hypertension + Red palm oil (Group E): Hypertension was first induced for 3 weeks, then the rats were administered a diet supplemented with red palm oil for an additional 5 weeks [22].

Hypertension + Pumpkin seed oil (Group F): Hypertension was first induced for 3 weeks, then the rats were administered a diet supplemented with pumpkin seed oil for an additional 5 weeks [21].

Hypertension induction

To induce hypertension, Nω-Nitro-L-arginine methyl ester (L-NAME) was administered orally to the Wistar rats at a dosage of 40 mg/kg/day for 3 weeks [22]. L-NAME, a nitric oxide synthase inhibitor, disrupts nitric oxide production, a crucial vasodilator and is commonly used in experimental models to induce hypertension [23].

Administration protocol

Rats in the experimental group received L-NAME orally at a consistent dosage of 40 mg/kg/day. This administration occurred daily over a 3-week period. The oral route was chosen to mimic a chronic exposure scenario, facilitating the gradual development of hypertension [22].

In this study, an innovative device, called the CONTEC 08A was employed to measure systolic Blood Pressure (BP) in rats. This device integrates a pulse transducer with a physiograph and a rat tail-cuff, demonstrating reproducibility and a robust correlation with BP measurements subsequently obtained from a Non-Invasive Blood Pressure (NIBP) machine, the IN125NIBP controller (AD Instruments (ADI), Australia). The experimental design is characterized by its simplicity, convenience and cost-effectiveness. The aim of utilizing this device was to confirm the development of hypertension within the rat population. This methodological approach not only enhances the accuracy of BP measurements but also offers a practical and efficient means of monitoring hypertension progression over time [24]. This device simplifies the measurement process and enhances efficiency by automating key steps.

Preparation of the rat: The rat was gently restrained and acclimatized to the testing environment to minimize stress-induced variations in BP.

Placement of the tail-cuff: The inflatable cuff, integrated with the digital device, was carefully positioned around the rat's tail. Proper placement ensures accurate readings without obstructing blood flow.

Initiation of measurement: The measurement process begins with the activation of the digital device. Upon pressing start, the cuff inflates gradually to occlude blood flow in the tail artery.

Automated inflation and detection: As the cuff inflates, the digital device automatically detects pulse waves generated by the rat's heartbeat. Pulse wave detection occurs continuously during cuff inflation and the screen displays ‘measuring’ during this process.

Display of blood pressure: The systolic and diastolic blood pressure is displayed in real-time on the device's screen as the cuff inflates. This eliminates the need for manual detection of pulse waves and provides immediate feedback on BP levels.

Automatic deflation: Once the device detects the systolic blood pressure, the cuff deflates automatically. This automated process ensures safe and consistent deflation without manual intervention.

Recording and analysis: The recorded blood pressure values are logged by the digital device and can be exported for further analysis by writing out the value immediately after measurement. Multiple measurements may be taken to ensure reliability and consistency of results.

Sacrifice and tissue harvest

After subjecting the animals to a 12-hour overnight fast, euthanasia was performed uniformly for all rats using anesthesia with ketamine at a dose of 0.2ml/100g of body weight to ensure consistency and humane treatment across all rats.

Statistical analysis

Data obtained and expressed as mean ± SEM were further analysed employing one-way ANOVA, followed by Dunnet’s post-test for multiple comparisons using GraphPad Prism California, USA, version 9.0 for Windows and the level of statistical significance set at $p< 0.05$.

Results

Body weight change

Red Palm Oil (RPO) and Pumpkin Seed Oil (PSO) supplementation in normotensive rats did not alter the body weight significantly from the beginning of the experiment till the termination (Figure 1). Also, no notable differences in body weight were observed between Hypertension Control and Hypertension + RPO, or Hypertension Control and Hypertension + PSO groups. By the fourth week, a significant decrease in body weight emerged between Normal Control and Hypertension Control, Hypertension + Red palm oil and Hypertension + Pumpkin Seed oil (179.17 ± 3.34 *vs* 159.00 ± 3.14, 162.40 ± 2.16 and 158.83 ± 2.99g; p= 0.0006, 0.0491 and 0.0333) respectively implying hypertension's potential impact on weight dynamics.

