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Effects of Tigernuts on Blood Urea, Uric Acid and Creatinine Levels in the Normal Weight Male Humans

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ABSTRACT

Natural antioxidants are gaining significant attention from nutritionists, food manufacturers, medical professionals, and consumers due to their numerous health benefits. This study explored the potential effects of tigernuts on blood urea, uric acid, and creatinine levels in normal-weight male subjects under resting conditions, as well as the possible mechanisms involved. Methods: A total of forty (40) non-habitual tigernut chewers, aged 18–28 years, participated in the study. After recording the anthropometric data of the control group, the subjects rested for 1 hour and 30 minutes. Urea levels were measured colorimetrically using the Urease-Berthelot's Method, where urea in plasma was hydrolyzed to ammonia in the presence of urease, and the resulting ammonia was detected photometrically through Berthelot's reaction. Uric acid was determined using an enzymatic colorimetric method, while creatinine was assessed using the Modified Jaffe's Method, in which creatinine in the sample reacted with picrate in an alkaline medium to form a colored complex, measured within a short period to minimize interference.On a separate day, 5g of tigernuts were given to the same subjects—who had previously served as controls—to be chewed as a bolus. Findings indicated that tigernuts significantly reduced ($P < 0.05$) blood urea levels post-consumption (from 16.32 ± 0.759 to 11.76 ± 1.325 mg/dl). However, uric acid levels significantly increased ($P < 0.05$) following ingestion (from 2.438 ± 0.439 to 4.851 ± 0.393 mg/dl). Blood creatinine levels decreased from 1.778 ± 0.093 to 1.617 ± 0.089 g/dl, though this reduction was not statistically significant. This study suggests that tigernuts have beneficial effects on renal urea and creatinine levels, supporting their consumption for maintaining kidney health

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INTRODUCTION

Cyperus esculentus L., commonly referred to as earthnut, chufa, or earth almond, is a perennial tuberous plant belonging to the sedge family (*Cyperaceae*). It is cultivated in regions such as Brazil, Spain, Portugal, East Africa, and several West African countries, including Nigeria, as well as in experimental and homestead plots in Ukraine.[1,2] This plant is primarily grown for its small, sweet, almond-like tubers, which serve as a source of edible oil. The tubers, which develop at the roots, have a hard shell, a crispy texture, and a naturally sweet flavor. The use of chufa tubers as a food source dates back to ancient times due to their rich nutritional profile, comprising 20–25% lipids, 20–35% starch, 12–28% sugars, and 5–9% proteins. The oil extracted from these tubers has applications in the food industry, manufacturing, and medicine. Owing to their bioactive compounds, *Cyperus esculentus* L. tubers are considered promising ingredients for dietary, pediatric, and specialized food production.[2]

LITERATURE REVIEW

Widely cultivated and utilized as a dietary supplement in the Arabian Peninsula and other regions, *Cyperus esculentus* (CE) is an upright, fibrous-rooted perennial plant that can grow between 1 to 3 feet in height and reproduces through seeds and rhizomes. The edible tubers possess a distinct sweet, nutty taste. In Nigeria, the fresh tubers are consumed in various ways, including roasting, baking, drying, eating raw, or preparing into 'kunnu'.[3] The fat composition of CE closely resembles that of olives, containing 72% unsaturated fatty acids (oleic and linoleic acids) and 28% saturated fatty acids (palmitic and stearic acids). Extracts from *C. esculentus* have demonstrated anti-cancer, anti-microbial, anti-diarrheal, and anti-flatulence properties and have also been used in managing anemia, urinary tract infections, and hypercholesterolemia.[4]

