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Original Article

Anti-hyperuricemic and Xanthine Oxidase Inhibitory Effects of *Jatropha tanjorensis* Methanolic Extract in Pyrazinamide-Induced Mice

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Abstract

Hyperuricemia presents as a prevailing concern in routine clinical practice, affecting an estimated 8.9% to 24.4% of the general populace. Central to the emergence of hyperuricemia and its associated ailments is the enzyme xanthine oxidase (XO), which participates in the breakdown of purines into uric acid. This investigation is dedicated to appraising the ability of *Jatropha tanjorensis* methanolic extract to counteract hyperuricemia and inhibit XO in mice induced with pyrazinamide. The isolation of XO from cow milk was accomplished using ammonium sulfate precipitation techniques, followed by quantification of its activity via spectrophotometric measurements at a wavelength of 293 nm. Evaluation of uric acid levels was carried out through an enzyme colorimetric approach. The yield of *Jatropha tanjorensis* was found to be 9.2% (27.6 g). The XO inhibitory action of the extract was evident in the reduction in uric acid concentration from 8.73 µg/ml to 4.45 µg/ml after 1 hour. Assessment of toxicity showed that the extract, even at a high dose of 8000 mg/kg bw, had no observable impact on the animals' behavior or physical appearance. The uric acid assay demonstrated that all three doses of *Jatropha tanjorensis* extract led to a noteworthy reduction in mean serum uric acid levels compared to the negative control group. The highest mean uric acid levels were noted in the negative control groups, measuring 5.36 ± 0.40 mg/dl and 2.71 ± 0.34 mg/dl, respectively. In contrast, the positive control group treated with febuxostat exhibited a mean uric acid level of 3.15 ± 0.27 mg/dl. Regarding weight changes, the normal control and positive control groups displayed average gains of 62.53 g and 35.94 g, respectively, while the negative control group did not exhibit substantial weight variation. Consequently, the *Jatropha tanjorensis* extract induced a notable reduction in serum uric acid levels, and this antihyperuricemic effect became more prominent as the extract concentration increased. This suggests the extract's potential value in managing hyperuricemia.

Keywords: *Jatropha tanjorensis*, Xanthine oxidase, Inhibition, Hyperuricemia.

Introduction

Hyperuricaemia is characterized by an abnormal elevation in the concentration of uric acid in the bloodstream [1]. Uric acid is a byproduct of various routine metabolic processes, including the breakdown of purine nucleotides. Under ordinary physiological circumstances, it transforms into ions or salts referred to as urate and acid urates, respectively [2]. Typically, the serum uric acid concentration ranges from 3.4-7.2 mg/dl, with any surplus being efficiently eliminated by the kidneys through urine excretion [3]. When the serum uric acid level surpasses this established range, it falls into the realm of hyperuricemia. This condition can be triggered by factors such as the consumption of purine-rich foods, inadequate renal excretion of uric acid, alcohol consumption, swift weight loss, and the use of specific medications such as thiazide diuretics, pyrazinamide, ethambutol, and others [4]. In addition, certain medical conditions, such as tumor lysis syndrome [5], can also induce hyperuricemia. Failure to address hyperuricemia could lead to its progression into more serious health complications, including gout, cardiovascular disorders, kidney stone formation, and others [6].

Out of the various conditions linked to hyperuricemia, gout stands out as the most prevalent. This ailment is characterized by the presence of sodium urate crystals within the synovial fluids of joints, inducing intense pain, inflammation, swelling, and reddening [7]. The enzyme XO drives the conversion of hypoxanthine and xanthine into uric acid while concurrently generating superoxide free radicals, which play pivotal roles in fostering inflammation [8]. Allopurinol, a common xanthine oxidase inhibitor, is frequently prescribed for managing hyperuricemia and gout. However, extended usage of this medication is associated with potentially serious adverse effects, including kidney impairment, hepatitis, and cardiovascular conditions. As a result, there is a burgeoning interest in exploring natural alternatives to allopurinol that can effectively lower uric acid levels with minimal to no side effects. Numerous plants with traditional usage for treating gout, stemming from hyperuricemia, have come into focus. Examples include *Cinnamomum osmophloeum* (Cinnamon plant), chamomile (Manzanilla) [9], *Curcuma longa* (Turmeric) [10], *Acacia confusa*, *Ginkgo biloba* [11], *Momordica charantia*, and Artemisia vulgaris [12].

