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Phytochemical, Proximate and Mineral Analysis of Leaves and Bulb of *Crinum jagus*

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Abstract

In this study, a phytochemical, proximate, mineral analysis of the leaves and bulb of the plant was carried out using standard procedures, The results show that hexane, ethylacetate and methanol extracts of the leaves and bulb of the plant contain different phytochemicals. The ethyl acetate extract of the bulb (98.340 mgGAE/g sample) had the highest phenolic content. This is followed by the methanol extract of the leaves (71.150 mgGAE/g sample) and bulb (53.950 mgGAE/g sample). The crude protein, ash and crude fibre contents of the leaves are 20.41%, 16.80 %, and 42 %, respectively. These values are higher than those obtained for the bulb which had values of 16.77%, 6.90%, and 31.25 %for crude protein, ash and crude fibre, respectively. The potassium content of the leaves was 877 mg/100 g while a value of 941 mg/100g was obtained for the bulb. The calcium content of the leaves was 268 mg/100 g while that of the bulb was 278 mg/100 g. The magnesium content of the leaves was 315 mg/100 g while a value of 326 mg/100 g was obtained for the bulb. The iron content of the leaves was 18.97 mg/100g while that of the bulb was estimated as 19.27 mg/100g. The zinc contents for the leaves and bulb were 5.67 mg/100 g and 6.25 mg/100 g, respectively. *C. jagus* leaves and bulbs could be potential sources of food.

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Introduction

A significant portion of the global population depends on plants for their healthcare needs for different reasons: they are believed to have fewer side effects than conventional drugs and are more accessible and affordable. Various parts of plants are employed in traditional medicine to treat multiple diseases. Beyond their therapeutic effects, medicinal plants also possess inherent nutritional values. Understanding these plants' nutritional contents helps determine their potential health benefits.

Crinum jagus (J. Thomps.) Dandy (family: Lilliaceae) thrives in tropical and subtropical regions (Sonibare and Gbile, 2008) and features tender perennial bulbs that produce striking tulip-like white flowers. These flowers bloom in clusters during the dry season, emerging atop leafless stalks that can reach up to one meter in height from a clump of elongated, strap-shaped green leaves (Olorode, 1984). The plant is widely utilized as a medicinal plant in different parts of Nigeria for treating memory loss, asthma, pain, constipation, cough, earaches, inflammatory swellings, skin sores, wounds, and boils (Nwaehujor *et al*., 2012; Sonibare and Gbile, 2008; Idu *et al*., 2008; Ogunkunle and Olopade, 2011).The medicinal properties of *C. jagus* are primarily attributed to its rich profile of secondary metabolites, including alkaloids, flavonoids, and saponins. Alkaloids, which are abundant in the bulbs, have been linked to the plant's anticonvulsant (Azikiwe et al., 2012) and antivenomous (Ode and Asuzu, 2006) properties. These compounds are known to interact with the nervous system, explaining their efficacy in treating memory loss, convulsions and venom-induced injuries. Similarly, flavonoids and saponins, known for their anti-inflammatory and antioxidant properties, are likely responsible for the traditional use of the plant in managing conditions such as inflammatory swellings, wounds, and skin sores (Ode et al., 2010).

However, despite the widespread use of *C. jagus*, there is a dearth of detailed studies on it's nutritional and mineral composition. Previous research has largely focused on the plant's pharmacological properties, leaving its nutritional potential underexplored. This gap is particularly significant, as the nutritional value of *C. jagus* could provide insight into its broader applications, including its use as a potential food source or dietary supplement. Given the importance of identifying plants with dual medicinal and nutritional benefits, a comprehensive analysis of both its phytochemical composition and nutritional profile is crucial.This study aims to bridge this gap by conducting phytochemical, proximate, and mineral analyses on the leaves and bulbs of *C. jagus*. By doing so, its suitability and potential not only as a medicinal plant but also as a nutritional resource would be assessed. This study distinguishes itself from previous works by integrating both medicinal and nutritional

perspectives, providing a more holistic understanding of the plant's potential.