Beyond its role as a food source, *Cyperus esculentus* tubers have several additional applications. In Spain, they are used to produce a milk-like beverage known as "horchata." Tigernut is highly nutritious, featuring a fat composition similar to that of olives while being free of gluten and cholesterol.[5][6] It is one of the richest sources of flavonoids and is abundant in water, fiber, alkaloids, digestible carbohydrates, saponins, and fatty oils (glycerides). Additionally, tigernuts contain essential minerals such as phosphorus, potassium, calcium, iron, zinc, magnesium, and manganese.[7][8][9] The oil derived from *C. esculentus* is rich in monounsaturated fatty acids, resembling those found in olive, avocado, and hazelnut oils. This oil is also characterized by high levels of unsaponifiable matter, phospholipids, and bioactive compounds, including tocopherols, phytosterols, and polyphenols.[10][11] The small, round tubers that grow along the roots have a mild almond-like taste and can be eaten raw or cooked or processed into the traditional chufa drink, "orxata." Previous studies have identified the presence of phytosterols, ascorbic acid (vitamin C), tocopherol (vitamin E), and β-carotene in tigernuts. These compounds, along with the unsaturated fatty acids in tigernut oil, are believed to contribute to its antioxidant properties.[6][12]

A wide variety of plants and their bioactive compounds have been shown to influence health-related conditions. Some medicinal plants, including *Cyperus esculentus*, have demonstrated beneficial health effects. Research has identified approximately 160 phytochemical compounds derived from 101 plant species that may provide protective benefits for the liver and kidneys. Currently, medicinal plants play a crucial role in treating liver and renal diseases.[13]

Pharmacotherapy increasingly incorporates knowledge from traditional herbal medicine, as the demand for new therapeutic agents to manage metabolic disorders remains a priority in both pharmacy and medicine.[14] The use of phytotherapy is well-justified due to its advantages over synthetic drugs, such as low toxicity, mild pharmacological effects, and long-term safety with minimal adverse effects.[15] The identification of medicinal plants with a history of safe use and minimal side effects continues to gain interest. The primary objective of utilizing these plants is to regulate metabolic disorders, given that plant metabolites share similarities with compounds naturally present in the human body.[16]

Building on this foundation, the present study investigated the effects of *Cyperus esculentus* (CE) on blood *urea*, *uric acid*, and *creatinine* levels in normal-weight male subjects. Additionally, the study sought to explore the possible mechanisms through which these effects may have been exerted.

METHODOLOGY

Subjects

Forty normal-weight male volunteers (18–28 years) from Ambrose Alli University participated, with health assessments conducted via questionnaires and physical exams. Informed consent and ethical approval were obtained before the study..

Inclusion/Exclusion Criteria

Subjects with hypertension, kidney, heart conditions, diabetes, ulcers, or other health issues were excluded. Normal-weight participants (BMI 18.5–25.0 kg/m^2) had their age, weight, height, BMI, blood pressure, and heart rate recorded before the study.

Determination of Body Mass Index

Body mass index (BMI) was calculated as weight (kg) divided by height (m^2), with measurements taken using a Camry balance (Italy) and a Henglida stadiometer (China). Participants (BMI 18.5–24.9) removed shoes and heavy clothing before measurement. Control subjects arrived fasting, relaxed for 1 hour 30 minutes, and had their blood samples taken for urea, uric acid, and creatinine analysis using Urease-Berthelot's, enzymatic colorimetric, and Modified Jaffe's methods, respectively. On a separate day, the same subjects consumed 5g of tigernut as a bolus, followed by 50ml of water. After resting for 1 hour 30 minutes, their blood samples were collected again to determine post-consumption urea, uric acid, and creatinine levels.

Collection of Blood Sample

A 7ml blood sample was drawn from the medial cubital vein using a vacutainer syringe and transferred into an anticoagulant-free tube. After 60 minutes of clotting, the serum was separated by centrifugation at 3,000 rpm for 10 minutes at room temperature.

Statistical Analysis

Statistical analyses were carried out using Graph Pad Prism Statistical Software version 8.1.The results were presented as Mean ± SEM. A P-value of less than 0.05 was considered to be statistically significant.

