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# NUTRITIONAL EVALUATION AND FUNCTIONAL PROPERTIES OF Cassia alata FLOWER

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**ABSTRACT**
Medicinal plant is a part of plant or the whole plant that possesses healing properties. It's of utmost importance in many areas of life. Cassia alata belongs to this class of plants. The present study was carried out to evaluate the mineral elements, proximate, vitamins, phytochemical compositions and infra-red spectra of the flower of Cassia alata plant. The analyses were carried out using standard analytical techniques. The proximate analysis (%) showed that the flower contained ash (7.060±0.082), moisture (8.489 ±0.151), crude fat (12.319 ± 0.292), crude fibre (16.055 ±0.756), protein (10.447±0.06) and carbohydrate (45.630± 0.120). Elemental analysis (ppm) showed the presence of zinc (0.719 ±0.006), copper (0.071 ±0.002), nickel (0.0064 ±0.001) manganese (0.059±0.001) and iron (0.061 ±0.002) in moderate quantity with magnesium (26.577 ±0.005) and calcium (37.302 ± 0.020) while phosphorus (106.400 ± 0.001) was found in large amount. The result from the vitamin analysis (mg/g) revealed vitamin C to be the most abundant vitamin with (37.853±0.039mg/g) while the composition of vitamin B1 was (0.244±0.002mg/g) and vitamin B2 (0.473±0.0009mg/g). Phytochemicals (mg/g) were detected; phenols (14.319±0.064), saponins (14.692±0.653), flavonoids (13.940±0.017) and tannins (1.247±0.050). Also, Infra-red characterization of the flower part of the plant indicated some functional properties which are of medicinal benefits to man and animals. This study proposes that the flower of Cassia alata can serve as good source of nutrients and with potentials as therapeutics.

**Keywords**: Cassia alata, Infra red characterization, therapeutic, medicinal plant, nutrients

## INTRODUCTION

*Cassia alata* is one of the many flowering plants that serve medicinal purposes. It is sometimes called Christmas candle, or candle tree. It has an average height of about five metres with widely separated branches. It has feather-like leaves of 50 cm long and comprising of 20 pairs of leaflets. *Casia alata* is a genus in the leguminosae family which is notable specie of Senna (Nicolson, 1991). It has some unique properties that gives it a characteristic colour and odour which differentiates it from other plants. This property also gives the plants flavour thereby making it a useful seasoning in food and also medically useful. Plants generally have large proportions of aromatic compound which consists of phenols and their derivatives with oxygen substitution (Akapulko, 2018). Over the years, nature has served as a useful source for medicinal compounds with a good amount of drugs being procured from different sources, most of which function as traditional medicine. (Maya and Agrawal, 2012).

Plants possess a great deal of medicinal properties that have not been fully exploited. This has brought about much and constant interest in traditional medicine and pharmacology, as they can synthesize chemical compounds which are used in primary health care for remedial purposes (Usha and Bopaiah, 2012). Plant parts such as roots, leaves and stems have been widely used in the treatment and curing of illness and diseases. Traditional medicinal plants are also used in alternative medicines by allopathic doctors as modern medicines are costly and may have severe side effects.

Cassia species are very common in India and other countries with hot humid climate (Maya and Agrawal, 2012). It is of a very high demand in Indian medicine system due to the various medical properties attached to it. Being a genus, Cassia consists of several species of trees and herbs, many of which are concentrated in India alone though it is scattered around the world.

*Cassia* species are of great benefits and economic importance as they are good raw materials in medicine. (Ganapaty *et al.*, 2002).

The objective of this research work is to access the medicinal properties of the flower of *Casia alata.*

## MATERIALS AND METHODS

### Sample Collection and Preparation

Fresh samples of *Cassia* flower was collected from a farm land at Egbedore Local Government area of Osun State, Nigeria. The sample was air-dried at room temperature. After drying, the sample was grounded with laboratory pestle and mortal and then sieved into a powdery form. The powdered sample was stored in an air tight container awaiting analyses.

### Aqueous extraction

Dissolving 100 g of the powdered sample in 200 ml of distilled water, an aqueous extract was obtained, which was later separated with whatman filter paper.

### Phytochemical analysis

In order to determine the components of the aqueous extracts and powdered specimens, various tests were performed according to the method of Sofowara (1993), Trease and Evans (1989) and Harborne (1973).

### Determination of vitamin C (Ascorbic acid)

The sample (0.5 g) was measured, heated with 10 ml of 0.4% oxalic acid in a test tube for 10 minutes, centrifuged for 5 minutes and the solution filtered. 1 ml of the filtrate was

transferred into a dry test tube in duplicates, 9 ml of 2.6 dichlorophenol was added and absorbance was taken at 15 seconds and 30 seconds interval at 520 nm (AOAC, 1990).

