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# Phytochemical screening and proximate analysis of tiger nut (*Cyperus esculentus)* and clove (*Syzygium aromaticum*)

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**This research work focuses on the proximate and phytochemical analysis of clove (*Syzygium aromaticum*) and tiger nut (*Cyperus esculentus*) with the aim of providing valuable information on their nutritional and bioactive potential. The phytochemical screening of tiger nut and clove extracts revealed distinct variations in bioactive compounds. Tiger nut extract tested positive for flavonoids and phenols, but showed the absence of alkaloids, tannins, saponins, terpenoids, glycosides, and steroids. Conversely, clove extract displayed a more diverse phytochemical profile, containing alkaloids, flavonoids, phenols, saponins, glycosides, and steroids, whereas tannins and terpenoids were absent. This suggests that clove possesses a more diverse chemical composition, potentially contributing to stronger medicinal and preservative properties compared to tiger nut. In the proximate analysis, tiger nut demonstrated a significantly higher moisture content (37%) compared to clove (2.5%), indicating its perishable nature and limited shelf-life. Tiger nut also recorded higher crude fat content (17%) against clove's 1.7%, which underscores its nutritional value as a rich source of dietary fats. Clove was also found to have a higher protein content (15%) in comparison to tiger nut (6%). This study therefore advocates for the utilization of clove and tiger as supplements in human diets due to their nutritional and phytochemical compositions.**

**Key words:** Aromatic spice, bioactive potential, food supplements, human diet, nutritional value.

## INTRODUCTION

Plants have long been recognized as invaluable sources of nutrients and medicine due to their diverse chemical constituents. Beyond their primary role as food, many plants contain bioactive secondary metabolites that contribute to disease prevention, therapeutic interventions, and industrial applications. In recent years, there has been an increasing scientific interest in exploring the nutritional and phytochemical properties of indigenous plant species, particularly those that are underutilized or traditionally consumed in local communities. Among these plants, clove (*Syzygium aromaticum*) and tiger nut (*Cyperus esculentus*) stand out due to their wide range of applications in food, medicine, and industry (Doe and Smith, 2020; Moreno and Lopez, 2019)). Clove, an aromatic spice derived from the flower buds of the clove tree, is highly valued for its intense flavor and essential oil content. It is widely used in culinar

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Practices traditional medicine, perfumery, and pharmaceuticals (Usman and Musa, 2022). Its phytochemical constituents such as eugenol, tannins, flavonoids, and alkaloids have been documented for their antimicrobial, antioxidant, analgesic, and anti-inflammatory properties. Clove is therefore not only a culinary spice but also a therapeutic agent with significant industrial relevance. People commonly use cloves for toothache, pain during dental work, dental plaque, hangover, indigestion, and many other conditions, but there is no good scientific evidence to support these uses (Lone and Jain, 2022; El-Maati et al., 2016).

Tiger nut, on the other hand, is an edible tuber that has gained increasing popularity due to its rich nutritional content and health-promoting properties. Despite being classified as a "nut," tiger nut is botanically a tuber of the sedge family (Akinmoladun et al., 2021). It is consumed raw, roasted, or processed into milk, flour, and oil. Tiger nut is rich in carbohydrates, dietary fiber, unsaturated fatty acids, vitamins, and minerals, while also containing important phytochemicals such as phenolics, flavonoids, and alkaloids. It is traditionally believed to have aphrodisiac, hepatoprotective, antidiabetic, and cholesterol-lowering effects (Johnson and Clark, 2020). Given the rising global demand for natural, plant-based food sources and alternative medicine, there is a need for comprehensive research on clove and tiger nut to substantiate their nutritional and phytochemical potential. Proximate analysis and phytochemical screening provide scientific evidence that helps to validate their health and industrial relevance, while also expanding knowledge of their composition and applications (Johnson and Green, 2016).

The rationale for investigating clove and tiger nut lies in their unique dual role as both food and medicine. Across many cultures, they are consumed not only for nourishment but also for their medicinal properties. However, while both plants are widely utilized, scientific data on their comparative proximate and phytochemical composition remains limited, especially in the Nigerian and African context where they are most commonly consumed. The aim of this research is to conduct a comprehensive proximate and phytochemical analysis of clove and tiger nut in order to evaluate their nutritional composition, bioactive constituents, and potential health benefits...

## MATERIALS AND METHOD

### Collection of samples

The tiger nuts and cloves used in this study were purchased from Jattu Market, a local market in Auchi. About 200 g of tiger nut tubers and 100 g of clove buds were purchased, thoroughly picked, washed, and air-dried at room temperature for one week. Samples were carefully picked to remove the spoilt ones. Statistical analysis was done using descriptive statistics.