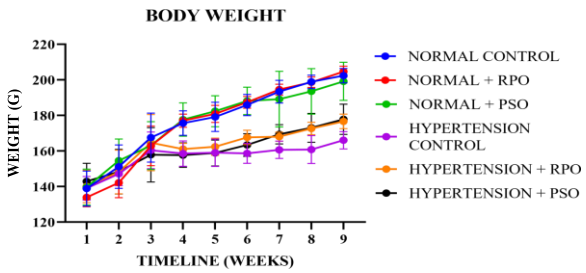

Figure 1: Line graph showing changes in body weight among the groups weekly for the duration of study.

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Systolic blood pressure changes

The experimental animals in the Red Palm Oil group demonstrated a notable reduction in systolic blood pressure (162.17 ± 2.30 *vs* 145.20 ± 1.39mmHg, p=0.0447) by week 5 when compared to the Hypertension Control group and this reduction remained significant until the end of the experiment as shown in Figure 4.2. In contrast, the Pumpkin Seed Oil group only showed a significant reduction in systolic blood pressure at week 7 (Control (159.20 ± 1.77 135.80 ± 0.86 mmHg, p=0.0032) when compared to the Hypertension Control. This reduction also persisted until the end of the experiment at week 8, with significant differences observed between the Hypertension Control *vs* Hypertension + Red Palm Oil and Hypertension Control *vs* Hypertension + Pumpkin Seed Oil groups (149.40 ± 0.40 *vs* 136.40 ± 0.75, 134.20 ± 1.53mmHg, p= 0.0034 and p= 0.0022).

However, there were no significant differences observed between the hypertensive groups supplemented with either Red Palm Oil or Pumpkin Seed Oil throughout the administration period. Likewise, comparisons between normotensive groups receiving Red Palm Oil or Pumpkin Seed Oil did not reveal any significant differences in systolic blood pressure levels (Figure 2).

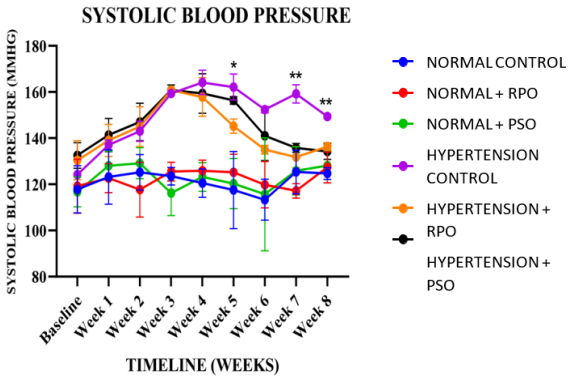

Figure 2: Line graph showing changes in systolic blood pressure among the groups per week for the duration of study. *p<0.05, **p<0.01.

Diastolic blood pressure

A significant reduction in diastolic blood pressure was observed in both the Hypertension + Red Palm Oil and Hypertension + Pumpkin Seed Oil groups compared to the Hypertension Control group (147.00 ± 9.04 *vs* 96.00 ± 4.53, 93 ± 3.992 mmHg; p=0.0103 and p=0.0233, respectively) starting from week 6 (Figure 3). By week 7, the Hypertension Control *vs*. Hypertension + Red Palm Oil groups continued to demonstrate a significant difference in diastolic blood pressure (p=0.0035) (88 ± 3.619), along with the Hypertension + Pumpkin Seed Oil group (84 ± 4.087) (p=0.0001). This reduction persisted until the end of the experiment at week 8, with significant differences observed between the Hypertension Control and both the Hypertension + Red Palm Oil and Hypertension + Pumpkin Seed Oil groups (125 ± 10.651 *vs* 69 ± 1.138, 81 ± 3.140mmHg; p=0.0347 and p=0.0380, respectively). Notably, no significant difference in diastolic blood pressure was observed between the hypertensive groups supplemented with either Red Palm Oil or Pumpkin Seed Oil throughout the administration period. Similarly, comparisons between the normotensive groups receiving Red Palm Oil or Pumpkin Seed Oil revealed no significant differences in diastolic blood pressure levels.