Materials and Methods

Sample Collection and Extraction

Fresh leaves and bulb samples of *C.jagus* were collected from the Botanical Gardens of the University of Ibadan. They were authenticated by Mr. Owolabi, a taxonomist working with the Garden. The samples were cut into small pieces and dried under mild sunlight for six weeks. A 1kg portion of both the leaves and bulbs was subjected to sequential extraction using 2.5 liters of hexane, ethyl acetate, and methanol, respectively. Each extraction step was carried out for 72 hours to ensure thorough extraction of the targeted compounds. The selection of these solvents was based on their varying polarity, which allows for the isolation of a broad spectrum of phytochemicals from non-polar to highly polar compounds. Hexane, a non-polar solvent would extract non-polar compounds such as lipids and terpenes from the leaves and bulb samples. Ethyl acetate, a solvent of medium polarity would target moderately polar compounds, including flavonoids and phenolics. Lastly, methanol a polar solvent would extract highly polar compounds such as glycosides, and tannins. The extracts were concentrated to dryness using a rotary evaporator. The percentage yields of the concentrated extracts were calculated.

Phytochemical Screening on Extracts

Phytochemical screening of the extracts was carried out using standard procedures. A brief description of each test is given below:

Test for tannins

Two (2) drops of 5% $FeCl_3$ was added to 1ml of the extract. A dirty green precipitate indicated a positive test (Edeoga*et al*., 2005).

Test for glycosides

Ten (10) ml of 50% H_2SO_4 was added to 1 ml of extract in a test tube, this mixture was heated in boiling water for 5 minutes. 10ml Fehling's solution A and B (5 ml each) were added and boiled. Brick red precipitate indicated a positive test (Joshi *et al*., 2013).

Test for resins

2.5 ml of Copper (II) Sulphate solution was added to 2.5 ml of the extract. The resulting solution was shaken vigorously and allowed to settle. A green colour indicated a positive test (Edeoga*et al*., 2005).

Test for saponins (Frothing test)

Two (2) ml of extract in water was vigorously shaken in a test tube for two minutes. Frothing indicated a positive test (Edeoga*et al*., 2005).

Test for phlobatannins

Five (5) ml of distilled water was added to 5 ml extract solution and boiled with 1%HCl for two minutes. A deep green colour indicated a positive test (Edeoga*et al*., 2005).

Test flavonoids

Two (2) ml of the extract solution was heated and cooled with 10 ml of ethyl acetate in a water bath. The layers were allowed to separate and a colour of ammonia layer (red colouration formed) indicated a positive test (Ekpo and Etim, 2009).

Test for sterols (Salkowski's test)

Two (2) ml of conc. H_2SO_4 was added to 2 ml of extract solution. A red precipitate indicated a steroidal ring (Ayoola *et al*., 2008)

Test for Phenols

Equal volumes of extract solution and $FeCl_3$ were mixed. A deep bluish-green solution confirmed the presence of phenols (Ekpo and Etim, 2009).

Test for carbohydrate (Fehling test)

Five (5) ml of the mixtures of equal volume Fehling's solution A and B were added to 2 ml of the extract in a test tube. The resultant mixture was boiled for two minutes. A brick-red precipitate of copper oxide indicated a positive test (Ekpo and Etim, 2009).

Test for alkaloids

One (1) ml of conc. H_2SO_4 was added to 3 ml of the extract, and then treated with a few drops of Wagner reagent. Reddish-brown precipitate indicated a positive test (Abdullahi and Ibrahim, 2013).

Terpenoid (Salkowski) test

0.2g of the extracted sample was mixed with 2ml of chloroform ($CHCl_3$) and conc. H_2SO_4 (3ml) was carefully added to form a layer. A reddish-brown colouration of the interface was formed to indicate a positive result for the presence of terpenoids (Ayoola *et al*., 2008).

