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Nutritional Prospect of Aphrodisiac Blend from *Cyperus esculentus*, *Phoenix dactylifera*, and *Zingiber officinal* in Modulating Sexual Functions

***Muhammed Maikarfi**
[1]Department of Applied Chemistry, College of Science and Technology, Kaduna Polytechnic, P.M.B. 2021, Kaduna, Nigeria

Damilola Fehintola Daramola
Department of Mathematics and Science Education, College of Technical and Vocational Education, Kaduna Polytechnic, P.M.B. 2021, Kaduna, Nigeria

Adamu Usman Ibrahim
Department of Applied Chemistry, College of Science and Technology, Kaduna Polytechnic, P.M.B. 2021, Kaduna, Nigeria

Abdulazeez Anjorin
Department of Biochemistry, Kwara State University, P.M.B 1530, Malete, Nigeria

*** Corresponding author:**
Muhammed Maikarfi College of Science and Technology, Nigeria. ✉mmuhammed02@kadunapolytechnic.edu.ng

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Abstract

Background of Study: Sexual dysfunction is a multifactorial condition that can be influenced by micronutrient status. In Nigeria, locally prepared beverages are widely consumed as aphrodisiacs to enhance libido, erectile function, sperm quality, and fertility, yet combined formulations remain poorly studied. This study aimed to evaluate the nutritional composition of a powdered beverage blend made from dried tiger nut, date, and ginger in a 50:40:10 ratio, and to examine literature-based evidence on the effects of its components on sexual function.
Aim and Scope of Study: The blend was analyzed for proximate composition, vitamin content, and mineral levels using standard analytical methods. Relevant peer-reviewed studies were also reviewed to identify the biological roles of the blend's components in sexual and reproductive health. Data were analyzed using descriptive statistics, independent t-tests, and one-way ANOVA at $p \leq 0.05$.
Results: Results showed that the beverage was rich in carbohydrates (76.20%), dietary fiber (7.17%), and fat (9.67%), with low moisture content. It contained appreciable levels of essential minerals, including magnesium, zinc, selenium, copper, and manganese, as well as vitamins A, B_6, B_9, B_{12}, and C. Literature evidence indicated that tiger nut, date, and ginger contribute to sexual function through modulation of hormonal activity, gene expression, spermatogenesis, and erectile mechanisms.
Conclusion: In conclusion, the tiger nut–date–ginger beverage possesses a favorable nutrient profile that supports reproductive physiology. While the findings suggest its potential as a nutritional adjunct for improving sexual function, further experimental and clinical studies are needed to validate its efficacy and safety.

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Introduction

Sexual dysfunction commonly refers to persistent difficulty an erection of sufficient quality sufficient for sexual intercourse (Strong *et al.,* 2008). This is a result of a combination of factors including psychological imbalance, chronic diseases, lifestyle amongst others. Its prevalence is high, with estimates suggesting it affects roughly one in four men and over half of women worldwide (Masoudi *et al.,* 2022).

Various plants are widely utilized as aphrodisiacs to address sexual dysfunctions and enhance fertility, offering concomitant nutritional benefits that may contribute to improved sexual performance and libido (Sumalatha *et al.,* 2010). Enhancements in general health, increased blood flow, and the stimulation of anabolic and growth hormones can lead to burst of energy, which may translate into heightened sexual desire, in addition to the plant's direct stimulatory effects (Omolola et al., 2012). These plants contain intrinsic bioactive compounds and other nutrients that contribute to their sexual function–modulating properties (Okigbo *et al.,* 2008).

Diet and nutrition are becoming increasingly recognized for their essential roles in male and female reproductive health. While there is a growing understanding of how macro and micronutrients dietary patterns are important factors in promoting reproductive health, prompting comprehensive investigation of these nutrients, that have a profound influence on human reproductive health (Yilmaz-Akyuz *et al.,* 2019).