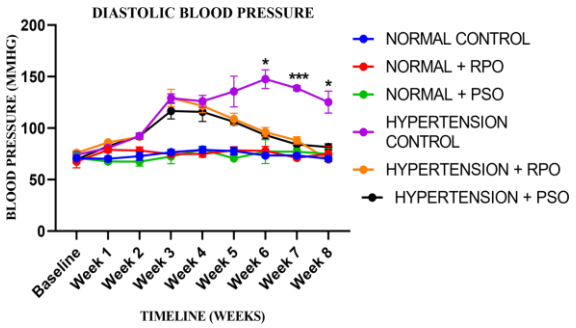

Figure 3: Line graph showing the changes diastolic blood pressure among the groups per week for the duration of study. *p<0.05, ***p<0.001.

Mean arterial pressure changes

A significant reduction in the Mean Arterial Pressure (MAP) was observed in both the Hypertension + Red Palm Oil and Hypertension + Pumpkin Seed Oil groups compared to the Hypertension Control group (145.00 ± 1.34 *vs* 109.00 ± 2.49, 115.67 ± 1.48 mmHg; p=0.0032 and p=0.0005, respectively) starting from week 6 (Figure 4). By week 7, the Hypertension Control *vs*. Hypertension + Red Palm Oil groups continued to demonstrate a significant difference in MAP (p=0.0036) (102.60 ± 2.45), along with the Hypertension + Pumpkin Seed Oil group (112.80 ± 2.71) (p=0.0015). This reduction persisted until the end of the experiment at week 8, with significant differences observed between the Hypertension Control and both the Hypertension + Red Palm Oil and Hypertension + Pumpkin Seed Oil groups (141.53 ± 1.98 *vs* 108.27 ± 3.02, 106.35 ± 4.23 mmHg; p=0.0025 and p=0.0186, respectively). Notably, no significant difference in MAP was observed between the hypertensive groups supplemented with either Red Palm Oil or Pumpkin Seed Oil throughout the administration period. Similarly, comparisons between the normotensive groups receiving Red Palm Oil or Pumpkin Seed Oil revealed no significant differences in MAP levels.

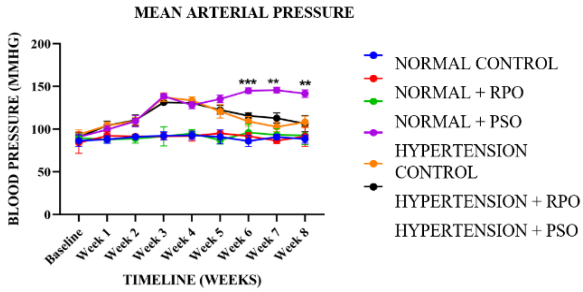

Figure 4: Line graph showing the changes in mean arterial pressure among the groups per week for the duration of study. **p<0.01, ***p<0.001.

Heart weight index

Supplementation with Red Palm Oil (RPO) or Pumpkin Seed Oil (PSO) did not significantly affect heart weight index compared to the normal control group. Additionally, there were no significant differences between red palm oil and pumpkin seed oil when compared with the control and when compared within each condition

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(p > 0.05). However, hypertension induction led to a significant change in heart weight index compared to the normal control group (4.6668352± 0.30 p= 0.0005) (Figure 5).

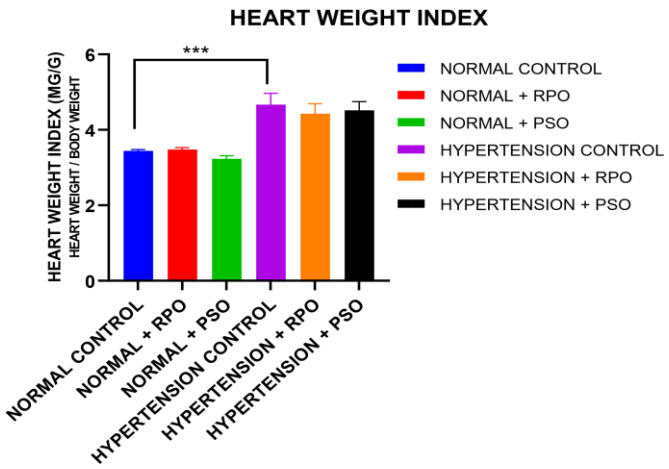

Figure 5: Bar Chart showing the heart weight index among the groups.