**Determination of Vitamin $B_1$ and $B_2$**

These vitamins were determined by spectrophotometric method as described in AOAC (2000).

**Fourier Transform Infra–Red Spectroscopy Analysis (FTIR)**

Dried powdered sample (300 g) of *Cassia alata* flower was placed in 500ml beaker and 250ml of methanol was added to the sample. It was covered with an aluminum foil for 48 hours in the laboratory. After 48 hours, it was filtered; the residue in form of paste was extracted from the diluted samples. The paste form the residue extracted was then analyzed using Fourier Transform Infrared (FTIR) Spectrometer (Perkins,1986).

**The proximate and mineral analyses**

These were carried out according to the method described by the Association of Official Analytical Chemist (1990)

## RESULTS AND DISCUSSION

**Table 1: Mineral analysis of *Cassia alata* flower (ppm)**

| Parameters | Compositions |
|---|---|
| Calcium | 37.302±0.020 |
| Magnesium | 26.577±0.005 |
| Zinc | 0.719±0.006 |
| Copper | 0.071±0.002 |
| Nickel | 0.064±0.001 |
| Manganese | 0.059±0.001 |
| Iron | 0.061±0.002 |
| Phosphorous | 106.400±0.001 |

**Table 2: Proximate analysis of *Cassia alata* flower (%)**

| Parameters | Compositions |
|---|---|
| Ash content | 7.060±0.082 |
| Moisture content | 8.489±0.151 |
| Crude fat content | 12.319±0.202 |
| Crude fibre content | 16.055±0.756 |
| Protein content | 10.447±.061 |
| Carbohydrate content | 45.630±0.120 |

**Table 3:Vitamins analysis *Cassia alata* flower**

| Parameters | Compositions |
|---|---|
| Vitamin $B_1$ (mg/g) | 0.244±0.002 |
| Vitamin $B_2$ (mg/g) | 0.473±0.009 |
| Vitamin C (mg/100g) | 37.853±0.039 |

**Table 4:Qualitative phytochemical analysis of *Cassia alata* flower**

| Parameters | Constituents |
|---|---|
| Tannins | +ve |
| Phenols | +ve |
| Alkaloids | -ve |
| Flavonoids | +ve |
| Terpenoids | -ve |
| Saponins | +ve |
| Steroids | -ve |

+ve= presence of constituents, -ve= absence of constituents

**Table 5:Quantitative phytochemical analysis of *Cassia alata* flower**

| Parameters | Compositions |
|---|---|
| Total phenols (%) | 14.319±0.064 |
| Saponins (%) | 14.692±0.653 |
| Flavonoids (%) | 13.940±0.017 |
| | |
| Tannins (mg/g) | 1.247±0.050 |

**Table 6: Infra Red Spectra Interpretation table**

| Wave number ($cm^{-1}$) | Status | Assignment | Functional group | Range |
|---|---|---|---|---|
| 3278.2 | Strong broad | O-H Stretching | Carboxylic acid | 3300-2500 |
| 2974.4 | Medium | C-H Stretching | Alkane | 3000-2840 |
| 2928.0 | Medium | C-H Stretching | Alkane | 3000-2840 |
| 1625.1 | Medium | C=C Stretching | Cyclic Alkene | 1650-1566 |
| 1541.3 | Strong | N-H Stretching | Nitro compound | 1550-1500 |
| 1377.3 | Medium | O-H Stretching | Phenol | - |