RESULT

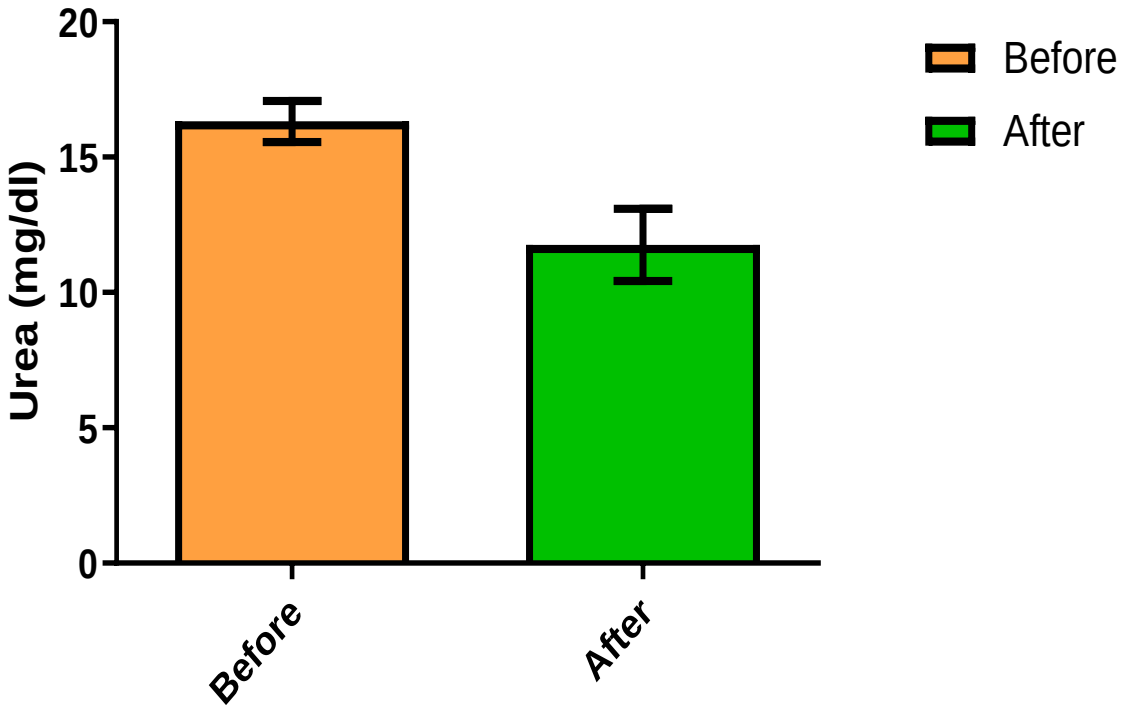

Fig I Showing the Effect of Tigernut Consumption on Urea in Young Adult Individuals

There was a significant decrease after consumption of Tigernut compared with before consumption

