MULTIFACETED HEALTH BENEFIT OF *Ficuscapensis*FRUITS AND VEGETABLES

Abstract

This study was carried out to evaluate the chemical properties of *Ficuscapensis*fruits and vegetables.*Ficuscapensis* vegetables and fruits were separately plucked, sorted, cleaned and milled using electric blender until the desired particle size was obtained (150 - 850 microns). Analyses of the proximate, mineral, vitamins, phytochemicals and anti-nutrient contents of the vegetables and fruits were carried out using standard methods. Proximate analysis showed that *Ficuscapensis*had a protein mean value of 6.11and 8.02g/100g, ash 7.63 and 2.92 g/100g, fibre 9.82 and 6.33g/100g, moisture 43.28 and 45.20 g/100g, carbohydrate 31.48 and 35.61 g/100g and fat content of 1.68 and 1.92 g/100g for the vegetables and fruits respectively. Mineral constituents were iron 14.24 and 11.68 mg/100g, calcium 25.46and 24.20 mg/100g, magnesium 21.48 and 28.10 mg/100g, zinc 2.42 and 5.22 mg/100g, sodium 0.51 and 1.25 mg/100g, potassium 126.80 and 5.01 mg/100g and phosphorus 0.62 and 1.24 mg/100g for the vegetables and fruits respectively. However, *Ficuscapensis*had some anti-nutrients such as tannin 4.28 and 1.67mg/100g, cyanide 1.97 and 0.09mg/100g, oxalate 5.10 and 2.64mg/100g,phytate 9.26 and 7.01mg/100g and saponin 2.97 and 1.20mg/100g for the vegetables and fruits respectively. The results showed that the fruits and vegetables of *Ficuscapensis* is an underutilized fruits and vegetable with high nutrient profile especially iron which when incorporated to the diet could help to fight iron in a community with high prevalence of anemia.

Keywords: *Ficuscapensis*, phytochemicals, anti-nutrient, anemia

Introduction

High consumption of plant foods are associated with numerous health benefits rooted in their various physiological effects as a result of their antioxidant, phytochemical and nutritional composition. The use of plants as medicine in treatment of some disease is an ancient and reliable practice. Plant materials and products continue to play an important role in the maintenance of human health since antiquity. Several plants are now being used in part or as a whole to treat many diseases [1].

High intake of fruit and vegetables has been linked epidemiologically with reduced risk of many non-communicable diseases. The important of antioxidants which fruits and vegetables are good sources of, play a role of scavengers cleaning up free radicals before they cause detrimental health effects [2]. The high fiber content of fruits and vegetables may play a role in calcium absorption and reduce the 'acid load' of the diet [3], enhancing bone formation and suppressing bone resorption which consequently result in greater bone strength [4]. Moreover, phytochemicals in fruits and vegetables such as isoflavones have shown to be protective against lens damage which occurs due to hyperglycemia [5] and certain flavonoids such as quercetin can prevent oxidative stress in the pathogenesis of glaucoma [6]. Sufficient fruits and vegetables intake is also associated with lower risk of cognitive decline hence proved beneficial for mental health due to the present of iodine [7].

Fig is a native of Western Asia and Africa. The first creature (Adam and Eve) ate the figs and made a covering (clothing) of their naked bodies using the leaves. It is called "Opoto" among Yoruba in Nigeria [8]. Fig tree belongs to the order of *Urticales* and family of *Moraceae*. Figs are used as an excellent source of minerals, vitamins, carbohydrates, and dietary fibre because it is fat and cholesterol free and contain high number of amino acids [9].*Ficuscapensis* are a widespread medicinal plant species of fruit and vegetable commonly grown, especially in warm, dry climates. It has moisture content of 80.2%, ash 4%, carbohydrates 16.3%, fat 0.53% and protein 0.53% [10].

MATERIALS AND METHODS

*Ficuscapensis*vegetables and fruits were collected from the ornamental garden in AmankpumeOzzi-EdemNsukka Local Government Area, Enugu state, Nigeria.