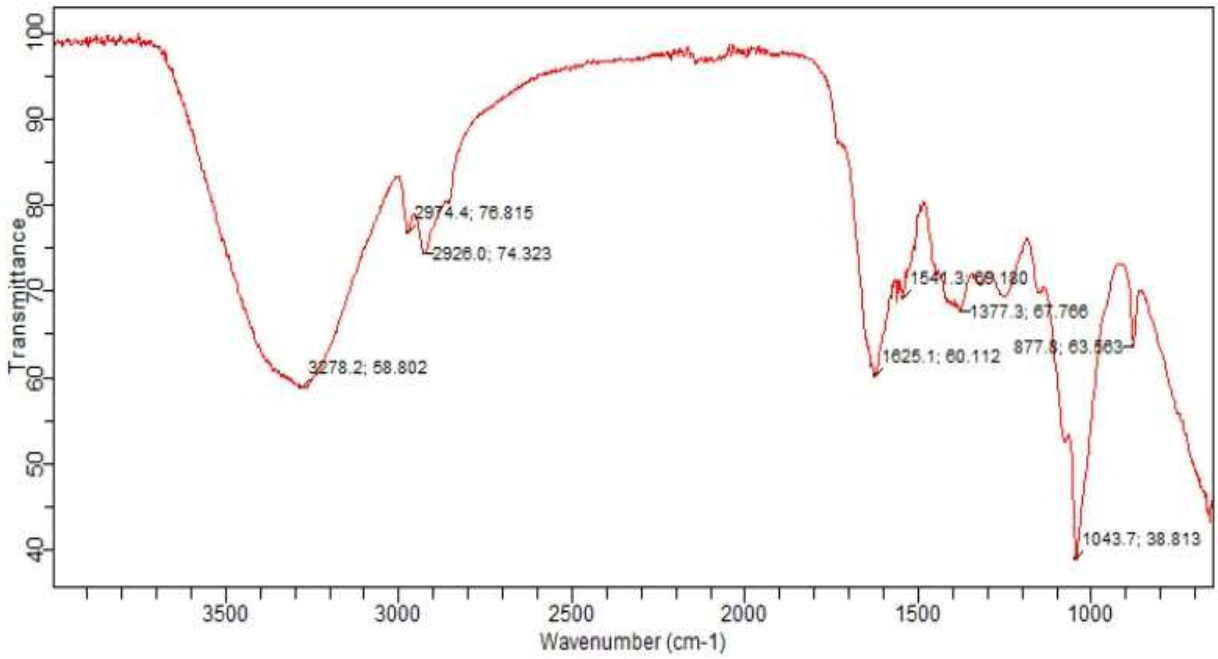


Fig 1: Infra Red Spectra of *Cassia alata* flower

**DISCUSSION**

Plant products play a great significant role in meeting the nutritional and therapeutic needs of man and animal. This has attracted a sense of concern in search of plants materials which could meet these needs. In view of this, table 1 revealed the mineral elements (ppm) of the flower of *Cassia alata*. Macro and micro elements of the sample were revealed such as calcium (37.302±0.020), magnesium (26.577±0.005), zinc (0.719±0.006), copper (0.071±0.002), nickel (0.064±0.001), manganese (0.059±0.001), iron (0.061±0.002) and phosphorus (106.400±0.001). Calcium ions plays an important physiological and biochemical role which include neuromuscular excitably and secretary processes (Sanmi, 2007). Proper extracellular fluid and periosteal concentration of calcium and phosphate ions are required for bone mineralization (Robert *et al.*, 2000).

The results of the sample for iron, zinc and manganese were compared with the results obtained for *Acalypha wikesiana* leaf (9.6728, 1.9787 and 0.0825mg/l) respectively. Iron, zinc and manganese were essential for several enzyme reactions as co-factors (Robert *et al.*, 2000).

Table 2 revealed the result of proximate analysis of the flower of *Cassia alata*. It showed that the flower of *Cassia alata* plant was rich in carbohydrate (45.630±0.120%). The carbohydrate content was comparable with that of *Cucumis metuliferus* seeds (50.24± 0.03%) as reported by (Cosmas *et al.*, 2020).

The fibre content of *Cassia alata* flower was found to be (16.055±0.756%) which was lower than the reported value for *Cucumis metuliferus* (19.23%). Fibre helps in digestion of food in the body and thereby reduces constipation (Erhirhie *et al.*, 2013).

The crude fibre content in this analysis showed that *Cassia alata* flower has the ability to maintain internal distension for a normal peristaltic movement of the intestinal track which is one of the major physiological roles that crude fibre plays in the living system (Onyegeme-Okerenta *et al.*, 2017).

The fat content was (12.319±0.202%) which is lower when compared with *Citrullus lanatus* (49.05%) as reported by (Jacob *et al.*, 2005). The value of fat for the analyzed sample indicated that it is not rich in oil. However, it could provide the body with enough amounts of energy and aid in various metabolic processes such as absorption of vitamins.

This study also showed the moisture content of the sample *Cassia alata* flowers to be (8.489±0.151%). Moisture is the amount of water that is contained in a material. The moisture content of the flower of *Cassia alata* plant is comparable with that of *Cucumis sativus* seeds (12.3%) as reported by (Jacob *et al.*, 2005). The moisture content of *Cassia alata* flower showed that the flower has a comparatively high shelf life and could be preserved for a long period without been susceptible to microbial attack (Cosmas *et al.*,2020).