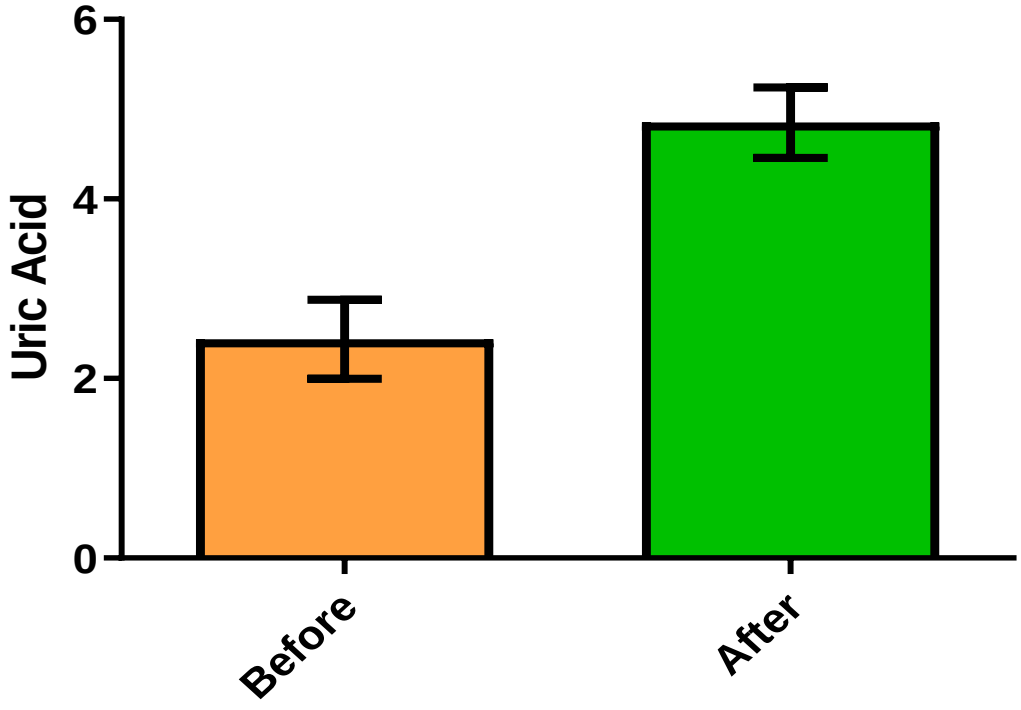

Fig II Shows the Effect of Tiger Nut Consumption on Uric Acid in Young Adult Individuals

There was a significant increase after consumption of TigernutS compared with before consumption

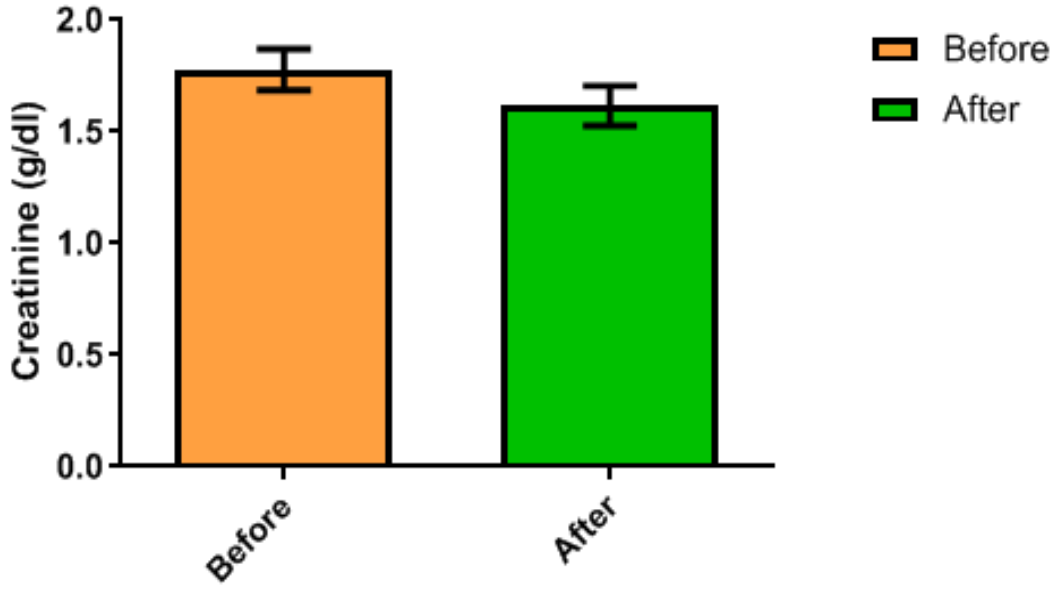

Fig III Shows the Effect of Tiger Nut Consumption on Creatinine in Young Adult Individuals

There was no significant difference after consumption of Tiger nut compared with before consumptionAdult Individuals

DISCUSSION

The study investigated the impact of tigernuts (Cyperus esculentus) on blood urea, uric acid, and creatinine levels in normal-weight male subjects at rest, as well as the potential underlying mechanisms. The findings demonstrated that tigernuts significantly reduced ($P < 0.05$) blood urea levels from 16.32 ± 0.759 to 11.76 ± 1.325 mg/dl while significantly increasing ($P < 0.05$) blood uric acid levels from 2.438 ± 0.439 to 4.851 ± 0.393 mg/dl. Additionally, tigernut consumption led to a reduction in blood creatinine levels from 1.778 ± 0.093 to 1.617 ± 0.089 g/dl, although this decrease was not statistically significant. Tigernuts contain bioactive compounds such as sterols, alkaloids, tannins, saponins, resins, and vitamins E and C. Their nutrient composition includes 22.14–44.92% lipids, 3.28–8.45% proteins, 23.21–48.12% starch, 8.26–15.47% fiber, and 1.60–2.60% ash. Rich in edible oils high in monounsaturated fatty acids, the nutritional quality of tigernuts is comparable to that of olive oil.

