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Nutritional and anti-nutritional properties of sweet cassava (*Manihot esculenta*) and black pepper (*Piper nigrum*) leaves

Fowomola Moshood Abiodun *, Girigisu Sadisu and Yusuf Kudirat Sade

Department of Biochemical and Chemical Sciences , School of applied Sciences and Technology, The Federal Polytechnic Offa, P.M.B. 420, Offa, Kwara State, Nigeria.

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Abstract

The proximate compositions,some minerals,some vitamins and antinutrients contents of sweet Cassava (*Manihot esculenta*) and Black pepper (*Piper nigrum*) leaves were investigated on dried weight basis by employing the standard methods described by the Association of Official Analytical Chemists (AOAC, 1990)., Association of vitamin chemists (1987) and Harborne. (1973). The results showed that Sample A (sweet cassava leabes) contained crude protein (11.70 ± 2.34%), Hexane extract (1.47 ± 0.1%), Ash content (1.90 ±0.1%), crude fibre (3.56 ± 0.14%), moisture (10.8 ± 0.00%) and carbohydrate (70.57 ± 0.45%).while Sample B(black pepper leaves) contained crude protein (8.73±1.25%), Hexane extract (1.49 ± 0.1222%), Ash content (1.82 ± 0.141%), crude fibre (2.92 ± 0.141%), moisture (12.81 ± 0.00%) and carbohydrate (78.46 ± 1.25%).

The results also revealed that Sample A contained potassium (155.75 ± 1.02 mg/100g), sodium (3.82 ± 0.14 mg/100g), calcium (2.47 ± 0.1 mg/100g), magnesium (75.28 ± 0.60 mg/100g), manganese (0.44 ± 0.10 mg/100g) and copper (0.17 ± 0.01 mg/100 g). Sample B on the other hand, contained potassium (164.45 ± 0.387 mg/100 g), sodium (4.80 ± 0.01 mg/100 g), calcium JJ(3.65 ± 0.223 mg/100 g), magnesium (94.75 ± 0.223 mg/100 g), manganese (0.10 ± 0.001 mg/100 g) and copper (0.17 ± 0.01 mg/100 g).

The results of vitamin analysis depicted that Sample A contained vitamin A (0.116 ± 0.01IU), vitamin B1 (0.032 ± 0 mg/100 g), vitamin B2 (0.0027 ± 0 mg/100 g), vitamin B6 (0.125 ± 0 mg/100 g), vitamin B12 (0.024 ± 0 mg/100 g), vitamin C (17.80 ± 0 mg/100 g), vitamin E (0.012 ± 0 mg/100 g) and vitamin K (0.002 ± 0 mg/100 g).

While Sample B contained vitamin A (0.114 ± 0.01 IU), vitamin B1 (0.0765 ± 0.038 mg/100 g), vitamin B2 (0.0435 ± 0.038 mg/100 g), vitamin B6 (0.1245 ± 0.022 mg/100 g), vitamin B12 (0.033 ± 0.031 mg/100 g), vitamin C (15.72 ± 0.282 mg/100 g), vitamin E (0.014 ± 0 mg/100 g) and vitamin K (0.00165 ± 0.036 mg/100 g).The results of antinutrient analysis also depicted that Sample A contained Tannin (0.3655±0.038 mg/100 g), saponin (0.2855 ± 0.0387 mg/100 g), Alkaloid (0.1025 ± 0.1025 mg/100 g), phytate (0.2815 ± 0.0387 mg/100 g), oxtate (0.195 ± 0.0316 mg/100 g), glycocyanide (0.005 ± 0.001 mg/100 g) and flavnoid (0.58 ± 0.04 mg/100 g).

However, Sample B contained Tannin (0.357 ± 0.031 mg/100 g), saponin (0.293 ± 0.031 mg/100 g), Alkaloid (4.551 ± 0.114 mg/100 g), pytate (0.347 ± 0.031 mg/100 g), oxtate (0.233 ± 0.0446 mg/100 g), glycocyanide (0.005 ± 0.001 mg/100 g) and flavonoid (0.6425 ± 0.05 mg/100 g).