Sample Preparation

Ficuscapensis leaves and fruits were separately plucked and sorted by removing extraneous materials and cleaned by washing with deionized water. They were milled using electric blender until the desired particle size was obtained (150 - 850 microns).

Chemical Analysis

Proximate composition

The moisture, protein, fat, fibre and ash content of the samples were determined using the method of AOAC [11, 12].

Determination of carbohydrate content

Carbohydrate content was calculated by difference. The estimated percentages of crude protein, ash, fat, fibre and moisture was summed up and the value subtracted from 100%.

CHO = 100% - % (protein + fat + ash + fibre +moisture).

Mineral determination

The mineral contents, namely: Na, K, Ca, Mg, Cu, Mn, Hg and Pb contents were determined by the method described by Pearson [13] using a PyeUnicam SP9 Atomic Absorption Spectrophotometer (AAS) connected to an SP9 computer (PyeUnicam Ltd, York Street, Britain). Total phosphorus was determined by the spectrophotometric molybdovanadate [13].

Vitamin determination

Determination of ß-carotene

The determination of carotenoids was carried out according to the method of Seo et al. [14] with slight modifications.

Determination of vitamin E profile

Vitamin E content was analysed by the method described by Burri [15] using High performance liquid chromatography (HPLC).

Vitamin C determination

Vitamin C determination by iodine titration as described by Anne Helmenstine was carried out [13].

Phytochemical Screening

A small portion of the extract was subjected to the phytochemical test using Traese and Evans [16] and Harbourne [17] methods to test for alkaloids, flavonoids, saponins, lycopene, phenol and cardiac glycoside. The Folin-Denis Spectrophotometer method was used to determine the tannin content of the foods. The method was described by Pearson [13].

Anti-nutrient determination

Cyanide was determined by Wang and Filled method [18]. Phytate was determined from duplicate samples of food using diluted HCL [19]. Oxalate determination was carried out as described by [20].

Results and Discussion

Proximate Composition of *Ficuscapensis*fruits and vegetables

Protein: The protein content of *Ficuscapensis*vegetables and fruits were 6.11 and 8.02% respectively. The fruit had higher protein content. The protein content of the vegetable was slightly higher that the findings of Al-Snafi[21] with value of 5.90% of *Ficuscapensis*. The protein content of the fruit was lower than the findings of [22] with the protein value of 15.03% on *Ficuscapensis*fruit. The low protein content of *Ficuscapensis*might be attributed to the fact that fruits and vegetables are not good source of protein. Protein is vital for various body functions such as body development, maintenance of fluid balance, formation of hormones, enzymes and sustaining strong immune function[23].

Ash: The ash content of the vegetables and fruits were 7.63 and 2.92% respectively with the vegetables having higher ash content compared to that of fruits. The ash content of the test samples were higher than the value recorded by Al-Snafi[21] with 5.30%, and 4.65% for vegetable and fruits of *Ficuscapensis*respectively. The variation in the ash content could be due to the nature and the age of the sample used. Ash is the measure of mineral matter in food. Measuring ash content is important because mineral matter may be the cause of a pharmacological effect [23].

Fibre: The fibre content of the vegetable and fruits were 9.82and 6.33% which were slightly higher than the research conducted by Jyoti*et al.* [24] and Al-Snafi[21] with fibre mean values of 7.50 and 3.68% respectively on *Ficuscapensis* vegetables. Crude fiber content of this plant could aid in the absorption of trace elements in the gut and therefore increases intestinal bowel movement [25]. Consuming vegetables in our diet could aid in managing constipation problems [26]. Dietary fibers also lower cholesterol, triglycerides and protect against cancer and digestive disorders.

Moisture: The moisture content of the *Ficuscapensis*vegetable and fruit ranged from 43.28 to 45.20%. There was higher moisture in *Ficuscapensis*fruits (45.20%) than its vegetables (43.28%). The values obtained in this research were lower than the findings of Onuekwe, [27] and Al-Snafi, [21] with values of 63.39% and 60.90% on *Ficuscapensis*fruits and vegetables respectively. The moisture content of the samples shows that the most single constituent of fruits and vegetable is water. The high moisture content in these vegetables and fruits were not a surprise as Ene-Obong [28] noted that the most single constituent of fruits and vegetable is water, which accounts for more than 80% of the nutrients.