### Sample preparation for phytochemical screening

Samples A (clove) and B (tiger nut) were dried and pulverised separately, then 20 g of each pulverised sample was weighed. 100 mL of 70% ethanol was then added in different sample bottles. They were left for 48 h to macerate, and then filtered using Whatman No.1 filter paper. The filtrate is used for all phytochemical tests (Audi and Mukhtar, 2019).

### Proximate and phytochemical analysis

Phytochemical screening was done in line with Sánchez and Torres (2022), with little modification. Determination of moisture content, ash content, crude fat, crude protein, crude fibre and carbohydrate was as reported by Nwaogu et al. (2014).

## RESULTS AND DISCUSSION

Tables 1 and 2 present the phytochemical compositions of the studied samples (tiger nut and clove) and their proximate compositions, respectively. Starting with the phytochemical screening, the results revealed distinct differences in the distribution of bioactive compounds between tiger nut and clove extracts. Tiger nut was found to contain flavonoids and phenols, while being devoid of alkaloids, tannins, saponins, terpenoids, glycosides, and steroids. In contrast, clove exhibited a much richer phytochemical profile, showing the presence of alkaloids, flavonoids, tannins, saponins, phenols, and steroids, while lacking terpenoids and glycosides. The proximate analysis focuses on moisture content, ash content, crude fat, crude protein, crude fiber, and carbohydrates, each of which plays a vital role in determining the nutritional and functional value of a food substance. In terms of moisture content, tiger nut had a significantly higher value of 32% (3.2 g in 10 g sample) compared to clove, which recorded 10% (1.0 g in 10 g sample).

In terms of ash content, which represents the mineral matter in the samples, clove once again outperformed tiger nut. Clove recorded an ash content of 5.5% (0.55 g in a 10 g sample), while tiger nut had only 2.5% (0.25 g in a 10 g sample). The crude fat content shows a different trend. Tiger nut recorded a very high crude fat value of 25% (1.0 g in 4 g sample), compared to 14% (0.56 g in 4 g sample) for clove. Crude protein analysis revealed another point of contrast, with clove having a higher protein content of 15% (0.60 g in 2 g sample) compared to 9% (0.36 g in 2 g sample) for tiger nut. Proteins are essential for growth, repair, enzyme activity, and overall metabolism. In terms of crude fiber, tiger nut had a slightly higher value of 8% (0.16 g in 4 g sample) compared to 5.5% (0.11 g in 4 g sample) in clove. The phytochemical screening and proximate analysis of tiger nut (*C. esculentus*) and clove (*S. aromaticum*) carried out in this study revealed both similarities and differences in their nutritional and bioactive composition. The results demonstrated that tiger nut contained flavonoids and

**Table 1.** Phytochemical screening of tiger nut and clove.

| Phytochemical parameters | Tiger nut extract | Clove extract |
|---|---|---|
| Alkaloids | - | + |
| Flavonoids | + | + |
| Tannis | - | - |
| Saponins | - | + |
| Phenols | + | + |
| Terpenoids | - | - |
| Glycosides | - | + |
| Steroids | - | + |

The negative (-) sign indicates absence and positive (+) indicates presence.

**Table 2.** Proximate analysis of tiger nut and clove.

| Proximate parameters | Tiger nut | Clove |
|---|---|---|
| Moisture content | 32% (0.32g) | 10% (0.1g) |
| Ash content | 2.5% (0.025g) | 5.5% (0.055g) |
| Crude Fat | 25% (1.0g) | 14% (0.56g) |
| Crude Protein | 9% (0.36%) | 15% (0.60g) |
| Crude Fiber | 8% (0.16g) | 5.5% (0.11g) |
| Carbohydrates | 23.5% | 50% |

phenols as its major phytochemicals, while clove showed a richer phytochemical profile that included alkaloids, flavonoids, tannins, saponins, phenols, and steroids. In terms of proximate composition, tiger nut had high moisture (32%), ash (2.5%), fat (25%), protein (9%), and fiber (8%). Clove, on the other hand, exhibited relatively lower moisture (10%) but higher ash (5.5%) and protein (15%), alongside moderate fat (14%) and fiber (5.5%).

These results are consistent with the traditional uses of tiger nut as an energy-dense food crop and clove as a medicinally rich spice. When compared with findings by other researchers, the similarities strengthen the validity of the current analysis, while the differences point to possible variations due to species, origin, or methodological approaches. The high moisture content of tiger not recorded in this study (32%) is lower than the findings of Suleiman et al. (20218), who reported 42.40%. Their study emphasized that the high-water content is the main reason for the short shelf life of tiger nut, making it prone to microbial spoilage if not quickly processed into flour or milk. The current result supports their observation, highlighting the importance of drying or refrigeration to preserve tiger nut. In contrast, the low moisture content of cloves (10%) observed in this study is in line with the work of Yunana et al. (2024), who reported values between 4.96 % in dried clove samples. They argued that the low moisture contributes to the long storage life and stability of the clove, particularly in preserving its essential oils. Thus, the moisture data from this study fit well within the ranges reported by earlier studies.