Jatropha tanjorensis, a member of the 'Euphorbiaceae' family, thrives predominantly in the southern regions of Nigeria, earning it the colloquial name "hospital too far." Leaves of this plant are a commonly consumed vegetable across various parts of Nigeria [13]. The remarkable health advantages, coupled with its accessibility and cost-effectiveness, have propelled *J.tanjorensis* into the spotlight [14]. Pharmacological investigations have revealed a diverse array of biological activities exhibited by this plant. These include antihypertensive, antioxidant, and gout-relieving properties [15], as well as antimicrobial, antimalarial, hypoglycaemic, hypolipidemic, and various hematological activities [16]. The composition of *J. tanjorensis* comprises a spectrum of phytochemicals, including alkaloids, flavonoids, phenolics, saponins, oxalate, tannins, and phytate [17].

While traditional usage suggests the effectiveness of *J. tanjorensis* in treating gout, scientific exploration of its antihyperglycaemic potential remains absent. This dearth of research prompts the necessity for a comprehensive investigation into the purported impact of *J. tanjorensis* on uric acid levels. These

botanicals hold promise in addressing elevated uric acid levels.

However, substantiating this assertion requires rigorous scientific inquiry. This involves validating its claimed benefits, elucidating its mechanism of action, and establishing its safety and efficacy for human consumption. Consequently, the forthcoming study seeks to ascertain the antihyperuricemic properties of the methanolic extract *J. tanjorensis*, using pyrazinamide-induced albino mice as subjects.

Materials and Methods

Equipment

The study employed a range of equipment, including a blender, Soxhlet extractor, round-bottom flask, electric cooker, water bath, desiccator, crucible, spectrophotometer, cuvette, conical flask, latex gloves, measuring cylinder, cannula, weighing balance, mouse cage, micropipette with tips, test tubes, dry incubator, stopwatch, porcelain mortar and pestle, bucket centrifuge, and a plain bottle.

Reagents

The study utilized several reagents, namely methanol, water, glucose powder, febuxostat (2-(3-cyano-4-isobutoxyphenyl)-4-methyl-1,3-thiazole-5-carboxylic acid), pyrazinamide, ethanol, random uric acid test kit, sodium chloride (table salt, NaCl), sodium phosphate buffer, cow milk, and xanthine oxidase (XO).

Sample Collection

On January 4th, 2022, the leaves of *J. tanjorensis* were collected from a residential garden located in Nyanya, Abuja. The plant's identification took place at the Department of Plant Biology, Federal University of Technology Minna, in Niger state. Following harvest, the leaves underwent thorough washing and subsequent air-drying. Subsequently, the dried leaves were finely ground using a manual blender to obtain a powdered consistency. The powdered material was carefully stored in a plastic bag for future application.

Preparation of Plant Extracts

A quantity of 300 grams of dried and pulverized *J. tanjorensis* leaves was accurately weighed and subjected to extraction using the Soxhlet extraction technique. In this process, 3 liters of 98% methanol was used. The procedure started by assembling the Soxhlet apparatus, placing the dried and pulverized leaves within the thimble, and introducing the methanol into the round-bottom flask. Soxhlet extraction was carried out over 48 hours, resulting in the acquisition of a sufficient amount of extract. To isolate the pure extract of *J. tanjorensis* leaves, methanol was meticulously recovered from the extract. The subsequent step involved transferring the extract from the thimble to a beaker, followed by subjecting it to a water bath set at 50 °C. This process facilitated the conversion of the extract into a paste-like consistency. The paste was dried for 72 h in a water bath, after which it was transferred to a crucible. Placing the crucible within a desiccator concluded the drying procedure, following the method outlined by [18].

The resultant extract was securely stored in a clean, dry, and hermetically sealed container at a low temperature, awaiting further use. For the creation of the desired concentrations, specific quantities of the extract were dissolved in precise volumes of distilled water. The proportions of extract and water were tailored according to the body weight of the mice, adhering to the protocol outlined by [18].

XO Isolation from Cow Milk

The technique proposed by [19] was adopted for the cow milk XO isolation process, with a few adjustments. To initiate the procedure, 500 mL of fresh cow milk was combined with 178.5 g of NaCl, and the resultant mixture was gently warmed to 30 °C. After this heating, the mixture underwent centrifugation at 5000 rpm for 15 minutes. The resultant supernatant was subjected to fractionation via ammonium sulfate at a temperature of 4 °C, followed by centrifugation at 5000 rpm and 4 °C for 30 minutes. The ensuing precipitate was subsequently solubilized in 0.2 M sodium phosphate buffer with a pH of 7.3 until the total volume reached 250 mL [19].

Determination of XO Activity

The approach described by [20] was modified for the assessment of XO activity within the leaf extract. Several adjustments were introduced to this method. The determination of XO activity involved gauging the transformation of xanthine into uric acid. To gauge this transformation, absorbance measurements were taken at 293 nm using a spectrophotometer. Initially, 1 mL of a 0.15 mM xanthine solution was measured and introduced into a clean test tube. Subsequently, 1.9 mL of sodium phosphate buffer at pH 7.3 was added.