Carbohydrate: The carbohydrate content of the vegetable was lower than that of the fruit with the values of 31.48±0.01 and 35.61% respectively. This finding was higher than the research work recorded by Adebisi and Oyeleke, [8] with the *Ficuscapensis*fruits and vegetables values of 25.9% and 30.93% respectively. Carbohydrates are known to produce energy required for the body because they are essential nutrient required for adequate diet and supplies energy to cells such as brain, muscle and blood.

Fat: On the basis of the fat, the mean value of the vegetable and fruit were 1.68 and 1.92% with the fruit having the higher fat while the vegetable had the least fat content. These values were also higher than the values obtained by Al-Snafi[21] and Jyoti*et al.,* 24]for fruits and vegetables of *Ficuscapensis* with fat content of 0.56% and 0.96% respectively. Leafy vegetables and fruits are poor sources of lipids, therefore the increase consumption of fruits and vegetables would naturally lower fat intake and will not predispose the consumers to cardiovascular diseases associated with consumption of fatty foods.

Mineral composition of *Ficuscapensis* vegetables and fruits

Iron: The iron content of the vegetable was 14.24mg/100g and the fruits was 11.68mg/100g. However, these values agreed with the findings of Adebisi and Oyeleke[8] that recorded iron values of 14.72 and 16.60 mg/100g for the *Ficuscapensis*fruits and vegetables respectively. Iron plays numerous biochemical roles in the body, including oxygen binding in hemoglobin and acting as an important catalytic centre in many enzymes such as the cytochrome oxidase [29]. The RDA for iron is 8 mg/day indicating that the studied fruits and vegetable could be recommended in diets for reducing anemia, which affects over one million people worldwide [30]. It is also essential for hemoglobin formation and plays a role in energy transfer within the plant and also an essential constituent of certain enzymes and proteins [31]. This justifies the use

of *Ficuscapensis*in folklore medicine as a blood tonic because of its blood boosting effect [32]. The recommended daily requirement for iron is 10mg, as such 100g portion of *Ficuscapensis*specie could supply substantial amount of iron to the body [27].

Calcium: This research also revealed that the calcium content of the *Ficuscapensis*vegetable (25.46mg/100g) was higher than that of the fruit (24.20mg/100g) which was lower than the findings of Ihediohaet *al.* [22] with the mean values of 35.46 and 34.49mg/100g for *Ficuscapensis*vegetables and fruits respectively. Calcium is reported to be essential for blood clotting, bone and teeth formation and as a co-factor in some enzyme catalysis [33]. The current daily requirement of calcium for children 4-8 years is (210mg).

Magnesium: The mean value of magnesium vegetables and fruits were 21.48 and 28.10mg/100g respectively which was higher in the fruits than the vegetables. The mean values of *Ficuscapensis* by Ihediohaet *al.* [22] were 18.80 and 22.48mg/100g for vegetables and fruits respectively. In humans, magnesium is required in the plasma and extracellular fluid, where it helps maintain osmotic equilibrium [31]. It can also prevent some heart disorders and lower blood pressure in humans.

Zinc: The Zinc content in *Ficuscapensis*fruits was 5.22mg/100g and the vegetable mean value was 2.42mg/100g while the vegetable agreed with the findings of Ihediohaet *al.*[22] with the value of 3.60mg/100g but the vegetable was lower than the value 17.22mg/100g. However, Pathak and Kapil [34] reported that zinc is vital in protein synthesis, cellular differentiation and replication, immunity and sexual functions. One hundred grammes (100g) portion of *Ficuscapensis*fruit could supply up to half of the daily requirement of the nutrient. Also one hundred grammes (100g) of the leaves could supply up to one quarter of the daily requirement of the nutrient.