Determination of Total Phenol Content of Leaves and Bulb

To a mixture of 0.1 ml of sample extract (1 mg/ml) or standard and 0.9 ml of distilled water was added 0.2 mlof Folin's reagent. The mixture was vortexed. After 5 min, 1.0 ml of 7% (w/v) Na_2CO_3 solution was added and the solution was further made up to 2.5 ml by adding 0.3 ml distilled water before it was finally incubated for 90 min at room temperature. The absorbance against a reagent blank containing 1 ml of methanol in place of the sample was measured spectrophotometrically at 750 nm. Gallic acid at different concentrations of 0.1, 0.08, 0.06, 0.04 and 0.02 mg/mL was used as the standard (Arvind *et al.*, 2012). The total phenolic content of the extracts was

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expressed as mg gallic acid equivalent per gram of extract (mg GAE/g) as shown below;

C = c x v/m

Where: C = total phenolic compound in gallic acid equivalent (mg GAE/g); c = concentration of gallic acid established from the calibration curve in mg/mL; v = volume of the extract in mL; m = weight of the extract in gram

Proximate and Mineral Analysis of Plants

Proximate analysis (total ash, dry matter, crude fibre, protein and fat contents) was conducted by standard methods of the Association of Official Analytical Chemists (AOAC, 1990). A description of the procedures adopted is given below:

Determination of Moisture Content

A crucible was dried in an oven and cooled in a desiccator. The weight of the crucible was recorded (W_1). 1g of the sample was weighed into the crucible and the weight of the sample and crucible was taken (W_2). The crucible (with the sample) was placed in an oven at 105^0C for about 2-3hrs until a constant weight of the dried sample and crucible was observed. The weight of the dried sample and the crucible was noted (W_3). The % moisture content in the sample was calculated from:

$$\%\ MoistureContent = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Determination of Ash Content

A crucible was dried in an oven and cooled in a desiccator. The weight of the crucible was recorded as W_1. A 2 g portion of the sample was weighed into the crucible and the total weight (sample + crucible) was recorded (as W_2).The crucible was then placed in a muffle furnace and heated to between 500 and 600ºC for 4-5hrs until the sample turned slightly whitish. The weight (of crucible and sample) after ashing is recorded (as W_3). The % ash is calculated from:

$$\%\ Ash = \frac{W_3 - W_1}{W_2 - W_1} \text{ x } 100$$

Determination of Crude Protein Content

The micro Kjeldahl method described by A.O.A.C (1990) was used. A two (2) - gram portion of the sample was mixed with 10ml of concentrated H_2SO_4 in a heating tube. One tablet of selenium catalyst was added to the tube and the mixture was heated inside a fume cupboard. The digest was transferred into distilled water. A ten (10) millimetre portion of the digest was mixed with an equal volume of 45% NaOH solution and poured into a Kjeldahl distillation apparatus. The mixture was distilled and the distillate collected into a 4% boric acid solution containing 3 drops of methyl red indicator. A total of 50 ml distillate was collected and titrated as well. The sample was duplicated and the average value was taken. The Nitrogen content was calculated and multiplied by 6.25 to obtain the crude protein content.

The percentage of Nitrogen is given as:

$$\%\ Nitrogen = \frac{(100 \times N \times 14 \times VF)T}{100 \times V_a}$$

Where:N= Normality of the titrate (0.1N); VF= Total volume of the digest= 100ml; T= Titre Value; Va= Aliquot Volume distilled

Determination of Fat Content

0.5g of the sample was weighed into Whatman filter papers. The sample was held tightly inside a soxhlet extractor. The weight of a 250 ml round bottom flask was determined (W_1). Petroleum ether (40- 60^0C b.p) was added up to about two-thirds of the volume of the flask and the weight (flask + petroleum ether) was measured (as W_2). The set-up was allowed to boil on the heating mantle for between 4-6hrs.The petroleum ether siphoned over the barrel and the condenser was detached. The weight of the flask after extraction was taken (as W_3).

$$\%\ Fat = \frac{W_3 - W_2}{W_2 - W_1} \text{ x } 100$$

Determination of Crude Fibre Content

0.4 g of the defatted sample was placed in a pre-weighed conical flask. 25 ml of dilute Sulphuric acid was added and allowed to boil for 30 mins. It was filtered through the filter paper and the residue was collected into a conical flask. A 100 ml solution of dilute sodium hydroxide was added to the residue and allowed to boil for 30 minutes. The mixture was passed through a filter paper, washed with hot distilled water, rinsed four times with distilled water and once with 10% HCl, rinsed again with hot distilled water, twice with ethanol, and three times with petroleum ether. When the water drained off, the residue was placed inside a pre-weighed crucible. The weight was recorded (as W_1). The sample was then dried inside an oven at 105^0C until a constant weight was achieved. The sample was placed in a desiccator, and the weight was taken as (W_2). The sample was then, placed inside a muffle furnace at about 300-400^0C for 1hr. The crucible containing the residue was allowed to cool and the weight was taken as (W_3).