Therefore, dried sweet cassava and black pepper leaves are good soourses of proteins, carbohydrates, fibre, potassium, vitamin C and flavonoids. Black pepper leaves also rich in alkaloid.

Keywords: Sweet cassava; Black pepper; Proximate composition; Minerals; Vitamins; Antinutrients

* Corresponding author: Fowomola Moshood Abiodun

1. Introduction

The present global food insecurity should be a great consined to both Scientists and Many workers like Oboh et.al., (2005),Oboh et.al., (2009). and Fowomola et.al.,(2023) had earlier reported the butritive values of some leafy vegetables.

Government planners. Most expecially in under developing countries where many peoples do not have purchasing power to buy enough right food items. This could be as a result of poverty, conflicts , environmental conditions , politics , unemployment , poor health c , over population ,hyper infliation and so on. One of the ways for tackling food insecurity is to search into alternative sources of food items which will be readily available to everybody.

Pennington and Fisher (2009) and Septembre-Malaterreb *et.al.,*(2018).had reported the importants of vegetables in human diets.

So also, many workers like Oboh *et.al., (*2005),Oboh *et.al.*, (*2009*).and Fowomola *et.al.*,(2023) had earlier reported the butritive values of some leafy vegetables.

Cassava *(Manihot esculenta)* is a woody shrub that belong to the family, Euphorbiaceae, native *to Brazil* and is extensively cultivated as an annual crop in tropical and subtropical regions for its edible starchy root tuber (*FAO. (2011), Fauquet and Fargette. (1990) and Afedraru,. (2019).it is called Fge by the Yoruba speaking people of Nigeria.*

There are two varieties of Cassava, sweet and bitter.The sweet type contained less cyanide while the bitter contained much cyanide(*Chiwona-Karltun,2002*).

Black pepper (*Piper nigrum*) is a flowering vine that belongs to the family Piperaceae and cultivated for its fruit (the peppercorn), which is dried and used as a spice and seasoning.it is called *Ewe Iyere* by the Yorubas. (*Harrison,(2016) also described the shape of black peper fruit.* Black pepper (*Piper nigrum*) is a flowering vine that belongs to the family Piperaceae and cultivated for its fruit (the peppercorn), which is dried and used as a spice and seasoning in accordance to *Germplasm Resources Information Network.{ 2008) report.* (*Harrison,(2016) also described the shape of black peper fruit.*Black pepper can be cultivated in the tropical regions(*Sen, (2004)and Hajeski, (2016). Both cassava and black pepper were cultivated majorly for their tuber and seed respectively. The consumption of both plants leaves were limited to few populace. This may be as a result of paucity of informations about the nutrional and antinutritional contents of their leaves. The present research work therefore, was aimed at providing the informations on the nutritional and antinutrional contentents of sweet* Cassava *(Manihot esculenta)* and Black pepper (*Piper nigrum*)Leaves.

2. Material and methods

2.1. Sources of materials

Fresh *young sweet* Cassava (*Manihot esculenta*) and Black pepper (*Piper nigrum*) leaves were harvested at the Biological garden, Science Laboratory Technology department, the Federal Polytechnic, Offa Kwara State,Nigeria..They were identified and authenticated by a botanist in the department of science laboratory Technology,Federal Polytehnic ,Offa,kwara State. They were washed separately with deionized water,oven dried at 6 °C for 12hrs ,grounded into fine powder with laboratory pestle and mortar and kept in clean polythene bags for analysis.

Analytical grade Chemicals were used for the analysis of samples

2.2. Methods

2.2.1. Determination of Proximate composition

The proximate composition of each sample was determined by using standard methods of the Association of Official Analytical Chemists (AOAC, 1990). Analyais of each sample was done in triplicates.