Micronutrient malnutrition continues to pose a major public health challenge in Nigeria, despite the widespread consumption of cereals, nuts, fruits, and vegetables. The diverse array of traditional crops not only offers affordable sources of essential micronutrients but also contribute to functional health, with indigenous beverages from these crops commonly consumed as refreshment or part of main meals (Ariyo *et al.,* 2021) and for their nutritional (Corbo *et al.,* 2014) and functional health values (Yilmaz-Akyuz *et al.,* 2019). Many of these are readily available thereby contributing to the efforts at promoting sexual health nutrition.

Functional foods are positioned as viable dietary strategies supporting reproductive and sexual health. A functional aphrodisiac blend composed of tiger nut *(Cyperus esculentus)*, date fruit *(Phoenix dactylifera*), and ginger *(Zingiber officinale)* combines complementary nutrients that may beneficially influence sexual function through food-based mechanisms. Tiger nut is characterized by a high content of dietary fiber, arginine, monounsaturated fatty acids, and phenolic compounds, which have been linked to improved endothelial function and nitric oxide-mediated vasodilation, a central physiological process underlying erectile response (Adejuyitan, 2011). Date fruit contributes rapidly metabolizable carbohydrates, essential minerals, and bioactive flavonoids and sterols, conferring antioxidant capacity and potential modulation of reproductive hormone activity, thereby supporting sexual vitality and sperm quality (El-Hadrami & Al-Khayri, 2012). Ginger, widely recognized as a functional spice, contains gingerols and shogaols that exhibit antioxidant, anti-inflammatory, and circulatory enhancing effects, with experimental evidence demonstrating improvements in testosterone levels, spermatogenesis, and sexual behavior (Banihani, 2018).

Despite extensive ethnobotanical documentation of aphrodisiac plants, a critical research gap remains regarding the scientific evaluation of composite food-based aphrodisiac formulations, particularly those combining commonly consumed indigenous crops. Most existing studies focus on single plant extracts or pharmacological preparations, with limited attention to nutritionally relevant blends, their functional composition, and their potential synergistic effects on sexual function. Furthermore, empirical evidence linking such blends to sexual health outcomes within a functional food's framework is still scarce.

Therefore, the present study aims to evaluate the sexual function-modulating potential of a composite aphrodisiac blend formulated from selected indigenous food crops, with emphasis on its nutritional composition and functional properties. The study is guided by the hypothesis that the synergistic interaction of bioactive compounds and essential nutrients within the blend will positively influence sexual function and related physiological parameters. By addressing this gap, the study seeks to provide scientific evidence supporting the development of culturally acceptable, nutritionally enriched functional foods for the promotion of sexual and reproductive health.

Methodology

Sample Collection and Identification

Tiger nut, date and ginger were randomly bought from Kasuwar baci market, Tudun Wada, Kaduna. It was further identified in the Department of Biology, Kaduna State University, Kaduna with voucher numbers; KASU/B5H/349, KASU/B5H/552 and KASU/B5H/9877 respectively.

Sample Preparation

Fresh tubers of tiger nuts, date fruit and ginger were first sorted to remove extraneous materials, deseeded, washed and rinsed with distilled water. The clean plant samples were then dried and ground to fine powder. Any bad or cracked nuts and seeds that could affect taste and quality were also removed. A blend was prepared by mixing 50 % tiger nut, 40 % date and 10 % ginger totaling 500 g. The resulting powdered blend was stored in an airtight container at room temperature until further analysis.

Chemical Analysis

Proximate Analysis

Proximate composition of the blend including moisture, protein, fat, ash, crude fiber, and carbohydrate content was determined according to the methods described by the Association of Analytical Chemists (AOAC, 2005). All analysis was performed in triplicates.

Moisture Content Determination

Two (2 g) of the sample was placed in a clean, pre-weighed dish and dried in an oven at 105 ^{0}C until a constant weight was obtained. The sample was then cooled in a desiccator and reweighed. The percentage of moisture was calculated as the loss in weight expressed as a percentage of the original sample weight.