Tigernuts possess a high lipid content (22.14–44.92%), with a fatty acid profile similar to olive oil, which is regarded as one of the healthiest fats for human consumption. Aside from their oil content, tigernuts are a source of essential minerals, including sodium, potassium, calcium, iron, magnesium, zinc, copper, and phosphorus. The antioxidants present in tigernut oil contribute to its superior oxidative stability compared to other vegetable oils. Additionally, tigernuts contain alkaloids, saponins, tannins, and phenols, which exhibit antibacterial and anti-inflammatory effects. Their tubers consist of 77.49 - 80.01% essential fatty acids and 31.32 - 34.03 mg/100 g of essential amino acids. They are also rich in the disaccharide D-sucrose, which, upon hydrolysis, releases D-glucose, D-galactose, and D-xylose.

The kidneys serve a crucial role in excreting xenobiotics and their metabolites, making them vulnerable to damage from various substances. Serum levels of urea, creatinine, and uric acid are essential markers of kidney function in both humans and rodents. This study evaluated kidney integrity by assessing serum levels of these markers. It was observed that tigernut administration significantly reduced ($P < 0.05$) serum urea levels while increasing ($P < 0.05$) serum uric acid levels. The reduction in serum urea suggests that tigernuts may have inhibited urea synthesis or limited its transport into the bloodstream. However, the observed increase in uric acid levels indicates a potential compromise in kidney function, likely linked to the phytochemical components of tigernuts.

These findings contradict those of [18], which reported that C. esculentus oil positively influenced renal dysfunction caused by a high-fat diet and low-dose streptozotocin exposure in rats. However, the results align with those of [19], who also observed a reduction in urea concentrations following tigernut oil treatment. The presence of unsaturated fatty acids in C. esculentus oil, as

noted by [20], may be responsible for its beneficial effects on glomerular filtration rate and renal plasma flow. The reduction in serum urea levels in this study suggests that kidney integrity remained intact, supporting previous findings from [17] and [18]. Moreover, [21] demonstrated the protective effects of tigernuts on renal function in hypercholesterolemic rats, where a significant reduction in serum urea, creatinine, and uric acid levels was observed in the C. esculentus-treated group compared to the positive control. The role of unsaturated fatty acids in promoting glomerular filtration and renal plasma flow may explain these effects, as indicated by [22,19].

Serum creatinine levels were also assessed as an indicator of kidney function. Tigernut administration was found to reduce serum creatinine levels, suggesting that it may have inhibited creatinine synthesis or limited its transport into the bloodstream. This result aligns with findings from [23], which reported a reduction in creatinine concentrations in animals treated with tigernut oil. Creatinine is primarily derived from the breakdown of creatine in muscle tissue, with its conversion to creatinine occurring at a constant rate. Kidney damage can lead to elevated creatinine levels, making serum creatinine a widely used marker of glomerular filtration rate in clinical settings [21,24].

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the study suggests that tigernuts have beneficial effects on renal urea and creatinine levels, supporting their potential use for maintaining kidney health. However, their negative impact on renal uric acid levels raises concerns about hyperuricemia, suggesting that caution should be exercised when considering tigernuts for kidney health.

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Conflict of Interest

The authors declare that we have no financial or personal relationship(s) which may have inappropriately influenced us in writing this paper.

Author Contributions

1. Igbinovia, Edokpolor N. conceptualized the research, was involved in data curation and supervision of the research
2. Ohiwerei, Wisdom O. was involved in the formal analysis, investigation, methodology and reviewing of the manuscript
3. Ohiwerei, Faith O. was involved in investigation and review of the manuscript
4. Otaye Micheal O. was involved in validation of the research and writing of the initial manuscript
5. Onokevbagbe Elisha O. was involved in the preparation of the initial manuscript and data visualization
6. Ibhadode Adesuwa was involved in funding acquisition, providing essential materials and reagents for the research

7. Echekwube Marylyn E. was involved in funding acquisition and provision of essential materials and reagents for the research

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to patient confidentiality.

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