2.2.2. Determination of mineral contents

Mineral contents were determined using flame photometer and atomic absorption spectrophotometer. Analyais of each sample was done in triplicates.

2.2.3. Determination of vitamin contents

Vitamin contents of each sample were determined using the methods described by Association of vitamin chemists (1987). Analyais of each sample was done in triplicates.

2.2.4. Determination ofantinutrient contents

Antinutrients of each sample were determined using the methods described by Harborne . (1973). Analyais of each sample was done in triplicates.

2.3. Statistical analysis

Data obtained from these studies were compared by ANOVA (SPSS 17.0.1 SPSS Inc.) and statistically significant means were separated by Duncan's Multiple Range Test. Statistical significance was set at 95% confidence interval. Results were reported as mean ± standard error.

3. Results and discussion

Table 1 depicts the results of the proximate Compositions of *sweet* Cassava *(Manihot esculenta)* and Black pepper (*Piper nigrum*) Leaves in percentage (%) dried weight basis. The results showed that Sample A contained crude protein (11.70 ± 2.34%), Hexane extract (1.47±0.1%), Ash content (1.90 ±0.1%), crude fibre (3.56±0.14%), moisture (10.8±0.00%) and carbohydrate (70.57 ± 0.45%).while Sample B contained crude protein (8.73±1.25%), Hexane extract (1.49 ± 0.1222%), Ash content (1.82±0.141%), crude fibre (2.92±0.141%), moisture (12.81±0.00%) and carbohydrate (78.46 ±1.25%).

Table 1 Proximate Compositions of *sweet* Cassava *(Manihot esculenta)* and Black pepper (*Piper nigrum*) Leaves in percentage (%) dried weight basis

Parameter	Sample A	Sample B
Crude protein	11.70 ± 2.34[a]	8.73 ± 1.25[b]
Hexane extract	1.47 ± 0.1[c]	1.485 ± 0.122 [d]
Ash	1.9 ± 0.1[e]	1.82 ± 0.141[f]
Crude fibre	3.56 ± 0.14[g]	2.92 ± 0.141[h]
Moisture	10.8 ± 0.00 i	12.81 ± 0.1[j]
Carbohydrate	70.57 ± 0.45[k]	78.46 ± 1.25 [l]

Each value is a mean of three determinations ± S.D; a,b,c values with different superscripts are significantly different ($p < 0.05$); KEY: Sample A= sweet Cassava (*Manihot esculenta*) Leaves ; Sample B = Black pepper (*Piper nigrum*) Leaves

Table 2 Some Mineral Contents of sweet Cassava (Manihot esculenta) and Black pepper (Piper nigrum) Leaves in milligram per 100 grams (mg/100 g) dried weight basis

Parameter	Sample A	Sample B
Potassium (k)	155.75 ± 1.02 [a]	164.65 ± 0.387 [b]
Sodium (Na)	3.82 ± 0.14 [d]	4.80 ± 0.01 [e]
Calcium (Ca)	2.47 ± 0.1 [g]	3.65 ± 0.223 [h]
Magnesium (mg)	75.28 ± 0.60 [j]	94.75 ± 0.223 [k]
Manganese (mn)	0.44 ± 0.10 [m]	0.10 ± 0.001 [n]
Copper (Cu)	1.43 ± 0.17 [p]	0.17 ± 0.01 [q]

Each value is a mean of three determinations ± S.D; a,b,c values with different superscripts are significantly different ($p < 0.05$); KEY: Sample A= sweet Cassava (Manihot esculenta) Leaves; Sample B = Black pepper (Piper nigrum) Leaves

Various functions of Proteins have been reported by Genton et.al., (2010) and Hermann, (2021).also the key functions of carbohydrates was explained by Keith (2023). Several Scientists such as Slavin (2008), Marlett, McBurney and Slavin (2002) and Zunft et.al.,(2003) had reported the importance of dietary fibre in the body.

