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Original Research Article

Evaluation of the Effects of Xylopia aethiopica and Tetrapleura tetraptera on Selected Metabolic Parameters in Wistar Rats

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Abstract

***Background*:** The postpartum period involves significant physiological changes requiring optimal nutrition and hydration. In African communities, Xylopia aethiopica and Tetrapleura tetraptera traditionally support maternal recovery. Despite their widespread use, scientific validation of their effects on food intake, water consumption, and weight regulation remains limited. This study assessed the effects of Xylopia aethiopica and Tetrapleura tetraptera on food intake, water intake, and weight changes in Wistar rats. ***Methods*:** Twenty-four female Wistar rats (87–103 g) were randomised into four groups (n = 6): control (standard rat chow), X. aethiopica (100 mg/kg extract), T. tetraptera (100 mg/kg extract), and a combined group (50 mg/kg of each extract). Food and water intake were recorded daily for 14 days, while body weights were measured at baseline and Day 14. Data were analysed using one-way ANOVA and Tukey's post hoc tests ($p<0.05$). ***Results*:** All treatment groups demonstrated significantly higher food and water intake than controls, with the X. aethiopica group having the highest intake (food: 95.3 g/day; water: 91.57 ml/day). Weight changes were minimal and statistically insignificant. ***Conclusion*:** Xylopia aethiopica and Tetrapleura tetraptera significantly enhance food and water intake without causing excessive weight gain.

Keywords: Xylopia Aethiopica, Tetrapleura Tetraptera, Postpartum Recovery, Maternal Health, Food Intake, Hydration.

INTRODUCTION

Significant physical and psychological transitions mark the postpartum period. Globally, 20% of mothers experience postpartum challenges, including nutrient depletion, lactation demands, and emotional instability (Radoš *et al*., 2020). In Sub-Saharan Africa, traditional diets enhanced with Xylopia aethiopica and Tetrapleura tetraptera have long been used to support recovery. These plants are incorporated into soups or stews to aid uterine involution, enhance hydration, and stimulate appetite (Bekoe *et al*., 2018).

X. aethiopica, known as "Negro Pepper," is widely utilised for its culinary and medicinal properties. It is believed to aid uterine contraction, stimulate lactation, and reduce postpartum fatigue (Bekoe *et al*., 2018; Uzodimma, 2013). Xylopia aethiopica is a rich source of xylopic acid, alkaloids, and volatile oils, known for their appetite-stimulating, anti-inflammatory, and neuroprotective properties (Biney *et al*., 2016).

Similarly, T. tetraptera, or "Aidan Fruit," is used for its aromatic and medicinal properties, including its role in improving hydration and energy restoration postpartum (Kemigisha *et al*., 2018). Tetrapleura tetraptera contains saponins, flavonoids, and aridanin, bioactive agents linked to hydration regulation, anxiety reduction, and antioxidant activity (Akin-Idowu *et al*., 2011). Despite anecdotal evidence of their benefits, rigorous scientific validation is sparse.

Chemical Composition and Bioactive Components

Xylopia aethiopica and Tetrapleura tetraptera have been analysed using Gas Chromatography-Mass Spectrometry (GC-MS), revealing their medicinal and nutritional properties. *Xylopia aethiopica* contains xylopic acid, a compound with anti-inflammatory, appetite-stimulating, and neuroprotective effects (Biney *et al*., 2016). It also contains volatile oils that aid digestion, zinc, and magnesium, essential for lactation and immune function (Bekoe *et al*., 2018).

Tetrapleura tetraptera features flavonoids and saponins with antioxidant and hydration-enhancing properties (Kemigisha *et al*., 2018), calcium and magnesium for bone health and metabolism (Akin-Idowu *et al*., 2011), and alkaloids that may regulate appetite and hydration by influencing the hypothalamus (Ojewole & Adewunmi, 2004).

These plants are valuable in traditional medicine and as potential functional food ingredients. Both plants have demonstrated neuroprotective and anti-inflammatory effects in previous studies. Xylopic acid, for instance, has been linked to reduced oxidative stress in neuronal tissues (Biney *et al*., 2016). Similarly, the saponins in T. tetraptera may enhance electrolyte balance, promoting hydration and reducing fatigue (Kemigisha *et al.,* 2018). This study aimed to assess the effects of X. aethiopica and T. tetraptera on food intake, water consumption, and weight changes.

METHODOLOGY

This controlled experimental study used Wistar rats to model the effects of Xylopia aethiopica and Tetrapleura tetraptera on food intake, water consumption, and weight changes. The use of rodents as experimental models is well-established in physiological and behavioural studies due to their genetic, biological, and behavioural similarities to humans.