$$\%\ CrudeFibre = \frac{W_2 - W_3}{W_1} \text{ x } 100$$

Determination of Carbohydrate Content

The carbohydrate content was determined by difference by subtracting the *measured* protein, fat, ash, and water from the total weight.

Mineral Analysis of the Leaves and Bulb of *C. jagus*

Eleven (11) grams of a portion of each of the samples were weighed and placed in a crucible. They were then

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ashed in the muffle furnace at 550ºC for 3 hours and cooled in a desiccator. The resulting white ash was subsequently dissolved in 5 ml of 20% v/v HCl solution heating gently for 30 min. The clear solution was filtered and diluted to a concentration suitable for the working range of the instrument. The mineral analysis of samples was done using an Atomic Absorption Spectrophotometer (Akintelu and Amoo, 2016).

Results

Table 1 shows the percentage yield of hexane, ethyl acetate and methanol extracts obtained for the leaves and bulb samples of *C.jagus*. The results show that the leaves and bulbs of *C.jagus*are very rich in polar compounds.

Table 1: Percentage Yield of Extracts

EXTRACT	Yield (%) w/w
CJBHE	0.28
CJBEE	0.44
CJBME	24.68
CJLHE	0.92
CJLEE	1.20
CJLME	25.20

CJBHE – *C. jagus* Bulb Hexane Extract; CJBEE – *C. jagus* Bulb Ethyl acetate extract;
CJBME-*C. jagus* Bulb Methanol Extract; CJLHE - *C. jagus* Leaves Hexane Extract
CJLEE - *C. jagus* Bulb Ethyl acetate Extract; CJLME - *C. jagus* Bulb Methanol Extract

The results of the phytochemical screening of the extracts are shown in Table 2. It can be observed that there are differences obtainable in the type of phytoconstituents present in the extracts from the leaves and bulb of *C.jagus*. For example, the hexane extract of the bulbs contains saponins, flavonoids, alkaloids, and phenols whereas the hexane extract of the leaves contains tannins, resins, saponins, alkaloids and terpenoids. The ethyl acetate extracts of the leaves and bulb have many constituents belonging to the same class: both extracts contain tannin, resin, saponin, phlobatannins, flavonoids, steroids, phenols and alkaloids. Similarly, while the methanol extract of the bulb contains tannins, resin, sterols, phenols, alkaloids, and terpenoids; the methanol extract of the leaves contains tannins, glycosides, saponins, flavonoids, carbohydrates, alkaloids and terpenoids.

Table 2: Phytoconstituents of Extracts

TESTS	CJBHE	CJBEE	CJBME	CJLHE	CJLEE	CJLME
Tannins	-	+	+	+	+	+
Glycosides	-	-	-	-	-	+
Resin	-	+	+	+	+	-
Saponins	+	+	-	+	+	+
Phlobatannins	-	+	-	-	+	-
Flavonoids	+	+	-	-	+	+
Sterols	-	+	+	-	+	-
Phenols	+	+	+	-	+	-
Carbohydrates	-	-	-	-	-	+
Alkaloids	+	+	+	+	+	+
Terpenoids	-	-	+	+	-	+

CJBHE – *C. jagus* Bulb Hexane Extract; CJBEE – *C.jagus* Bulb Ethyl acetate extract;
CJBME-*C .jagus* Bulb Methanol Extract; CJLHE - *C.jagus* Leaves Hexane Extract;
CJLEE - *C. jagus* Bulb Ethyl acetate Extract; CJLME - *C.jagus* Bulb Methanol Extract; + = Present; - = Absent

The total phenolic content was determined as the Gallic acid equivalence/gram of sample. The total phenol contents of the extracts are shown in Table 3. The highest phenolic contents were obtained for the ethyl acetate extract of the bulb of *C. jagus* (98.340 mg GAE/g), and the methanol extract of the leaves of *C. jagus* (71.150 mg GAE/g).All measurements were made in triplicates.