The reaction was instigated by incorporating 0.1 mL of the XO solution. Over an hour, absorbance readings were taken at 10-minute intervals, with distilled water serving as the baseline. Following the absorbance measurements, the concentration of uric acid was ascertained [20]. The definition of one unit (U) of XO activity was established as the quantity of enzyme capable of catalyzing the conversion of 1 µg/mL xanthine to uric acid per minute under specified conditions.

Determination of XO Inhibitory Activity of the Extract

The procedure outlined by [21] was adjusted to evaluate the XO inhibitory activity of the leaf extract, incorporating a few modifications. The methanol extract derived from *J. tanjorensis* leaves was diluted to five distinct concentrations-20, 40, 60, 80, and 100 µg/ml-using a phosphate buffer solution at a pH of 7.5. A mixture of 3 ml of the extract solution, 2.9 ml of xanthine solution, and 0.1 ml of crude XO was prepared. This amalgamation was then subjected to incubation at 37 °C for 15 minutes. After this incubation, the enzymatic reaction was terminated by adding 1 ml of 1 N hydrochloric acid (HCl). A parallel iteration of this process was conducted using allopurinol as a reference standard. The solution obtained was analyzed using a spectrophotometer, measuring the absorbance at a wavelength of 290 nm. The inhibitory activity was computed by employing the linear equation derived from the XO curve concerning time and concentration, by the methodology presented by [22]. The computation of percentage inhibition was achieved through the subsequent formula.

$$\% \text{ Inhibition} = \frac{A_{control} - A_{extract}}{A\ control} \times 100$$

$A_{control}$ = Absorbance of the control

$A_{extract}$ = Absorbance of the reacting mixture in the presence of the extract

Preparation of Pyrazinamide Dosage Form

For the formulation of a pyrazinamide solution at a concentration of 100 mg/ml, 500 mg of pyrazinamide was meticulously measured and introduced

into a measuring cylinder. Following this, distilled water was added to the cylinder, bringing the total volume to 5 ml. To achieve a uniform mixture, glucose powder was incorporated. The volume of this pyrazinamide solution to be administered was determined based on the body weight of the mice, adhering to the approach established by [23].

Experimental Animals

Albino mice with a weight range of 25-35 g were sourced from Jos, Plateau state, Nigeria. These mice were then accommodated within the animal facility of the School of Life Sciences at the Federal University of Technology, Minna, located in Niger state. They were granted a period of acclimatization to adapt to the standard environmental conditions. During this phase, the mice were maintained within a controlled room environment characterized by a 12-hour light and 12-hour dark cycle. The mice were provided with standard mouse feed pellets acquired from the Centre for Genetic Engineering and Biotechnology at the Federal University of Technology, Minna. This feed served as their foundational diet throughout the experimental proceedings. The mice were given 2 weeks for acclimatization, during which their handling adhered to established guidelines, ensuring the animals' comfort and well-being.

The entire protocol followed for the care and management of the animals was approved by the Department of Biochemistry at the Federal University of Technology, Minna, in Niger state.

Determination of Lethal Dose

For the assessment of the lethal dose of *J. tanjorensis* leaves, mice were subjected to varying doses via oral gavage. The doses administered were 100 mg/kg, 500 mg/kg, 1000 mg/kg, 2000 mg/kg, 4000 mg/kg, and 6000 mg/kg body weight. After administration, a vigilant observation of the mice was conducted for any indications of toxicity or unfavorable outcomes, spanning 14 days, by the methodology outlined by [24].

Experimental Design

A total of 18 mice weighing between 25-33 g were subjected to random division, resulting in six distinct groups. Each of these groups comprised 3 mice. Throughout the experimental duration of 6 weeks, every group received a consistent supply of feed pellets and water daily. The administration of pyrazinamide solution and the *J. tanjorensis* leaf extract was conducted via oral gavage utilizing a cannula. The specific measurements for both substances were carefully administered according to the following schedule:

(1) Group I (normal control): Animals in this group were given mouse feed pellets and glucose water.

(2) Group II (negative control): This group was given 500 mg/kg pyrazinamide in glucose water and mouse feed pellets.

(3) Group III (positive control): This group was given 500 mg/kg pyrazinamide in glucose water alongside febuxostat, and the mice were fed pellets.

(4) Group IV: This group was given 500 mg/kg pyrazinamide solution, and the mice were fed pellets and treated with 100 mg of *J.tanjorensis* leaf extract per kg body weight.

(5) Group V: This group was given 500 mg/kg pyrazinamide solution, and the mice were fed pellets and treated with 200 mg of *J. tanjorensis* leaf extract per kg body weight.