Formula: Moisture (%) = $(W_2 - W_3) / (W_2 - W_1) \times 100$

Keys:

W_1 = Weight of empty dish (g)

W_2 = Weight of dish + fresh (wet) sample (g)

W_3 = Weight of dish + dry sample after drying (g)

Ash Content Determination

Five (5 g) of the dried sample was placed in a crucible and incinerated in a muffle furnace at 550 °C until a light grey or white ash was obtained. The crucible was cooled in a desiccator and weighed. The percentage ash content was calculated from the residue remaining after combustion.

Formula: Ash (%) = $(C_3 - C_1) / (C_2 - C_1) \times 100$

Keys:

C_1 = Weight of empty crucible (g)

C_2 = Weight of crucible + sample before ashing (g)

C_3 = Weight of crucible + ash after ashing (g)

Crude Protein Determination (Kjeldahl Method)

The nitrogen content of the sample was determined using the Kjeldahl method. The sample was digested with concentrated sulfuric acid and a catalyst until a clear solution was obtained. The digest was made alkaline, and the released ammonia was distilled and collected in boric acid solution. The distillate was titrated with standard acid to determine the amount of nitrogen present. The crude protein content was calculated by multiplying the nitrogen value by a factor of 6.25.

Formula: Crude Protein (%) = N (%) × 6.25

Keys:

N (%) = Percentage of nitrogen obtained from titration

6.25 = Protein conversion factor (based on 16% nitrogen content)

Crude Fat Determination (Soxhlet Method)

Five (5 g) dried sample was extracted continuously with petroleum ether using the Soxhlet extraction method for about six hours. The solvent was evaporated, and the extracted fat residue was dried to constant weight. The fat content was expressed as a percentage of the original sample weight.

Formula: Crude Fat (%) = $((W_2 - W_1) / W_s) \times 100$

Keys:

W_1 = Weight of empty extraction flask (g)

W_2 = Weight of flask + extracted fat (g)

W_s = Weight of sample used (g)

Crude Fiber Determination

The defatted sample was digested sequentially with dilute acid and dilute alkali to remove soluble materials. The residue was filtered, dried, weighed, and then incinerated at 525 ^{0}C. The loss in weight after ignition represented the crude fiber content (AOAC, 2005).
Formula: Crude Fiber (%) = $(W_2 - W_3) / W_1) \times 100$
Keys:
W_1 = Weight of sample before digestion (g)
W_2 = Weight of dried residue after digestion (g)
W_3 = Weight of residue after ashing (g)

Carbohydrate Content Determination

The carbohydrate content was determined by subtracting the sum of the percentages of moisture, ash, crude protein, crude fat, and crude fiber from 100.
Formula: Carbohydrate (%) = 100 - (Moisture + Ash + Protein + Fat + Fiber)

Micronutrient Analysis

Sample digestion

1g of sample was weighed into 50mls beaker, 2.5ml of hydrochloric acid and 7.5mls of nitric acid aqua regia solution (1:3) was added. The beaker containing the mixture was boiled at temperature range of 100-170OC until precipitate was observed. The precipitate was removed and few drops of water was added. The resulting solution were mixed and filtered, the filtrate was measured and made up to 50mls and then analyzed. Microwave Plasma Atomic Emission Spectrophotometer was used for the mineral analysis.

Vitamins

Vitamin A (Retinol) was extracted with cold ethanol and hexane and quantified spectrophotometrically at 325nm using s standard retinol calibration curve. Vitamin B6 (Pyridoxine), B9 (Folate) and B12 (Cobalamin) were extracted by acid hydrolysis followed by enzymatic digestion and analyzed sing high-performance liquid chromatography (HPLC) equipped with UV detector. Concentrations were determined against appropriate calibration standard. Vitamin C (Ascorbic acid) was determined by titration with 2,6-dichlorophenolindophenol (DCPIP) dye and expressed as mg/100g of sample

Extraction of Modulating Effect of Blend Components on Sexual Functions

To complement the experimental analysis, the modulatory effects of some of the blend components on sexual functions were extracted from published peer-reviewed articles. Data were extracted, synthesized, and summarized in tabular form (Table 3) to further provided scientific support the nutritional relevance of the blend on sexual functions.