Dried fruits of X. aethiopica and T. tetraptera were macerated in 70% ethanol for 72 hours, filtered, and concentrated using an oven dryer. Extracts were stored at 4°C until use.

The animals were housed in standard laboratory conditions with a 12-hour light/dark cycle. They were allowed to acclimatise for seven days and fed standard rat chow and water ad libitum. The study utilised 24 female Wistar rats aged 7 weeks (87–103 g). After acclimatisation, the rats were randomly divided into four groups (n = 6):

- Control: Standard rat chow and water.
- X. aethiopica Group: Administered 100 mg/kg of extract.
- T. tetraptera Group: Administered 100 mg/kg of extract.
- Combined Group: Administered 50 mg/kg of both extracts.

Daily food intake was calculated by subtracting the weight of leftover chow from the initial 100 grams provided. Measurements were taken at the same time daily. Daily Water consumption was calculated by subtracting the remaining volume from the initial 250 ml provided. The rats were weighed at baseline (Day 0) and on the final day of the study (Day 14) using a digital laboratory scale.

Descriptive statistics were used to summarise the data. Differences between groups were analysed using ANOVA and post hoc tests to determine significance. Independent t-tests were conducted to compare means between specific groups. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1: Effects of Plant Extracts on Food Intake, Water Intake, and Weight in Wistar Rats

Group	Food Intake (g/day)	Water Intake (ml/day)	Weight Gain (g)
Control	90.42 ± 2.1	60.86 ± 1.8	45.8 ± 2.5
X. aethiopica	95.3 ± 2.4*	91.57 ± 3.2*	42.5 ± 2.2
T. tetraptera	93.8 ± 2.0*	85.3 ± 2.7*	43.2 ± 3.1
Combined	92.5 ± 2.6*	87.1 ± 2.5*	43.8 ± 2.8

*Values are expressed as mean ± standard error of the mean (SEM). *Significant difference from the control ($p<0.05$).

Treatment groups exhibited significantly higher food and water intake than controls ($p<0.05$). The X. aethiopica fed group demonstrated the highest increase (95.3 ± 2.4 g/day), followed by T. tetraptera and the combined group.

Water intake increased substantially in all test groups, with X. aethiopica leading (91.57±3.2ml/day). This may reflect the thirst-enhancing properties of its volatile oils and osmoregulatory components.

Weight gains were comparable across all groups, with no significant differences observed. This finding indicates that the extracts may improve energy metabolism without contributing to excessive weight gain.

Statistical tests (ANOVA) confirmed significant differences in food and water intake between the control and treatment groups ($p<0.05$), while weight changes remained statistically insignificant ($p>0.05$).

DISCUSSION

The increased food and water intake observed in treatment groups is likely due to the appetite-stimulating properties of xylopic acid and the osmoregulatory effects of saponins. Xylopic acid activates hypothalamic hunger pathways, while saponins and flavonoids improve hydration by enhancing electrolyte balance (Kemigisha *et al*., 2018; Biney *et al*., 2016; Ojewole & Adewunmi, 2004).

Enhancing food and water intake without excessive weight gain aligns with postpartum nutritional

goals. Increased hydration supports uterine contraction and lactation, while the absence of significant weight changes helps prevent postpartum obesity—a growing concern in modern maternal health (Biney *et al*., 2015).

Increased food intake ensures adequate energy for lactation and recovery. Enhanced water consumption promotes uterine contraction and prevents dehydration. Minimal weight changes suggest improved metabolic efficiency, which is critical for postpartum weight control.

The findings highlight the potential for developing functional foods or supplements using these plants, addressing postpartum health in resource-limited settings.

Recommendations

1. Clinical Trials should be carried out to validate efficacy and safety in postpartum women.
2. Research into the contributory role of hormones in observed effects.
3. Development of plant-based supplements tailored for maternal recovery.

CONCLUSION

This study demonstrates that X. aethiopica and T. tetraptera enhance food and water intake without inducing excessive weight gain, supporting their traditional use in postpartum recovery. Further research is needed to explore long-term safety, molecular pathways, and applications in human populations.

Ethical Consideration:

Ethical approval for the unpublished master's dissertation from which this study was extracted was obtained from the faculty of Basic Medical Sciences, Rivers State University Research Ethics Committee with ref: RSU/FBMS/REC/23/007 dated 1 June 2022.

Authors' Contribution:

Dr. Wami-Amadi CF developed and executed the research, hypothesis, and study design under the supervision and guidance of Dr. Owhorji BI.

Conflict of Interest: Authors declare no conflict of interest

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