Table 3: Total Phenol Content of Extracts

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EXTRACT	AVERAGE Mg GAE/g Sample	SD	SEM
CJLHE	34.890	3.100	1.790
CJLEE	44.420	1.360	0.788
CJLME	71.150	9.700	5.598
CJBHE	33.230	3.060	1.767
CJBEE	98.340	7.890	4.531
CJBME	53.950	8.320	4.803

CJBHE – *C. jagus* Bulb Hexane Extract; CJBEE – *C.jagus* Bulb Ethyl acetate extract;
CJBME-*C.jagus* Bulb Methanol Extract; CJLHE - *C.jagus* Leaves Hexane Extract;
CJLEE - *C.jagus*Bulb Ethyl acetate Extract; CJLME - *C.jagus* Bulb Methanol Extract; SD- Standard Deviation, SEM-Standard Error of the Mean

The results of the proximate and mineral analysis on the leaves and bulb of the plant are shown in Table 4. Measurements are taken in duplicates and errors are reported as standard deviations.The leaves and bulb of *C. jagus* have high fibre contents, 42% and 31.25% respectively. Both plant parts have reasonably high crude protein content (20.41% for the leaves and 16.77% for the bulb). The bulb (44.57%) had higher carbohydrate content than the leaves (19.19 %). The leaves (0.01 %) and the bulb (0.04%) had low crude fat content. The ash content of the leaves (16.80%) is higher than that of the bulb (6.90%). The results of the mineral analysis of the samples show that they are rich in potassium, calcium, magnesium and iron. However, the copper and zinc contents in the leaves and the bulbs were low.

Table 4: Proximate and Mineral Analysis of Leaves and Bulb of *C.jagus*

Compositions	CJL	CJB
Moisture (%)	1.59 ± 0.01	0.47 ± 0.01
Crude protein (%)	20.41 ± 0.02	16.77 ± 0.01
Ash (%)	16.80 ± 0.02	6.90 ± 0.03
Crude Fibre (%)	42.00 ± 0.01	31.25 ± 0.02
Crude Fat(%)	0.01 ± 0.00	0.04 ± 0.00
Carbohydrate (%)	19.19 ± 0.00	44.57 ± 0.01
K (mg/100 g)	877.00 ± 0.10	941.00 ± 0.20
Ca(mg/100 g)	268.00 ± 0.10	278.00 ± 0.02
Mg (mg/100 g)	315.00 ± 0.12	326.00 ± 0.10
Fe (mg/100g)	18.97 ± 0.02	19.27 ± 0.10
Cu (mg/100g)	0.60 ± 0.00	0.67 ± 0.01
Zn (mg/100g)	5.67 ± 0.02	6.25 ± 0.02

*Values are in duplicate determinations; CJL- *C.jagus*Leaves; CJT- *C.jagus*Bulb

Discussion

The percentage yields of the extracts are presented in Table 1. The leaves and bulbs of the plant were extracted using solvents of varying polarity: hexane (the least polar), ethyl acetate (of medium polarity) and methanol (a polar solvent). Expectedly, the phytoconstituents in the leaves and bulb samples would be distributed across the three extracts according to their polarities.

The phytoconstituents in the hexane, ethylacetate and methanol extracts are shown in Table 2. Phytoconstituents are known to possess a broad range of health benefits. For example, a high saponins diet can be used in the inhibition of dental caries, and platelet aggregation, as an antidote against acute lead poisoning, and treatment of hypercalciuria in humans. It is also known to reduce blood lipids, lower cancer risks and lower blood glucose response (Shi *et al*., 2004). Saponins are known anti-nutritional phytochemicals that have been known to reduce the uptake of nutrients including cholesterol and glucose in the gut suggesting possible uses in the treatment of diabetes and cardiovascular-related diseases. Flavonoids are associated with reduced risk of several chronic diseases, including cancer, cardiovascular disease (CVD) and neurodegenerative disorders. The growing body of scientific evidence indicates that flavonoids play a beneficial role in disease prevention (Kozłowska and Szostak-Wegierek, 2014). Tannins have also been reported to exert other physiological effects, such as accelerating blood clotting, reducing blood pressure, decreasing the serum lipid level,