Statistical Analysis

Data results obtained from proximate, mineral, and vitamin analysis were analyzed using GraphPad Prism version 8.0 (GraphPad Software, USA). Results were expressed as mean ± SD. Differences between mean values were assessed using one-way analysis of variance (ANOVA) with statistical significance set at $p \leq 0.05$.

Results and Discussion

Table 1: Proximate Composition of the Aphrodisiac Blend

Parameters	Percentage Composition	Standard Deviation
Moisture	1.97	0.21[a]

Crude Protein	3.33	0.61[a]
Fat	9.67	1.30[c]
Ash	1.93	1.12 [a]
Carbohydrate	76.20	1.90[d]
Fibre	7.17	1.10[b]

Data are expressed as mean±SD. Groups bearing different superscript are statistically significantly different.

Table 2: Elemental Concentration in mg/kg Dry Weight of the Aphrodisiac Blend

Elements	Concentrations (mg/g)	Standard Deviation
Mg	74.08	1.60[c]
Se	1.38	0.05[a]
Cu	0.57	0.01[a]
Zn	0.72	0.02[a]
Mn	20.12	0.30[b]

Data are expressed as mean±SD. Groups bearing different superscript are statistically significantly different

Table 3: Vitamin Concentration of the Aphrodisiac Blend

Vitamins	**Concentrations**
Vit A (µg/100g)	85.30±6.23
Vit B_6 (µg/100g)	15.54±0.40
Vit B_9 (µg/100g)	16.17±0.84
Vit B_{12} (µg/100g)	18.56±0.17
Vit C (mg/100g)	130.40±0.88

Data are expressed as mean±SD.

Table 3: Modulating Effect of Aphrodisiac Blend Components on Sexual Functions

Ingredient and Bioactives	Hormonal	Gene Expression	References
Ginger (*Zingiber officinale*): Gingerols Shogaols 6-Gingerol Zingerone	• Increase Luteinizing hormone (LH) secretion • stimulates Leydig cells for testosterone production • Increase serum testosterone levels • Increase testicular cholesterol (steroid precursor) • Increase Nitric Oxide (NO), enhances cGMP signalling and penile smooth muscle relaxation	• Increase *StAR* (Steroidogenic Acute Regulatory protein): cholesterol transport for steroid synthesis • Increase level *P450scc*: catalyses first step in testosterone biosynthesis • Increase *17β-HSD:* converts androstenedione to testosterone • Stimulate Increase in *SOD*, *CAT*, *GPx* antioxidant enzymes in testes	Mohammadi *et al.,* 2019; Kamtchouing *et al.,* 2002; Alida Nihayah *et al.,* 2025
Tiger Nut (*Cyperus esculentus*): Quercetin Vitamin C Vitamin E Zinc Arginine	• Stimulate increase in serum testosterone • increase Follicle-stimulating hormone and Leutinising Hormone secretion • Increase Nitric oxide production from arginine and subsequent improved penile blood flow	• Antioxidants protect steroidogenic enzyme genes from oxidative damage • Zinc acts as cofactor for transcription factors regulating androgen receptor expression	Al Essawe and Almashhadani, 2010; El-Taweel *et al.,* 2015
Date (*Phoenix dactylifera*): Flavonoids Carotenoids Steroidal-compounds Triterpenes	• Increase testosterone levels • Increase LH secretion • Increase spermatogenesis rate via gonadotropic hormone modulation • Phytoestrogens modulate oestrogen receptor activity	• Flavonoids upregulate antioxidant and anti-apoptotic genes in testes • Steroidal compounds may activate *StAR* and *3β-HSD* for androgen synthesis • Polyphenols protect against oxidative sperm DNA damage	Al Za'abi *et al.,* 2022; Bahmanpour *et al.,* 2006; El-Kashlan *et al.,* 2015