Sodium: There were 0.51 and 1.25mg/100g mean value of sodium in the vegetables and fruits respectively. Adebisi and Oyeleke, [8] observed mean value of 10.53 and 8.60mg/100g in the sodium content of vegetables and fruits. Sodium regulates the body fluids and also transmits electric impulses within the human body. It is also one of the most significant constituents of nerves while it also helps in regulating muscle contractions. High consumption of sodium

predisposes one to hypertension, therefore taking this plant would not raise the blood sodium of individuals.

Potassium: Potassium level in the vegetable was (126.80mg/100g) and the mean value in the fruits was (5.01mg/100g) while the findings of Ihediohae*t al.* [22] recorded mean value of 113.01mg/100g for the vegetable of *Ficuscapensis*. However, the fruits mean value agreed with the findings of Adebisi and Oyeleke, [8] with the value of 5.70mg/100g for *Ficuscapensis*fruits. Moderate quantities of sodium and potassium were present in the leaves fruits and vegetables of *Ficuscapensis*and these are principal cations of extracellular and intra-cellular fluids and aid in maintaining electrolyte balance in the body [33]. Potassium is essential for proper growth and plant reproduction.

Phosphorus: The Phosphorus level in the vegetable and fruits were 0.62 and 1.24mg/100g respectively. It was observed that the fruits had higher phosphorus than that of the vegetables. The values obtained in this research were in line with the mean value of phosphorus in the vegetables 0.35mg/100g [22] but lower than the findings of Adebisi and Oyeleke, [8] that had 187.25mg/100g. Phosphorous maintain blood sugar levels and normal heart contraction. It is also important for normal cell growth and repair, bone growth and kidney function. It plays an important role in maintaining the body's acid-base balance [23].

Vitamins composition of *Ficuscapensis* fruits and vegetables

Beta-carotene: The beta-carotene content of the fruits and vegetables were 2500.00 and 450.00 RE respectively. There was higher beta carotene in fruits than the vegetables. Beta carotene is invaluable for the promotion of growth of cells and tissues, resistance to diseases and for delaying the ageing process. It is also important for the maintenance of eye, skin, nails and hair health. The RDA for Beta-carotene for a normal healthy, active adult man and non pregnant woman is 0.3mg/day and 0.27 mg/day respectively [30]. The beta carotene content for fruits and vegetables in this study suggests that the foods may be capable of providing adequate levels of beta carotene for healthy living.

Vitamin E: Vitamin E content were 4.28 and 2.11 mg/100 g for the vegetable and fruits respectively. ` According to FAO [35] the RDA requirement for vitamin E is 10 mg/day for normal healthy adult men between the ages of 19-65 years while that of adult non-pregnant

women within same age range is 7.5 mg/day. Vitamin E is a very potent antioxidant that helps to protect body cells from damage due to reactive oxygen species. It is very important for the formation and normal function of erythrocytes and muscles [36].

Vitamin C: The results of vitamin C content of the samples were 3.45 and 5.26 mg/100 for vegetables and fruits respectively. Vitamin C is a potent antioxidant that facilitates nonhaem iron transport and uptake at the intestinal mucosa, the reduction of intermediates of folic acid as well as the synthesis of cortisol. It also aids in the purification of blood [37]. The recommended daily requirement for Vitamin C according to FAO [30] is between 45.83 mg/day to 68.50 mg/day for both male and female adults between the ages of 19 to 65 years.

Phytochemicals and antioxidant content of *Ficuscapensis* vegetables and fruits

Alkaloid: The alkaloid contents were 0.32 mg/100 g and 0.67 mg/100 g for the vegetables and fruits respectively. Alkaloids are used as medicinal agents for analgesic, antispasmodic, and bactericidal effects [38]. The presence of alkaloids in the fruits and vegetables is of interest because of its health benefit.

Glycosides: Glycosides content of vegetable was (2.38 mg/100 g) and that of fruits was (0.42mg/100 g). These values were lower than the critical level 20 mg/100 g [39]. High level of glycoside causes toxicity which shows symptoms of diarrhea, vomiting, and heart failure in human. Studies showed that high level of glycoside could be reduced during processing such as soaking, malting, fermentation, boiling or frying [40]. The health benefit of glycoside is the fight against cancer and it helps in reducing pain associated with arthritis and also, in lowering high blood pressure (www.brighthub.com/health/alternative).