Table 2 shows the results of Some Mineral Contents of *sweet* Cassava *(Manihot esculenta)* and Black pepper (*Piper nigrum*) Leaves in milligram per 100 grams (mg/100 g) dried weight basis. The results revealed that

Sample A contained potassium (155.75±1.02 mg/100 g), sodium (3.82±0.14 mg/100 g), calcium (2.47±0.1 mg/100 g), magnesium (75.28±0.60 mg/100 g), manganese (0.44±0.10 mg/100 g) and copper (0.17±0.01 mg/100 g).

Sample B on the other hand, contained potassium (164.45±0.387 mg/100 g), sodium (4.80±0.01 mg/100 g), calcium JJ(3.65±0.223 mg/100 g), magnesium (94.75±0.223 mg/100 g), manganese (0.10±0.001 mg/100 g) and copper (0.17±0.01 mg/100 g).

The various functions of calcium, phosphorus, sodium, potassium and Magnesium had been reported by Dawson-Hughes et.al.,(1987), Draper et.al.,(1972), Erne et.al.,(1984),Ettinger et.al.,(1987),Garland et.al.,(1985), Harrison and Fraser. (1960),Heaney(1985),Heaney(1986), Kawashima(1986),Leichsenring et.al.,(1951),McCarron(1985), et.al., (1986), Miller(1985), Rafter et.al.,(1986),Resnick et.al.,(1986) and Seelig (1974).

Table 3 Some Vitamin Contents of *sweet* Cassava *(Manihot esculenta)* and Black pepper (*Piper nigrum*) Leaves in milligram per 100 grams (mg/100 g) dried weight basis

Parameter	Sample A	Sample B
Vitamin A	0.116 ± 0.01^{a} (I U)	0.114 ± 0.01^{b} (I U)
Vitamin B1	0.032 ± 0^{d}	0.0765 ± 0.038^{e}
Vitamin B2	0.0027 ± 0^{g}	0.0435 ± 0.038^{h}
Vitamin B6	0.125 ± 0^{j}	0.1245 ± 0.022^{k}
Vitamin B12	0.024 ± 0^{m}	0.033 ± 0.031^{n}
Vitamin C	17.80 ± 0^{p}	15.72 ± 0.282^{q}
Vitamin E	0.012 ± 0^{s}	0.014 ± 0^{t}
Vitamin K	0.002 ± 0^{v}	0.00165 ± 0.036^{w}

Each value is a mean of three determinations ± S.D; a,b,c values with different superscripts are significantly different ($p < 0.05$)

KEY: Sample A= sweet Cassava (Manihot esculenta) Leaves; Sample B = Black pepper (Piper nigrum) Leaves

Table 3 reveals the results of Some Vitamin contents of *sweet* Cassava *(Manihot esculenta)* and Black pepper (*Piper nigrum*) Leaves in milligram per 100 grams (mg/100 g) dried weight basis. The results of analysis depicted that Sample A contained vitamin A (0.116±0.01IU), vitamin B1 (0.032±0 mg/100 g), vitamin B2 (0.0027±0 mg/100 g), vitamin B6 (0.125±0 mg/100 g), vitamin B12 (0.024±0 mg/100 g), vitamin C (17.80±0 mg/100 g), vitamin E (0.012±0 mg/100 g) and vitamin K (0.002±0 mg/100 g).

While Sample B contained vitamin A (0.114±0.01 IU), vitamin B1 (0.0765±0.038 mg/100 g), vitamin B2 (0.0435±0.038 mg/100 g), vitamin B6 (0.1245±0.022 mg/100 g), vitamin B12 (0.033±0.031 mg/100 g), vitamin C (15.72±0.282 mg/100 g), vitamin E (0.014±0 mg/100 g) and vitamin K (0.00165±0.036 mg/100 g).