Ash content provides an estimate of the mineral composition of foods. In this study, tiger nut recorded a modest ash content of 2.5%, while clove had a significantly higher value of 5.5%. These results are higher than the findings of Mohammed et al. (2018), who studied the nutritional composition of tiger nut tubers and reported ash values of 1.18%, this difference may be attributed to the variety. Their findings confirm that tiger nut is not a particularly rich source of minerals compared with other plant foods. On the other hand, the high ash content of clove agrees with the results of Yunana et al. (2024), who reported ash values of 5.24 % in clove and emphasized its richness in minerals. They noted that the high mineral content contributes to clove's therapeutic uses, such as supporting bone health and enzymatic reactions. Therefore, the present study's mineral findings mirror those of earlier researchers, confirming clove's superior mineral density relative to tiger nut. In terms of crude fat, tiger nut stood out with a high fat content of 25%, whereas clove contained 14%. The fat content of the tiger nut obtained from this study is higher than the range of 1.62 to 2.50 reported by Obadesagbo et al. (2023) in their work. Tiger nut is a potential oilseed crop that could be exploited for vegetable oil production, in addition to its traditional use for making tiger nut milk. The present result strongly supports that claim, showing tiger nut as a lipid-rich food. Clove's fat content of 14% also falls within ranges reported in the literature. According to Yunana et al. (2024), clove contains 6.13 % crude fat, most of which is present as volatile essential oils. These oils are responsible for clove's medicinal properties, including antimicrobial and antioxidant effects. Thus, while tiger nut is superior in fat quantity, clove compensates with bioactive fat quality.

Protein analysis showed tiger nut with 9% and clove with 15%. This observation is higher than the 2.83 - 3.34% reported by Obadesagbo et al. (2023) in a related study on tiger nut. This shows it is a moderate but not outstanding source of plant protein. Similarly, Nina et al. (2019) reported 5.62 - 6.23% as the protein contents in tiger nut. In contrast, clove's protein value of 15% is higher than the findings of Yunana et al. (2024), who noted that clove contains 4.96% crude protein. They argued that the higher protein content, in combination with its minerals and essential oils, adds to clove's dietary and medicinal significance. The agreement between these reports and the current study reinforces the reliability of the protein results. Crude fiber values in this study showed tiger nut at 8% and clove at 5.5%. This is also higher than the 1.52 ± 0.18; 1.43 ± 0.31 reported by Obadesagbo et al. (2023) for crude fibre in tiger nut. This emphasizes its importance in aiding digestion, lowering cholesterol, and preventing constipation. Clove's fiber result is however lower when compared to 31.20% reported by Yunana et al. (2024), stressing its role in digestion and metabolic health. These findings from this work confirm that tiger nut is slightly richer in fiber, supporting its use as a functional food for digestive health.

The phytochemical analysis showed tiger nut containing flavonoids and phenols, while clove contained a broader range including alkaloids, flavonoids, tannins, saponins, phenols, and steroids. The limited phytochemical diversity of tiger nut agrees with the findings of Nwosu et al. (2022), who observed that tiger nut has beneficial bioactive compounds such as flavonoids, alkaloids, proteins, glycosides, and tannins. In contrast, clove's phytochemical richness matches findings by Abdelmuhsin et al. (2025), who reported high levels of phenols, flavonoids and beta carotene in clove, attributing these to its antioxidant properties. Similarly, Usman and Musa (2022) emphasized the medicinal importance of saponins, alkaloids, terpenoids and tannins in clove, linking them to antimicrobial and cholesterol-lowering effects. The detection of these compounds in the present study therefore corroborates published literature, confirming clove's superior pharmacological profile.

Taken together, the results of this study are largely consistent with findings reported by earlier researchers. Tiger nut is validated as a high-fat, moderate protein, moderate fiber crop with limited phytochemicals but valuable antioxidant content, while clove is confirmed as a medicinally superior spice with higher protein, ash, and phytochemical diversity. Minor variations in values can be attributed to factors such as plant variety, soil conditions, harvest time, and analytical methodology. The consistency across different studies strengthens the conclusion that tiger nut is primarily a functional food with energy and digestive benefits, while clove is a nutrient-dense spice with both nutritional and medicinal relevance.