(6) Group VI: This group was given 500 mg/kg pyrazinamide solution, and the mice were fed pellets and treated

with 400 mg of *J. tanjorensis* leaf extract per kg body weight [25].

Blood Sample Collection

Upon completion of the six weeks, the mice were humanely euthanized, and their blood was collected and transferred into plain sample bottles. To initiate clotting, the collected blood was initially left undisturbed. Subsequently, the blood samples were centrifuged at 5000 rpm for 5 minutes. Following centrifugation, the resulting serum was carefully aspirated using a micropipette and transferred into separate test tubes. This serum was then set aside for the subsequent analysis of uric acid levels, by the procedure outlined by [23].

Uric Acid Assay

Blood serum was meticulously collected from the mice, and the assessment of uric acid levels was executed employing the enzymatic colorimetric technique devised by Trivedi and Kabasakalian. This analytical procedure was conducted through the utilization of the Randox Uric Acid Kit, a product manufactured by Randox Laboratories Ltd. in the UK. The Randox Uric Acid Kit is designed for quantitative analysis, determining uric acid concentration within blood samples through an enzymatic colorimetric method. The procedural steps included the preparation of a blank by incubating 1000 µl of the R1 reagent at 37 °C for 5 minutes. Setting the spectrophotometer to a wavelength of 520 nm, a blank was employed for zeroing the instrument. In addition, a mixture of 1000 µl of the R1 reagent and 20 µl of the standard was prepared. This blend was incubated at 37°C for 5 minutes, after which the absorbance was measured at 520 nm. Subsequently, another mixture comprising 1000 µl of the R1 reagent and 20 µl of the serum was prepared, followed by an incubation period of 5 minutes at 37 °C. The resulting mixture's absorbance was then quantified using a spectrophotometer, employing a path length of 1 cm [26].

Uric acid concentration (mg/dl) = Absorbance of sample x Standard concentration

Absorbance of standard

Statistical Analysis

Statistical analyses were executed using SPSS version 25.0 (IBM Corp, Armonk, NY, USA). A one-way analysis of variance (ANOVA) was employed to evaluate the mean uric acid levels across the study groups. Statistical significance was attributed to a p-value below 0.05. In instances where the ANOVA test yielded statistical significance, post hoc analysis was carried out using Dunnett's test. This post hoc examination aimed to identify specific variations between individual groups. The data are presented as the mean ± standard deviation (SD).

Results

Percentage Yield

Soxhlet extraction of 300 g of *J. tanjorensis* leaves yielded an aqueous crude extract of 67.19 g, representing 22.4% of the initial weight. After the drying process, the yield was determined to be 27.6 g. A summary of the percentage yield following both the extraction and drying procedures is presented in Table 1 below.

Determination of the Rate of XO Activity

The pace of xanthine conversion into uric acid corresponds directly to the activity of XO. As depicted in Figure 1, the uric acid concentration generated was monitored at 10-minute intervals over an hour. The findings illustrate a substantial

reduction in the concentration of uric acid produced after one hour. This observation indicates that the extract effectively curtailed the pace of XO activity.

Inhibitory Activity of the XO Extract

To explore the connection between rising extract concentrations and inhibitory effects, the XO inhibitory potential of various concentrations of *J. tanjorensis* leaf extract was assessed. The outcomes revealed a noteworthy decline in uric acid production in conjunction with ascending extract concentrations. This observation suggests that the methanol extracts derived from *J. tanjorensis* leaves exhibit considerable *in vitro* XO inhibitory activity, which strengthens as the extract concentration increases. The graphical representation in Figure 2 outlines the percentage inhibition of XO across different extract concentrations and febuxostat.

Table 1 Percentage yield of Soxhlet extraction of *Jatropha tanjorensis* leaves with methanol

Sample	Weight before extraction (g)	Weight after extraction (g)	Percentage yield (%)
Jatropha tanjorensis (Dried leaves)	300	67.19	22.4
Crude methanol extract	67.19	27.6	9.2