Keys: cGMP: Cyclic Guanosin Monophosphate, *17β-HSD: 17β-Hydroxysteroid Dehydrogenase, P450scc: Cytochrome P450 side-chain cleavage enzyme, SOD*: Superoxide Dismutase, *CAT*: Catalase, *GPx: Glutathione Peroxidase, 3β-HSD: 3β-Hydroxysteroid Dehydrogenase, StAR:* Steroidogenic Acute Regulatory protein

Table 1 presents the proximate composition data for the blend, its low moisture content (1.97±0.21%) reflects a characteristic of a typical powdered beverage, translating to high shelf life

and decreased microbial contamination can compromise the safety of the food. Additionally, high moisture content has been associated with reduced shelf life and stability (Akande and Okunola, 2011). The elevated carbohydrate fraction of the blend (76.20±1.90%) provides readily available energy for cellular metabolism, which may also support energy-demanding physiological processes like erectile function. This support similar carbohydrate surge by (Odesanmi, 2012) with 40.84% carbohydrate. The crude protein constitutes 3.33% of the blend and could serve as source of amino acids, such as arginine which is closely associated with the enhancement of activities in many aphrodisiacs by increasing nitric oxide production and subsequent improved penile blood flow (Sumalatha *et al.,* 2010). The bit high fiber constituent of the blend suggests its potential in prevention and management of weight, diabetes and diverticulosis (Borges *et al.,* 2008). Also function as prebiotic, thereby promoting gut microflora and enhance textural quality of the blend (Singla and Chakkaravarthi, 2017; Yilmaz-Akyuz et al., 2019). The ash percentage is a reflection of good rheological properties and the nutritional quality in terms of mineral composition (Schuck *et al.,* 2012). The high fat composition was predicted as a result of high tiger nut percentage composition of the blend formulate (50 %), Tiger nut is naturally rich in fat (25.50%) (Belewu and Abodunrin, 2006). Therefore, the blend fat percentage of (9.67±1.30) supports this claim.

The blend contained high level of magnesium (74.08±1.60 mg/g), a mineral vital for bioenergetics, muscle tone, and vascular function. This high amount may support erectile function by facilitating smooth muscle relaxation through nitric oxide (NO) pathways. Similar associations have been reported by (Veronese et al., 2019), who linked magnesium intake with improved testosterone levels and sexual performance in men. Manganese, also present at appreciable level (20.12±0.30 mg/g), is involved in steroid hormone synthesis and testicular function. Research by (Gupta et al., 2017) indicated that manganese supplementation enhanced libido and spermatogenesis in animal models, which supports the potential role of this blend in reproductive enhancement. Other trace elements such as selenium, zinc, and copper, though present at lower concentrations (1.38±0.05, 0.72±0.02 and 0.57±0.01 mg/g) respectively, are nonetheless critical. Selenium protects spermatozoa from oxidative damage and improves motility, as stated by (Agarwal et al., 2014), who highlighted its role in male fertility. Zinc play a vital role in testosterone biosynthesis and sperm quality, and inadequate intake has been linked with reduced sexual performance (Fallah et al., 2018). Copper, though in trace amounts, participates in antioxidant enzyme systems such as superoxide dismutase, contributing indirectly to reproductive health by reducing oxidative stress (Table 2).