producing liver necrosis, and modulating immune responses (Chung *et al*., 1998). Alkaloids have been known to exhibit muscle relaxant, antioxidant, anticancer, antimicrobial and amoebicidal activities (Ujwala *et al*., 2012; Tiong *et al*., 2013).

Some phytoconstituents previously isolated fromthe bulbs of *C. jagus* possess a broad spectrum of biological activities. For example, crinamine, an alkaloid, showed very good activity against *Staphylococcus aureus* and *Bacillus subtilis*. Lycorine, showed antimicrobial activity against *Bacillus subtilis* and *Pseudomonas aeruginosa*. Crinamine and lycorine demonstrated anticancer activities against several cancer cell lines (Likhitwitayawuid *et al.* , 1993). Galanthamine, an alkaloid isolated from the bulb of the plant, exhibited reversible muscarinic and anticholinesterase activities and can be used for the treatment of nervous diseases, neurological injuries, schizophrenia, as well as Alzheimer's disease (Harvey, 1995). Lycorine and hamayne previously isolated from the bulb of the plant can antagonize Alzheimer's progression (Kwon *et al*., 2011). 4'-hydroxy-7-methoxyflavan showed important cytotoxic activities against human leukaemic Molt 4 cells (Abd El-Hafiz*et al.*, 1991). Isoliquiritigenin, a flavonoid reported in the bulb, inhibited cell proliferation and induced apoptotic cell death in human hepatoma cells (HepG2) (Hsu *et al*., 2005). Haemanthidine and lycorine possess analgesic and anti-inflammatory properties.

Table 3 shows the phenolic contents of the different extracts of the leaves and bulbs of *C.jagus*. Phenolic compounds are widely distributed in different plant parts including vegetables, fruits, spices, grains, legumes, and nuts. They play key roles in different physiological processes in plants such as colouring, flavour, and stress resistance. Phenolic compounds exert various effects including antimicrobial (Karunakaran *et al*., 2016), antioxidant (Martins *et al*., 2016), anticarcinogenic (Miller *et al*., 2019), anti-inflammatory (Boo, 2019) and prevention of cardiovascular diseases, cancers, diabetes, and diseases associated with oxidative stress (Yasir *et al*.,2016).

The results for the proximate and mineral analysis of the leaves and bulb of the plant are shown in Table 4. The crude protein content (16.77%) of *C. jagus* bulbs is higher than that of *C. ornatum* (4.04%), *C. zeylanicum* (3.19%) (Daben et al., 2017) and garlic bulb (7.87%) (Odebunmi *et al*., 2010). The high crude protein content of *C. jagus* bulbs (16.77%) makes it a valuable dietary addition for individuals seeking to prevent or slow down the loss of muscle mass and strength, particularly in aging populations. Protein is essential for muscle repair, immune function, and maintaining overall health. Incorporating *C. jagus* bulbs into a balanced diet could support muscle health and recovery, especially for those at risk of sarcopenia or engaging in physical activity (Hayes, 2020). The crude fibre content of *C. jagus* bulb (31.25%) is higher than that of *C.zeylanicum* (26.55%), *C. ornatum* (2.67%), and garlic (2.43%) (Hussain et al., 2010). The high crude fiber content of *C. jagus* bulbs (31.25%) is particularly beneficial for digestive health. Dietary fiber enhances gut motility, prevents constipation, and promotes healthy bowel function. Its ability to improve glycaemic control and reduce blood lipid levels could also aid in managing conditions like obesity and type 2 diabetes, as well as improving overall metabolic health (Russell et al., 2016). Including *C. jagus* in a diet could support weight management by increasing satiety and reducing the frequency of food intake. The carbohydrate content of *C. jagus* bulb (44.57 %) is lesser than that of *C. ornatum* (87.96%) (Lawal and Dangoggo, 2014), garlic (73.22%) and onion (76.71%) (Nwinuka *et al*., 2005). Carbohydrates are the body's main source of energy, providing the fuel for the brain, kidneys, heart muscles, and central nervous system.The relatively low crude fat content of *C. jagus* is beneficial for cardiovascular health, as diets low in saturated fat are associated with reduced risks of hypercholesterolemia and cardiovascular diseases (Kiin-Kabari *et al.*, 2017). A diet providing 1-2 % of its caloric energy as fat is sufficient for human beings (Antia *et al.*, 2006).