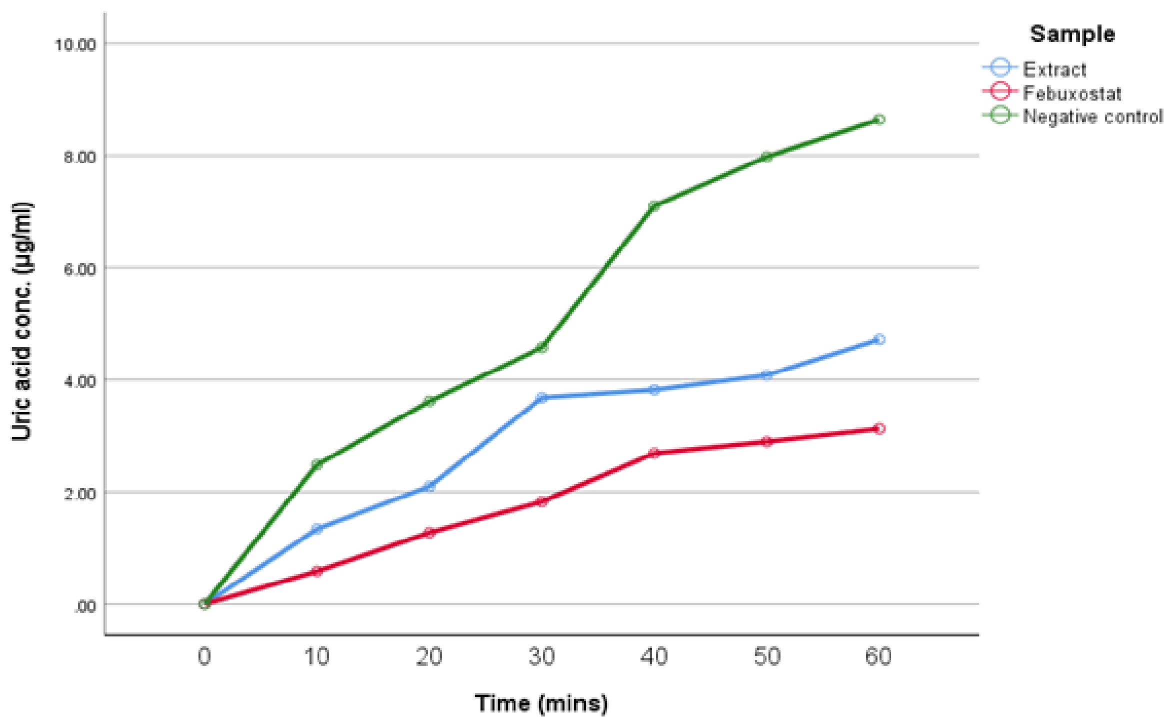

Figure 1 Xanthine oxidase activity of methanol extracts of *Jatropha tanjorensis* leaves

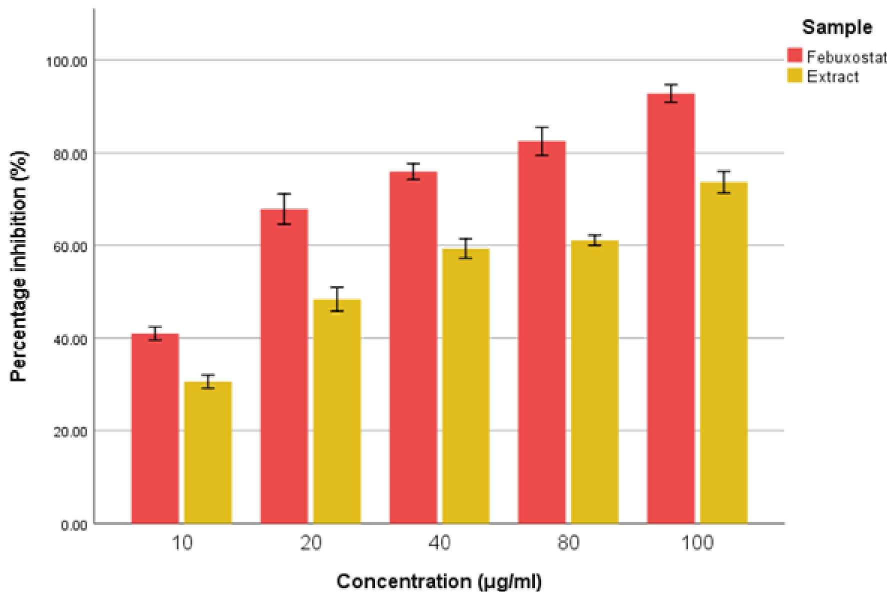

Figure 2 Percentage inhibition of XO at different concentrations of methanol extracts of *Jatropha tanjorensis* leaves and Febuxostat

Mean Lethal Dose

The findings presented in Table 2 elucidate the toxicity of *J. tanjorensis* leaves in mice. Throughout the observation period, mice across all dosage groups exhibited no indications of toxicity or adverse outcomes. There were no instances of abnormal behavior, clinical indicators, or mortality recorded.

Uric Acid Assay

The negative control group exhibited a significantly ($p < 0.05$) elevated uric acid level in comparison to the normal control group. Meanwhile, the positive control group displayed a serum uric acid level surpassing that of the normal control but falling below that of the negative control. The analysis further indicated that groups treated with *J.tanjorensis* showed serum uric acid levels significantly ($p < 0.05$) lower than those of the negative control group but higher than those of the normal control group. In comparison to the positive control group, the mice treated with 100 mg/kg bw and 200 mg/kg bw *J. tanjorensis* exhibited marginally higher serum uric acid levels.