Table 3 reveals the vitamin concentration of the blend. Vitamins plays a crucial synergistic role in modulating sexual functions through improved reproductive hormone regulation, enhanced neurotransmitter balance, vascular support, and antioxidative defence. In this study, Vitamin A was in relatively high amounts (85.30±6.23 µg/100 g). This finding is consistent with its known role in spermatogenesis and steroid hormone regulation. Vitamin A and its derivatives, such as retinoic acid, regulate the expression of genes involved in testicular function and sperm maturation. Sufficient Vitamin A is essential for spermatogenesis and has been correlated with improved sperm motility and sexual behaviour in experimental studies (Sharma et al., 2019). In comparison with the 72.6 µg/100g reported by (Abulude et al., 2021) in an herbal reproductive tonic, the present blend yielded higher concentrations, suggesting enhanced potential for modulating reproductive physiology. The B-complex vitamins identified in the blend also contribute significantly to sexual health. Vitamin B_6 (15.54 µg/100 g) functions as a cofactor in the biosynthesis of neurotransmitters such as serotonin, dopamine, and gamma-aminobutyric acid (GABA), which play critical roles in sexual functions. Vitamin B_9 (16.17 µg/100 g) and Vitamin B_{12} (18.56 µg/100 g) are essential in homocysteine metabolism and methylation reactions. Elevated homocysteine has been linked with endothelial dysfunction and impaired penile vasodilation (Yao et al., 2020). Thus, adequate levels of folate (B_9) and cobalamin (B_{12}) in the present blend may contribute to improved erectile function via endothelial protection and nitric oxide bioavailability. A similar relationship was reported (Selhub and Miller, 2017), who demonstrated that folate and Vitamin B_{12} supplementation improved endothelial responsiveness in men with erectile dysfunction, highlighting the potential synergistic role of these vitamins in maintaining vascular health and sexual function. The blend exhibited a notably high Vitamin C content (130.40 mg/100 g). this antioxidant vitamin is known to counteract

oxidative stress, a major factor in impaired sperm quality and erectile disorders. Its physiological role includes safeguarding sperm DNA, maintaining nitric oxide bioactivity, and supporting testosterone production (Abulude et al., 2021). The concentration in the present study is higher than values reported by (Adewumi et al., 2018) in an herbal fertility enhancer (92.3 mg/100 g), suggesting that the blend under investigation may provide stronger antioxidative support to counteract free radical-mediated impairments of sexual function (Table 3).

Despite these promising implications, several limitations must be acknowledged. First, the study was limited to compositional analysis and did not include in vivo or clinical assessments of sexual function outcomes. While the nutritional and bioactive profiles strongly suggest potential aphrodisiac effects, direct physiological or behavioral evidence is required to substantiate these claims. Second, bioavailability and metabolic interactions of the identified nutrients were not assessed. Nutrient content alone does not necessarily translate into biological efficacy, as absorption and utilization can be influenced by food matrix interactions and individual metabolic variability. Third, the study did not evaluate sensory acceptability or consumer perception, which are critical factors for the successful adoption of functional food products.

Future research should therefore focus on validating the functional effects of the blend through controlled animal studies and human clinical trials, with particular emphasis on erectile function, libido, hormonal profiles, and sperm parameters. Assessing nutrient bioavailability and antioxidant activity in vivo would also strengthen the mechanistic understanding of the blend's aphrodisiac potential. Additionally, optimization of formulation ratios could further enhance functional efficacy while improving sensory qualities such as taste, aroma, and mouthfeel. Incorporating consumer acceptability studies and shelf-life assessments under real storage conditions would facilitate translation from laboratory formulation to market-ready functional beverage products.

Conclusion

This research work has provided comprehensive insight into the nutritional composition of the blend which may explain the basis for its aphroditic and general sexual health usage. The result indicate that the blend possesses the capacity to improve micronutrient status, modulate vascular, hormonal, and anti-oxidant pathways, suggesting its potentiality to translate into superior efficacy in supporting sexual health.

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Authors Contribution

Muhammed M, conceived and designed the study. Anjorin A, collected the research materials. Muhammed M, Ibrahim A,U carried out the laboratory experiments and data collection. Daramola D,F, performed the data analysis and interpretation. Muhammed M, drafted and coordinated its revision. All authors reviewed, the final version of the manuscript before submission.

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