Lycopene: The lycopene level in the fruits and vegetables were 0.72 and 6.24 mg/100g respectively. Consumption of *Ficuscapensis* fruits with high lycopene level should be advocated to harness the health benefit of the fruits. Lycopene is an antioxidant that protects the body from damages caused by free radical, stress which can hurt DNA and other cell structures [41].

Flavonoids: The flavonoid values for the vegetable was 0.35% while the values for the fruits was 2.58%. The use of *Ficuscapensis* fruits and vegetables in food consumption is of immerse benefit not only for food diversification but also due to their health benefit. Flavonoids lower

high blood pressure and have strong anti-inflammatory properties [42]. Flavonoids are potent anti-oxidants. They also inhibit low density lipoprotein (LDL) by free radicals and reduce the risk of cancer and Cardiovascular diseases [43]. Flavonoids are also involved in platelet aggregation, antimutagenic and antiproliferative properties [44].

Phenol: The level of phenol in the studies vegetable and fruit were 0.48 and 3.21 mg/100g respectively. The antioxidant activity of phenonic compounds is attributed to the capacity of scavenging free radicals, donating hydrogen atoms, electrons, or chelatemetal ion [45].

Anti-Nutrient Composition of *Ficuscapensis*fruits and vegetables

Tannin: The tannin content of the vegetables and fruits were 4.28 and 1.67mg/100g. Although the tannins were higher in the vegetable than that of the fruits. The findings were lower than the values recorded by Achi *et al.* [23] that had the tannin content of 687.64mg/100g for the vegetables of *Ficuscapensis*while Onuekwe [27] reported the tannin content of 0.05 mg/100g. Tannin act as antinutrient when the value is above safe level but below safe level (0.15-0.20%) it functions as phytochemicals. These fruits and vegetables should be subjected to different food processing methods to reduce the tannin level and extend their food uses. Holz and Gibson [46] suggested that many traditional methods of food preparation such as fermentation, cooking and malting increases the nutritive quality of plant foods through reducing certain anti nutrients such as phytic acid, tannins, polyphenols and oxalic acid. Subjecting the vegetables and fruits to these processes will reduce the toxic level and at the same time boost the phytochemical properties of the vegetables [36]. Tannins may be employed medically in anti-diarrheal, haemostatic and antihemorrhoidal treatment. The anti-inflammatory effects of tannins help to control all indications of gastric enteritis and irritating bowel disorders. Tannins not only heal burns and stop bleeding, but they also stop infection while they continue to heal the wound internally.

Cyanide: The Cyanide content of the vegetables and fruits were 1.97mg/100g and 0.09mg/100g respectively. The cyanide levels (1.97mg) and (0.09 mg) in the vegetables and fruits were below the toxic limit for cyanide (35 mg) [47]. Cyanide is a toxin affecting the host when consumed in large quantity. The low levels of cyanide in the vegetables and fruits studied suggest that cyanide content of these food may not pose a threat to the consumers.

Oxalate: The oxalate content of the vegetables was 5.10mg/100g while that of the fruits was 2.64mg/100g. The mean values in this study were similar with the research work of 8.54 and

2.74mg/100g recorded by Ihediohaet *al.* [22] on vegetables and fruits of *Ficuscapensis*respectively. It is known that oxalate chelates calcium to precipitate its deficiency thereby causing it not to be bioavailable. The values obtained in this study were higher than the toxic limit for oxalate (2.20 mg) [48]. Holz and Gibson [46] suggested that many traditional methods of food preparation such as fermentation, cooking and malting increases the nutritive quality of plant foods through reducing certain anti nutrients such as phytic acid, polyphenols and oxalic acid.