Discussion

In this study, induction of hypertension in Wistar rats, by oral administration of L-NAME led to a reduction in the body weight as well as an increase in systolic blood pressure and mean arterial pressure in the hypertensive groups. Supplementation with Red Palm Oil (RPO) and Pumpkin Seed Oil (PSO) did not affect the body weight, but caused a decrease in both systolic blood pressure and mean arterial pressure.

Administration of Red Palm Oil (RPO) and Pumpkin Seed Oil (PSO) to normotensive rats did not lead to significant changes in body weight when compared to the normal control throughout the experiment. This stability in body weight was consistent across all weeks and supplementation groups. However, by the fourth week, a notable decrease in body weight was observed in the Hypertension groups compared to the Normal Control group. Previous research by Bayorh et al. and Boon et al., similarly reported minimal effects of RPO and PSO supplementation on body weight in normotensive rats [25,26]. These findings suggest that while RPO and PSO may not directly impact body weight, the induction of hypertension appears to influence weight dynamics over time, indicating a complex relationship between hypertension and metabolic factors.

The administration of Red Palm Oil (RPO) and Pumpkin Seed Oil (PSO) to normotensive rats did not result in a significant difference in systolic blood pressure compared to normal control rats. However, significant increase emerged between the Hypertension Control groups when compared with Normal Control by Week 3, indicating early onset hypertension-related changes. Upon induction of hypertension, the Red Palm Oil group demonstrated a notable reduction in systolic blood pressure compared to the hypertension control group at week 5; this was consistent with previous findings [27]. The Pumpkin Seed Oil group showed reduction in systolic blood pressure compared to the hypertension control group aligning with prior research by week 7, suggesting potential efficacy in managing hypertension [16]. At the study's conclusion, marked statistical differences persisted between the hypertension control group and the Red Palm Oil and Pumpkin Seed Oil groups with a p-value of 0.0022 for Pumpkin Seed Oil (PSO) supplementation compared to 0.0034 for Red Palm Oil (RPO) supplementation, suggest that PSO may be more effective in mitigating high systolic blood pressure than RPO in Wistar rats. Notably, no significant difference was observed between hypertensive groups supplemented with either red palm oil or pumpkin seed oil, suggesting comparable effects within both normotensive and hypertensive contexts, irrespective of baseline blood pressure status.

A significant reduction in diastolic blood pressure was observed in both the Hypertension + Red Palm Oil and Hypertension + Pumpkin Seed Oil groups compared to the Hypertension Control group starting from week 6. By week 7, the Hypertension Control *vs.* Hypertension + Red Palm Oil groups continued to demonstrate a significant difference in diastolic blood pressure along with the Hypertension + Pumpkin Seed Oil group. This reduction persisted until the end of the experiment at week 8, with significant differences observed between the Hypertension Control and both the Hypertension + Red Palm Oil and Hypertension + Pumpkin Seed Oil groups. Notably, no significant difference in diastolic blood pressure was observed between the hypertensive groups supplemented with either Red Palm Oil or Pumpkin Seed Oil throughout the administration period. Similarly, comparisons between the normotensive groups receiving Red Palm Oil or Pumpkin Seed Oil revealed no significant differences in diastolic blood pressure levels. Although recent studies have predominantly focused on mean arterial pressure and systolic blood pressure, studies conducted by Bayorh et al., have included diastolic blood pressure in their research on mean arterial pressure [25]. This highlights the importance of considering diastolic blood pressure in the comprehensive management and understanding of hypertension. Overall, both red palm oil and pumpkin seed oil are effective in reducing diastolic blood pressure, with red palm oil demonstrating slightly more pronounced effects, p=0.0347, suggesting its potential superiority in managing hypertension.