The ash content of *Cassia alata* flower as shown in table 2 (7.060±0.082%) was higher than that of *Cucumis metuliferus* (5.23±0.18%) as reported by (Cosmas *et al.*, 2020 ) in comparison. Ash is an index of mineral content of material. The ash content of the powdered flower of *Cassia alata* is relatively high and this value showed the percentage in the flower of *Cassia alata*. The study also shown high level of mineral elements in food, increases growth and development and also catalyzes metabolic processes in human body (Jacob *et al.*, 2005). The crude protein obtained for this analysis was (10.447±0.61%) which is high when compared with value obtained for *Cucumis metuliferus* (2.63±0.06%) as reported by (Cosmas *et al.*, 2020). The result obtained for *Cassia alata* flowers also shown that the flower is a good source of protein.

Table 3 shows the results obtained from vitamin analysis. Vitamins are micronutrients which play a vital role in the body system. Vitamin C was the most abundant with a percentage of (37.853±0.039mg/100g) among the vitamins analyzed with value of vitamin $B_1$ to be (0.244±0.002mg/g) and $B_2$ (0.473±0.009mg/g). Vitamin C is necessary for the growth, development and repair of all body tissues. It is involved in many body functions, including formation of collagen, absorption of iron. The proper functioning of the immune system, healing of wound and the maintenance of cartilage, bones and teeth among others, are very crucial in the functions of vitamin C. (Button, 2004).

Vitamin $B_1$ and $B_2$, which form part of the B-complex vitamins, are involved in macronutrient metabolism acting as co-enzymes. Vitamin $B_1$ is known as anti-beriberi. Vitamin $B_2$ aids in the manufacturing of red blood cells, and also

necessary for growth, healthy body, skin, eyes and nervous system (Lukaski, 2004).

Table 4 and 5 revealed the results obtained for the qualitative and quantitative phytochemical analysis of the sample flower of *Cassia alata*. The value of saponins (14.692±0.653%) was the most abundant while phenol and flavonoids are (14.319±0.064%) and (13.940±0.017%) respectively. Tannin revealed (1.247±0.050mg/g) in its result. Tannins are polyphenols which are found in many plants. They have been involved in the speeding up of blood clothing processes, reduction of blood pressure, modulation of immune-response and in reduction of plasma lipid (Chung *et al.,* 1998).
Saponins are glycosides which are amphipathic in nature and are used as adjuvants in the treatment of cancer (Sun *et al*., 2009). They form complex with dietary cholesterol in the intestinal walls, preventing their uptake and hence lowering the amount of circulating cholesterol. They also act as surfactants, which help in the uptake of macromolecules, such as proteins, through cells membrane (Onyegene-Okerenta *et al.,* 2017). Phenols play an important role in scavenging for free radicals. They possess antioxidant activities and may possibly have anti-carcinogenic properties (Ghasemzadeh *et al.,*2011).
Flavonoids also possess antioxidant properties, in several physiological activities such as anti-inflammatory, anti-allergic, antioxidant, antimicrobial, anti-diarrheal and anticancer (Cazarolli *et al.,* 2008).
The Infra-Red spectrum as shown in table 6; 3278.2cm$^{-1}$ is assigned to O-H stretching vibration, where its functional group possesses carboxylic acid which falls between the range of 3300-2500cm$^{-1}$ in the IR spectra table. The presence of carboxylic acid aids in the production of polymers, biopolymers, coatings, adhesives and pharmaceutical drugs. They can also be used as food additives, antimicrobials and flavouring (Georgiana *et al.,* 2020). 2974.4cm$^{-1}$ and 2928.0cm$^{-1}$ are assigned to C-H stretching vibration, where its functional group possesses alkane which falls within the range of 3000-2840cm$^{-1}$ on the IR spectra table. The alkane contains methane and ethane which are used for heating and cooking (Georgiana *et al.,* 2020). 1625.1cm$^{-1}$ is assigned to C=C stretching vibration, where its functional group is cycloalkenes and it falls within the range of 1650-1566cm$^{-1}$ on the spectra table. Cyclo alkenes is used as anaesthetic. It produces a deep unconsciousness in a matter of seconds.1541.3cm$^{-1}$ has a strong status and it is assigned to N-O stretching vibration, where its functional group is nitro compound with a range of 1550-1500cm$^{-1}$ on the table. 1377.3cm$^{-1}$ has a medium status and it's assigned to O-N bending. The functional group for this wave number is phenol. Phenol is a type of organic compound. Pure phenol is used in certain medicinal procedures and as an ingredient in numerous treatments and laboratory applications (Alan-Carter *et al.,* 2019)

**CONCLUSION**

*Cassia alata* flower are rich sources of nutrients and with medicinal potentials and functional properties which can be employed in modern day medicine.

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