The group administered 400 mg/kg body weight *J.tanjorensis* demonstrated a mean uric acid level near that of the positive control group. The impact of *J. tanjorensis* leaf extracts on mouse serum uric acid levels after a 6-week treatment period is demonstrated in Figure 3.

Effects of Treatment on Body Weight

Throughout the weeks, the mice across all dose groups demonstrated a trend of increasing body weight, except for the negative control group, where a decline in body weight was observed. When comparing the weight gain across various dose groups, the normal control group exhibited the highest weight gain of 62.53 g by the conclusion of the 6 weeks. The group treated with 400 mg/kg bw *J. tanjorensis* closely followed, recording an average weight gain of 49.38 g after 6 weeks of treatment. In contrast, the negative control group experienced an average weight loss of 19.11 g by the end of the 6 weeks. The alterations in body weight among the mice in different dose groups throughout the 6-week treatment are graphically demonstrated in Figure 4.

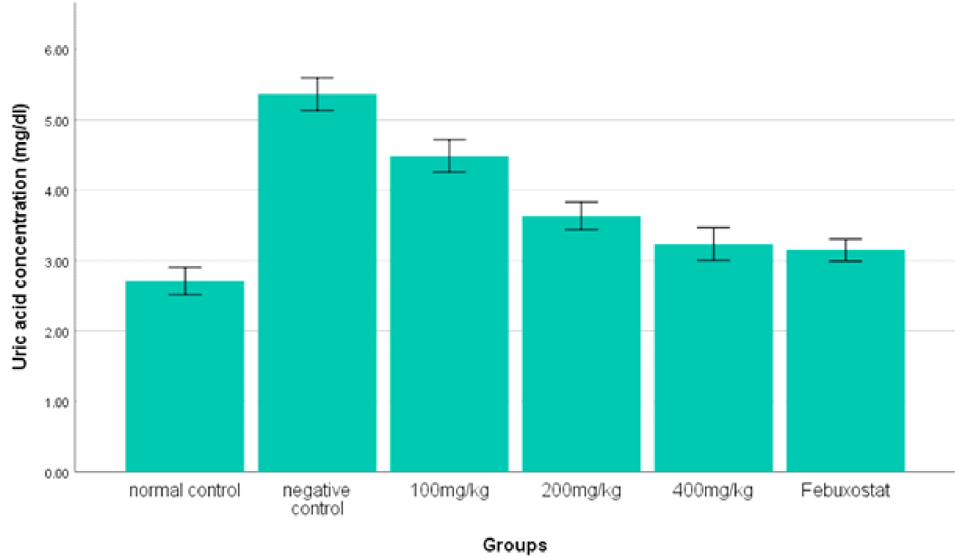

Figure 3 Effect of methanol extract of *Jatropha tanjorensis* leaves on serum uric acid levels in mice

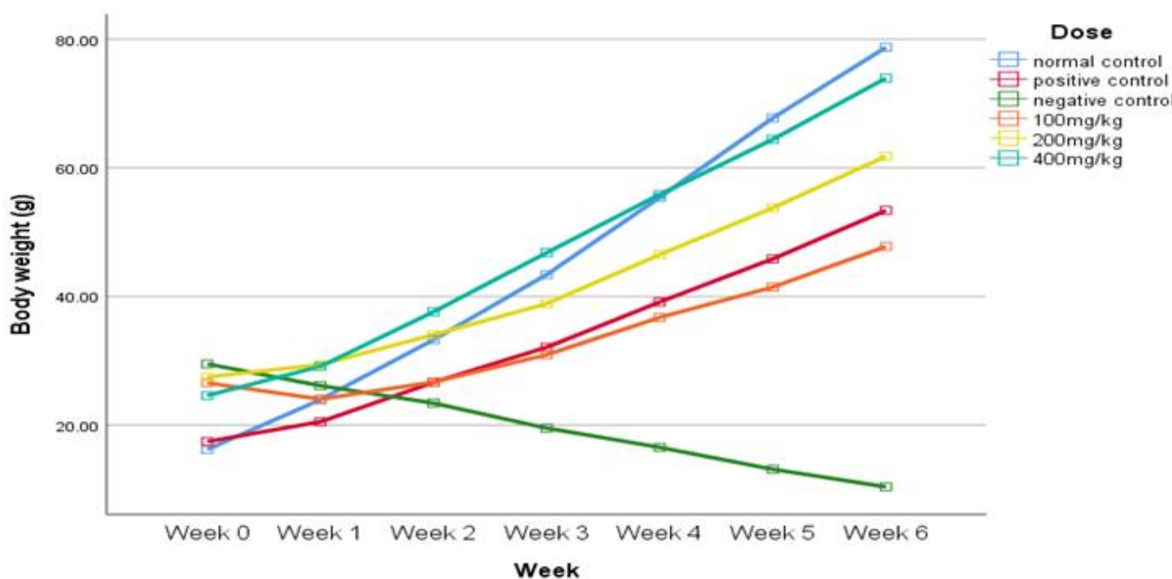

Figure 4 The effect of *Jatropha tanjorensis* extract on the body weight of Pyrazinamide-treated mice during six weeks of study