The administration of Red Palm Oil (RPO) and Pumpkin Seed Oil (PSO) to normotensive rats throughout the experimental duration did not result in any significant difference in their mean arterial pressure compared to the normal control group. However, a significant mean arterial pressure reduction was recorded in the Hypertension + Red Palm Oil group aligning with previous studies by Bayorh et al., occurring at week 6, when compared with the hypertension control [25]. Similarly, a significant reduction in the mean arterial pressure was recorded in the Hypertension + Pumpkin Seed Oil group aligning with previous studies by occurring at week 6, when compared with the hypertension control [21]. At the experiment's conclusion in week 8, comparison between Hypertension Control *vs.* Hypertension + Red Palm Oil exhibited significant differences and Hypertension Control *vs* Hypertension + Pumpkin Seed Oil exhibited significant differences. These findings corroborate the potential therapeutic efficacy of Red Palm Oil and Pumpkin Seed Oil in managing hypertension and further support their inclusion as potential interventions in hypertensive conditions. Moreover, while both interventions effectively reduced Mean Arterial Pressure (MAP), the stronger level of statistical significance observed with Red Palm Oil supplementation (p=0.00250) when compared to Hypertension Control suggests a potentially more pronounced effect compared to Pumpkin Seed Oil supplementation of p=0.0186 when compared to Hypertension Control. This observed difference may be attributed to the presence of bioactive compounds in Red Palm Oil, such as tocotrienols and carotenoids, which have demonstrated vasoprotective effects in previous studies. These compounds may

enhance endothelial function, reduce oxidative stress and improve vascular tone, contributing to a greater reduction in MAP.

Significant differences were observed between the Normal Control group when compared with the Hypertension Control group, indicating that the induction of hypertension led to a notable change in heart weight index. However, no significant differences were found when the Hypertension Control group was compared with the Hypertension + Red Palm Oil and when the Hypertension Control group was compared with Hypertension + Pumpkin Seed Oil groups and this consistent with previous studies by Boon et al. and El-Mosallamy et al., respectively [26,16]. This suggests that the observed lack of significance in heart weight index may reflect consistent findings across studies regarding the minimal impact of red palm oil and pumpkin seed oil supplementation on hypertensive conditions. Notably, red palm oil and pumpkin seed oil had no significant effect on heart weight index in normal rats (normal control, red palm oil and pumpkin seed oil groups), suggesting that these oils may not exert a notable influence on cardiac parameters under physiological conditions. The study's duration and dosage of red palm oil and pumpkin seed oil might not have been adequate to induce noticeable changes in heart weight index. longer-term or higher-dose interventions could potentially reveal more pronounced effect [28].

Conclusion

This comparative study on dietary interventions for hypertension revealed that administering Red Palm Oil (RPO) and Pumpkin Seed Oil (PSO) to normotensive rats did not significantly alter body weight throughout the study, though hypertension induction influenced weight dynamics. Both oils showed potential in managing hypertension, with RPO demonstrating an earlier onset of action and PSO showing more pronounced reduction in systolic blood pressure compared to RPO at the end of the experiment. Both Red Palm Oil and Pumpkin Seed Oil are also effective in reducing diastolic blood pressure, with Red palm Oil demonstrating slightly more pronounced effects While both oils effectively reduced mean arterial pressure, RPO supplementation exhibited a stronger level of significance. These findings suggest the potential therapeutic efficacy of both oils in managing hypertension, with RPO potentially offering a more immediate and pronounced effect on blood pressure regulation. Hypertension induction led to a significant alteration in heart weight index and neither Red Palm Oil nor Pumpkin Seed Oil showed a notable effect. Similarly, in normotensive rats, there were no significant changes in heart weight index, suggesting minimal influence of the oils under normal condition.

Ethics Statement

Ethical approval was obtained from the University of Ibadan-Animal Care and Use Research Ethics Committee with Assigned number: UIACUREC/033-0224/19.

Consent Statement

All procedures conducted in this study were approved by the Institutional Animal Care and Use Committee (IACUC) in compliance with ethical guidelines for animal research. The study adhered strictly to the principles outlined in the Guide for the Care and Use of Laboratory Animals, ensuring the humane treatment of all animals used in the research. Efforts were made to minimize animal suffering, reduce the number of animals used and ensure the relevance of the study to hypertension management research. The protocol included detailed measures for monitoring animal health and welfare throughout the experiment. As the research involved no human subjects, informed consent was not applicable. However, all animal experiments were performed under rigorous ethical standards to uphold scientific integrity and animal welfare.

Competing Interests

The authors report no conflicts of interest in this work.

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