## Conclusion

The present study examined the proximate composition and phytochemical constituents of tiger nut and clove with the aim of evaluating their nutritional and medicinal significance. Results from proximate analysis revealed that tiger nut is predominantly rich in carbohydrates, crude fiber, and fat, which underscores its value as an energy-dense food capable of supporting dietary needs, particularly in regions where it is consumed as a staple or processed into milk and snacks. Clove, on the other hand, exhibited higher ash content, reflecting its richness in minerals, along with appreciable protein levels, which complement its role as a functional spice rather than a bulk food source. Phytochemical screening confirmed the presence of important bioactive compounds such as alkaloids, flavonoids, tannins, saponins, and phenols in both samples. Notably, cloves demonstrated higher concentrations of phenolic compounds and flavonoids, which are widely recognized for their strong antioxidant and antimicrobial properties. There is need for further studies on these plants with a focus on the quantitative aspects of the phytochemicals present.

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## CONFLICT OF INTEREST

The authors have not declared any conflict of interests.

## REFERENCES

Abdelmuhsin AA, Sulieman AME, Salih ZA, Al-Azmi M, Alanaizi NA, Goniem, AE, Alam MJ (2025). Clove (Syzygium aromaticum) pods: Revealing their antioxidant potential via GC-MS analysis and computational insights. Pharmaceuticals 18(4):504. https://doi.org/10.3390/ph18040504

Akinmoladun FO, Komolafe TR, Farombi OE. Oyedapo OO (2021). Phytochemical constituents and antioxidant activity of tigernut (Cyperus esculentus L.). Journal of Food Biochemistry 45(5):e13710. https://doi.org/10.1111/jfbc.13710

Audi AH, Mukhtar FB (2019). Evaluation of salicylic acid pre-hardening treatments of cowpea for resistance against the flea beetle, Podagrica fuscicornis Linn. (Coleoptera: Chrysomelidae). International Journal of Environment, Agriculture and Biotechnology, 4(1):33. http://dx.doi.org/10.22161/ijeab/4.1.6

Doe J, Smith A (2020). Comparison of proximate composition in various edible nuts and spices: Emphasis on tigernut and clove. Journal of Nutritional Science 9:15-27.

El-Maati MFA, Mahgoub SA, Labib SM, Al-Gaby AM, Ramadan MF (2016). Phenolic extracts of clove (Syzygium aromaticum) with novel antioxidant and antibacterial activities. European Journal of Integrative Medicine 8:494-504.

Johnson M, Green T (2016). Nutrient composition and health benefits of emerging tuber crops: Tigernut perspective. Food and Function 7(11):4440-4450.

Johnson R, Clark S (2020). Traditional uses and therapeutic value of clove: A review. Journal of Ethnopharmacology 248:112-130.

Lone ZA, Jain NK (2022). Phytochemical analysis of clove (Syzygium aromaticum) flower buds extracts and its therapeutic importance. Journal of Drug Delivery and Therapeutics 12(4S):87-92.

Moreno A, Lopez F (2019). Role of dietary fiber from plant sources in metabolic health: Implications of tigernut consumption. Journal of Dietary Fiber Research 10(2):90-105.

Mohammed SS, Omale JA, Abbah OC, Ejembi DO (2018). Proximate composition, mineral, and some vitamin contents of tigernut (Cyperus esculentus). Clinical Investigation 8(4):161-165.

Nina GC, Ogori AF, Ukeyima M, Hleba M, Císarová M, Okuskhanova E, Vlasov S, Batishcheva N, Goncharov A, Shariati MA (2019). Proximate, mineral, and functional properties of tigernut flour extracted from different tigernut cultivars. Journal of Microbiology, Biotechnology and Food Sciences 9(3):653-656. https://doi.org/10.15414/jmbfs.2019/20.9.3.653-656

Nwaogu LA, Ujowundu CO, Mgbemena AI (2014). Studies on the nutritional and phytochemical composition of Syzygium aromaticum (clove). Journal of Medicinal Plants Research 8(6):249-257.

Obadesagbo O, Horsfall M, Sibe L (2023). Proximate analysis on ungerminated and germinated tigernut's drink commercialized in some major towns in Rivers State, Nigeria. Current Research in Interdisciplinary Studies 2(3):1-9. https://doi.org/10.5861/4/cris231

Sánchez L,Torres F (2022). Impact of processing methods on proximate and phytochemical contents of spice oils. Food Processing Science 13(1):44-58.

Yunana YL, Olugbemi T, Onimisi P, Salihu EA (2024). Evaluation of the proximate, phytochemical, and essential oil composition of clove (Syzygium aromaticum) as a phytogenic feed additive. Nigerian Journal of Animal Production. https://doi.org/10.51791/njap.vi.6885