Table 2 Determination of lethal dose of the methanol extract of *Jatropha tanjorensis* leaves

Dose (mg/kg bw)	No. of mice	Treatment period	Mortality	Toxicity signs
		Phase 1		
100	3	2 weeks	0	None observed
500	3	2 weeks	0	None observed
1000	3	2 weeks	0	None observed
		Phase 2		
2000	3	2 weeks	0	None observed
4000	3	2 weeks	0	None observed
8000	3	2 weeks	0	None observed

Discussion

The historical utilization of plants for medicinal purposes traces back to medieval eras, wherein they were harnessed to address a wide spectrum of health concerns. Beyond their nutritional value, many plants have garnered recognition for their therapeutic attributes [27]. Owing to their affordability, accessibility, efficacy, and perceived low toxicity, medicinal plants have been embraced as a remedy for various ailments [28]. Among these, *J. tanjorensis*, a frequently employed medicinal plant in West Africa, has drawn substantial attention due to its myriad health advantages. In the endeavor of extracting compounds from *J. tanjorensis*, the Soxhlet method employing 98% methanol yielded a crude extract of 67.19 g from 300 g of the plant material. This constitutes 22.4% of the original weight. This result aligns with the percentage yield of 22.84% attained through the methanol extraction of *J. tanjorensis* leaves, a process conducted by [29]. After the extract's conversion into paste form through drying, the pure extract weighed 27.6 g, equivalent to 9.2% of the initial weight. This figure surpasses the 4.68% yield yielded from the extraction of *J. tanjorensis* leaves using distilled water [17]. This observation underscores methanol's superiority as a solvent compared to distilled methanol for *J. tanjorensis* extraction purposes.

The outcomes obtained from the *in vitro* investigation of the extract's XO inhibitory activity demonstrated a noteworthy decrease in the concentration of uric acid produced after a 1-hour interval, transitioning from 8.73 µg/ml to 4.45 µg/ml. This outcome signifies a substantial mitigation in the pace of XO activity due to the extract. Furthermore, the extract at a concentration of 100 mg/dl exhibited an XO inhibition rate of 73.12 ± 3.47%, whereas the equivalent dose of febuxostat yielded an inhibition of 93.11 ± 3.97%. This underscores that the extract possesses substantial in vitro XO inhibitory potential, albeit not at the level of potency exhibited by the standard medication febuxostat.

The assessment of the mean lethal dose for *J. tanjorensis* extract in mice revealed that even at a substantial dosage of 8000 mg/kg bw, there were no discernible shifts in the animals' behavior or physical appearance. This observation aligns with a prior investigation conducted on the acute oral toxicity of *J. tanjorensis'* methanol extract [30]. Their findings similarly indicate the absence of any toxic impact from *J. tanjorensis*, even at a high dose of 5000 mg/kg in albino mice. Given the absence of mortality even at the 8000 mg/kg dose level, it can be reasonably concluded that the LD_{50} is significantly elevated, indicating the safety of consuming *J.tanjorensis* at higher doses.

This study aimed to explore the potential of the methanolic extract derived from *J. tanjorensis* leaves in mitigating serum uric acid levels. The group designated as the negative control exhibited a notable elevation in serum uric acid levels, attributed to the administration of pyrazinamide alone. Consistent with prior research, pyrazinamide has been demonstrated to induce a considerable rise in serum uric acid levels [23,31]. The negative control group registered the highest mean uric acid level at 5.36 ± 0.40 mg/dl. In contrast, the normal control group showed a mean uric acid level of 2.71 ± 0.34 mg/dl. Comparatively, the positive control group treated with febuxostat exhibited a mean uric acid level of 3.15 ± 0.27 mg/dl. This value is lower than the mean uric acid level in the negative control group.