Phytate: The phytate content of *F.capensis* vegetables and fruits were 9.26mg/100g and 7.01mg/100g respectively. The values obtained in this research were similar to the findings of Ihediohaet *al.* [22] with the phytate value of 8.54mg/100g and 8.64mg/100g for the *F.capensis*vegetables and fruits respectively. The toxic limit for phytate is (5.00 mg/100 g) [47]. It will be necessary to employ some processing techniques on the fruits and vegetable before consumption since their levels are beyond the toxic limit for phytate.

Saponin: The result showed that the saponin content was (1.20mg/100g) for the fruits and (2.97mg/100g) for vegetables. Ihediohaet *al.*[22] observed that the saponin level in *Ficuscapensis*fruits was 0.50mg/100g while Achi *et al.* [23] reported that the mean value of saponin in the vegetables of *Ficuscapensis*was 0.27mg/100g. Saponin is an antinutrient as well a phytochemical at safe level. The saponin level in the fruits and vegetable were below 3.00mg which was reported by Kumar [49] to be responsible for cattle losses when they grazed on alfonibrilla. Saponins have expectorative, anti-inflammatory and immune stimulating activity. They also demonstrate antimicrobial properties particularly against fungi, bacteria and protozoa [48]. There is evidence of the presence of saponins in traditional medicine preparations [50,51,52]. Saponins are bitter and reduce the palatability of food and increase excretion of cholesterol concentration by free radicals that are bond with cholesterol and other pathogens in the body. Saponin decreases tumor size and improves cognitive ability [53].

Table 1: Proximate composition of *Ficuscapensis* fruits and vegetables (%/100g)

Samples	Protein	Ash	Fibre	Moisture	Carbohydrate	Fat
F. Vegetable	6.11±0.01	7.63±1.01	9.82±0.42	43.28±0.67	31.48±0.01	1.68±0.45
F.Fruits	8.02±0.24	2.92±0.33	6.33±0.05	45.20±0.22	35.61±0.36	1.92±0.18

Values are mean ± standard deviation of 3 replicate

Table 2: Mineral composition of *Ficuscapensis* fruits and vegetables (mg/100g)

Samples	Fe	Ca	Mg	Zn	Na	K	P
F. Vegetable	14.24±0.18	25.46±0.27	21.48±0.27	2.42±0.34	0.51±0.02	126.80±0.26	0.62±0.05
F.Fruits	11.68±0.14	24.20±0.08	28.10±0.06	28.10±0.06	1.25±0.61	5.01±0.72	1.24±0.12

Values are mean ± standard deviation of 3 replicate

Table 3: Vitamin composition of *Ficuscapensis* fruits and vegetables

Samples	Beta-Carotene	Vitamin C	Vitamin E
F. Vegetable	450.00±1.26	3.45±0.23	4.28±0.11
F. Fruits	2500.00±2.01	5.26±0.28	2.11±0.07

Values are mean ± standard deviation of 3 replicate

Table 4: Phytochemical composition of *Ficuscapensis* fruits and vegetables (mg/100g)

Samples	Flavonoids	Lycopene	Alkanoid	Phenol	Glycoside
F. Vegetable	0.35±0.06	0.72±0.38	0.32±0.01	0.48±0.06	2.38±0.70
F.Fruits	2.58±0.07	6.24±0.21	0.67±0.11	3.21±0.24	0.42±0.18

Values are mean ± standard deviation of 3 replicate

Table 5: Anti-nutrient composition of *Ficuscapensis* fruits and vegetables (mg/100g)

Samples	Tannin (mg/100g)	Cyanide (mg/100g)	Oxalate (mg/100g)	Phytate (mg/100g)	Saponin
F. Vegetable	4.28±0.77	1.97±0.46	5.10±0.11	9.26±0.92	2.97±0.25
F.Fruits	1.67±0.21	0.09±0.24	2.64±0.82	7.01±0.68	1.20±0.02

Values are mean ± standard deviation of 3 replicate

Conclusion

The results showed that the fruits and vegetables of *Ficuscapensis* is an underutilized fruits and vegetable with high nutrient profile especially iron which when incorporated to the diet could help to fight iron in a community with high prevalence of anemia.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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