The ash content for the bulb of *C. jagus* (6.90 %) is higher than that reported for *C. ornatum* (4.67%) and onion bulbs (0.70%) (Odebunmi *et al.*, 2007) but comparable to that of *C. zeylanicum* (6.26%) (Lawal and Dangoggo, 2014; Daben *et al*., 2017). The ash content is a measure of the mineral content of a sample. The mineral analysis of *C. jagus* leaves and bulbs revealed significant concentrations of essential nutrients, including potassium (K), calcium (Ca), magnesium (Mg), iron (Fe), copper (Cu), and zinc (Zn), all of which are vital for human health. Compared to the daily recommended intakes (DRIs) for adult males (NIN, 2009), the plant demonstrates substantial nutritional value. The potassium content in the leaves (877 mg/100g) and bulbs (941 mg/100g) provides approximately 23-25% of the recommended daily intake (3800 mg). Potassium is needed for fluid balance and regulation of nerve impulse conduction, regular heart beat and cell metabolism (Fagbuaro *et al*., 2006). Similarly, the calcium content (268 mg/100g in leaves and 278 mg/100g in bulbs) supplies around 45-46% of the daily requirement (600 mg). Calcium, alongside other microminerals, contributes to bone formation, blood clotting, some metabolic processes and muscle contraction (Abulude *et al*.,

2006). The magnesium content (315 mg/100g in leaves and 326 mg/100g in bulbs) fulfills approximately 93-96% of the daily requirement (340 mg). Magnesium, as a micronutrient, is needed for the health of the nervous system (Mottonen and Uhari, 1997). Notably, both the leaves and bulbs are rich in iron, providing over 100% of the daily requirement (17 mg). Iron is essential for red blood formation. Iron is the most essential and abundant element within the haemoglobin molecule which transports oxygen around the body and plays an important role in a great number of cellular reactions within living organisms (Falodun *et al*., 2010). The rich iron content of *C. jagus* (18.97–19.27 mg/100g) makes it an excellent source for individuals at risk of iron deficiency anemia, such as women of reproductive age or those with dietary restrictions. The copper content (0.60 mg/100g in leaves and 0.67 mg/100g in bulbs) meets around 33-34% of the daily requirement (2 mg). Copper is an essential cofactor for forming proteins such as cuproprotein (Hurrell, 2003). The zinc content (5.67 mg/100g in leaves and 6.25 mg/100g in bulbs) contributes 47-52% of the recommended intake (12 mg). Zinc is an antioxidant enzyme, a cofactor for superoxide dismutase (SOD) distributed in cells all over the body where they function as the body's defensive (immune) system. Zinc is also needed for the growth and development of cells. Incorporating the plant into the diet could strengthen the immune system and aid in recovery from illnesses or injuries (Hurrell, 2003).

Conclusion

The results show that the leaves and bulbs of the plant contain many phytochemicals. Both plant parts are rich in phenolic contents. *C. jagus* shows potential as a functional food due to its diverse nutritional profile. Its high fiber content makes it suitable for promoting digestive health, while its protein, iron, and essential mineral content supports muscle maintenance, cardiovascular health, and immune function. Incorporation of *C. jagus* in meals or as a dietary supplement could provide significant health benefits, particularly for those with specific nutritional needs. However,toxicological studies are necessary to ensure its safety for long-term consumption. Also, further studies aimed at isolating and characterizing the compounds responsible for the plant's medicinal properties should be carried out.Clinical trials are also needed to evaluate its efficacy in promoting health and preventing diseases.

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