The findings also indicated that all three doses of *J. tanjorensis* extract prompted a notable decrease in mean serum uric acid levels in comparison to the negative control group. Among the groups subjected to *J. tanjorensis* extract treatment, the cohort administered 400 mg/kg bw *J. tanjorensis* leaves exhibited the lowest serum uric acid level. This outcome demonstrates the dose-dependent effect of methanol extract from *J. tanjorensis* leaves on reducing serum uric acid levels, with an inverse relationship between extract dosage and uric acid levels. While the mean uric acid level of the positive control group was marginally lower than that of the 400 mg/kg bw treated group, statistical analysis revealed no significant difference ($p < 0.05$) in serum uric acid levels between these two groups. This implies that the 400 mg/kg bw dosage of *J. tanjorensis* leaves is nearly as efficacious as febuxostat in diminishing serum uric acid levels. Notably, statistical analysis indicated a substantial variance between the negative control group and the groups administered 200 mg/kg bw and 400 mg/kg bw *J. tanjorensis* leaf extract. The specific mechanism underlying the reduction in uric acid levels in *J. tanjorensis* remains incompletely understood. However, it has been documented that *J. tanjorensis* leaf extract encompasses diverse bioactive compounds, such as flavonoids, saponins, alkaloids, and phenolic acids, which are known for their antioxidant and anti-inflammatory properties [32].

While no prior studies have explored the impact of *J. tanjorensis* extract on serum uric acid levels, a limited number of investigations have delved into the effects of other *Jatropha* species and various medicinal plants. Some of these studies serve as references for comparing the outcomes of the current investigation. For instance, an assessment of the anti-inflammatory effects of *Jatropha isabelli* leaf extract on a rat gout model revealed that the extract did not induce alterations in uric acid levels within the mice [33]. In addition, a distinct study showed that a specific fraction of *Jatropha podagrica* stem bark displayed XO inhibitory effects, resulting in a substantial reduction in uric acid levels within a rat gout model [34]. Furthermore, a study by [35] unveiled the robust XO inhibitory activity of *Moringa oleifera* twig extracts, leading to a noteworthy decrease in serum uric acid levels. These investigations provide a comparative foundation for assessing the findings of the present study.

The impact of the methanol extract from *J.tanjorensis* leaves on the body weight of albino mice with pyrazinamide-induced hyperuricemia is notable. The findings reveal that the normal control group exhibited the highest average weight gain at 62.53 g, an unsurprising outcome given their untreated feeding regimen. Meanwhile, the positive control group, receiving febuxostat, experienced an average weight gain of 35.94 g, demonstrating a significant increase in weight, albeit lower than the normal control group. In contrast, the negative control group, exclusively administered pyrazinamide, registered an average weight loss of 19.11 g, suggesting a detrimental effect on body weight due to pyrazinamide. Among the *J. tanjorensis* extract-treated groups, the 100 mg/kg dose yielded an average weight gain of 21.20 g, which was slightly lower than that of the positive control but still a significant increase. The 200 mg/kg-treated group demonstrated a higher average weight gain of 34.32 g compared to the positive control. Remarkably, the group subjected to the highest dose of 400 mg/kg displayed the most substantial weight gain, with an average of 49.36 g.

Earlier research has indicated the presence of anti-inflammatory,

antioxidant, and antimicrobial properties within *J. tanjorensis*, and there have been varying reports regarding its impact on body weight [16]. These attributes may counteract some of the negative effects of pyrazinamide on the gut microbiome and gastrointestinal tract. Furthermore, *J. tanjorensis* might offer nutritional support to mice, contributing to the prevention of weight loss.

Conclusion

The outcomes derived from this study underscore the capacity of *Jatropha tanjorensis* extract to induce a significant reduction in serum uric acid levels, with its antihyperuricemic influence intensifying alongside escalating concentrations. In direct comparison to febuxostat, a recognized standard drug, the most elevated extract dose (400 mg/kg bw) exhibited equivalent efficacy in curbing serum uric acid levels. Beyond its antihyperuricemic impact, *J. tanjorensis* extract exhibited a protective effect against weight loss in the context of pyrazinamide-induced hyperuricemia mice. To sum up, this study establishes the potential of *Jatropha tanjorensis* extract as a natural agent capable of mitigating hyperuricemia and stabilizing body weight in the setting of pyrazinamide-induced hyperuricemic albino mice.

Given that certain other *Jatropha* species have demonstrated minimal impact on uric acid levels, further exploration is warranted to uncover the potential mechanisms underpinning its antihyperglycemic properties. Notably, it is essential to acknowledge that the current study was conducted in mice, necessitating subsequent investigations to determine the extract's efficacy in reducing uric acid levels in humans. To sum up, further research endeavors are indispensable to unravel the full potential of *J. tanjorensis* extract and its suitability as a therapeutic intervention for managing hyperuricemia in humans.

Ethical Approval

The ethical clearance for this study was approved by the Federal University of Technology, Minna/Nigeria ethical review board (CUERB) by international standards on the care and use of experimental animals.

Conflict of Interest

The authors declared that there is no conflict of interest in conducting this study with any internal or external entity.

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