Many Workers like Afzal and Armstrong(2002),Aviram and Rosenblat (2005). Hidalgo *et.al*.,(2017), Halliwe ll *et.al.*, (1995),Kaur and Kapoor(2001),Percival(1998) and Williams *et.al.*, (2004) had earlier reported that foods containg green vegetables are rich in antioxidants such as vitamins (examples, vitamin C and vitamin E) and phytochemical compounds (e.g., flavonoids ,polyphenols and carotenoids) that can combat free radicals in our body.Thus preventing deadly diseases like cancer,cardiovascular disease and diabetes.

Table 4 shows the results of the Anti nutrients contents of of *sweet* Cassava *(Manihot esculenta)* and Black pepper (*Piper nigrum*) Leaves in milligram per 100 grams (mg/100 g) dried weight basis. The results depicted that Sample A contained Tannin (0.3655±0.038 mg/100 g), saponin (0.2855±0.0387 mg/100 g), Alkaloid (0.1025±0.1025 mg/100 g),

phytate (0.2815±0.0387 mg/100 g), oxlate (0.195±0.0316 mg/100 g),glyco cyanide (0.005±0.001 mg/100 g) and flavnoid (0.58 ±0.04 mg/100 g).

Table 4 Anti nutrient contents of of sweet Cassava (Manihot esculenta) and Black pepper (Piper nigrum) Leaves in milligram per 100 grams (mg/100 g) dried weight basis

Parameter	Sample A	Sample B
Tannin	0.3655 ± 0.0387 ^{a}	0.357 ± 0.031 ^{b}
Saponin	0.2855 ± 0.0387 ^{d}	0.293 ± 0.031 ^{e}
Alkaloid	0.1025 ± 0.1025 ^{g}	4.551 ± 0.114 ^{h}
Phytate	0.2815 ± 0.0387 ^{j}	0.347 ± 0.031 ^{k}
Oxatate	0.195 ± 0.0316^{m}	0.233 ± 0.044^{n}
Glycocyanide	0.005 ± 0.00 ^{p}	0.005 ± 0.001 ^{f}
Flavonoid	0.58 ± 0.04 ^{s}	0.64± 0.05 ^{t}

Each value is a mean of three determinations ± S.D; a,b,c values with different superscripts are significantly different ($p < 0.05$); KEY: Sample A= sweet Cassava (Manihot esculenta) Leaves ; Sample B = Black pepper (Piper nigrum) Leaves

However, Sample B contained Tannin (0.357±0.031 mg/100 g), saponin (0.293±0.031 mg/100 g), Alkaloid (4.551±0.114 mg/100 g), phytate (0.347±0.031 mg/100 g), oxtate (0.233±0.0446 mg/100 g), glycocyanide (0.005±0.001 mg/100 g) and flavonoid (0.6425 ± 0.05 mg/100 g).

Phytate precipitates minerals by binding to them.Examples include calcium, magnesium, iron, copper, and zinc. Thereby make them unavailable for absorption in the intestines(Cheryan ,1980).

Oxalates bind to calcium and prevent its absorption in the human body (Dolan *et.al*., 2010).

According to Coudray *et.al*., (2003), excessive intake of dietary fiber can reduce the transit time through the intestines to such a degree that other nutrients cannot be absorbed Cheryan,1980).

Other mineral chelating agents are polyphenolic compounds like tannins(Scheers ,2013). These compounds chelate metals such as iron and zinc and reduce the absorption of these nutrients.

Saponins in plants are antifeedants (Boh et.al.,2014and Sparg et.al., 2004).

4. Conclusion

In conclusion, the present research work has revealed that, dried sweet cassava and black pepper leaves are good soourses of proteins, carbohydrates, fibre, potassium, vitamin C and flavonoids. Black pepper leaves also rich in alkaloid.

Recommendation

Because of the fact that the two leafy vegetables that were analyzed are rich in affore mentioned nutritional factors but low in antinutrient contents, we hereby recommend them for consumption so as to compliment the monotonous staple foods being consumed by many people living in under developing countries. However, further studies should be carried out to determine the levels of their toxicities.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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