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Nutritional values of green and white cucumber (*Cucumis sativus* L.) and African horned cucumber (*Cucumis metuliferus* E.)

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ABSTRACT

Purpose: Cucumbers play an immediate and crucial role in fighting against micronutrient deficiency and are often consumed crudely. This study aimed to assess the nutritional and phytochemical values of these three whole fruits of cucumber and the share of their different parts such as the epicarp, the mesocarp, and the endocarp. **Research method:** Fresh cucumber fruits were collected and their different parts were separated and crushed. Samples were analyzed to determine the proximate, the phytochemicals, the vitamins, and the minerals. **Findings:** The results show significant variation in nutritional and phytochemical content. White *Cucumis sativus* contained more sugars (704.57±124.79 mg/100g), total polyphenols (133.05±21.26 mg/100g), flavonoids (1.07±0.46 mg/100g), tannins (43.26±5.18 mg/100g), Sodium (28.52±1.37 mg/100g) and Potassium (286.58±25.40 mg/100g). Green *C. sativus* concentrated more protein (35.65±5.12 mg/100g) and Iron (4.22±5.44 mg/100g) while, non-bitter wild *C. metuliferus* was richer in acidity (6.5±1.45 meq/100g), vitamin C (275.07±44.23), Magnesium (47.87±10.53 mg/100g) and Calcium (21.25±25.40 mg/100g). According to the different parts, the endocarp concentrates more acidity (7.25±2.21 meq/100g), proteins (39.76±5.07 mg/100g), nitrogen (6.36±0.81 mg/100g), total polyphenol (104.12±28.67 mg/100g) and flavonoids (1.10±0.45 mg/100g). The Mesocarp has more sugars (663.50±12.10 mg/100g) while Epicarp concentrates more Tannin (40.19±1.99 mg/100g), Magnesium (56.51±2.94 mg/100g), Calcium (28.21±20.72 mg/100g), Sodium (25.05±5.28 mg/100g), Potassium (312.66±13.84 mg/100g) and Iron (4.79±4.98 mg/100g). Cucumbers are recognized as fruits and vegetables with multiple nutritional values. **Research limitations:** Further genotypic characterizations were required for a better understanding of the difference between cucumbers. **Originality/Value:** The knowledge of the nutritional value of each part of the fruit was necessary for better valorization and maximizing the nutrient supplies.

INTRODUCTION

Diets rich in vegetables, in all their many forms, ensure an adequate intake of most micronutrients, dietary fibers, and phytochemicals which can bring a much-needed measure of balance back to diets contributing to solving many of these nutrition problems. Increasing dietary diversity and the intake of vegetables and fruits is widely recognized as a key strategy to address the problem of macro and micronutrient deficiency (Hughes & Keatinge, 2012). The nutritional values derived from different plants, fruits, and vegetables have been studied to maintain food quality, food safety, and appeal, or as food additives or nutraceuticals to improve nutritional quality and support physiological functions (Šeregelj et al., 2021). Nutritional values refer to all compounds which are naturally present in foods that exert a specified biological effect on the human body. Recent studies reveal that numerous food wastes and non-edible parts are a good source of nutrients that can be extracted and reintroduced into the food chain as natural food additives (Vilas-Boas et al., 2021). This approach is supported by a circular economy that encompasses the valorization of waste, allowing for the extraction of novel ingredients by returning them to the supply chain and boosting the economy while reducing the environmental impact (Meléndez-Martínez et al., 2022).

Fruits and vegetables play a significant role in human nutrition by providing important nutrients including proteins, vitamins, minerals (zinc, calcium, potassium, and phosphorus), fiber, folacin, and riboflavin (Wargovich, 2000). The nutritional value varies greatly among fruits and vegetables (Prior & Cao, 2000). It is better to consume a variety of commodities rather than limit consumption to a few with the highest nutritional content. Cucumbers are the most important fruits and vegetables consumed and used for a salad a food. They are sources of nutrients required for human health (Sheela et al., 2004; Mukherjee, 2013; Deguine et al., 2015). The major species of cucumbers growing in Senegal are *Cucumis sativus* and *Cucumis metuliferus* (Diop et al., 2020). *Cucumis sativus* or the cucumber has many varieties, including green and white (Burkill, 1985). *Cucumis metuliferus*, horned melon, kiwano, and bitter or non-bitter wild cucumber have high economic and nutritional value that is yet to be fully exploited (Aliero & Gumi, 2012). It has many common names like jelly melon, Kiwano, Melano, and bitter or non-bitter wild cucumber (Vieira et al., 2020). It is often eaten raw, as a snack, but may also be used in cooking (Burkill, 1985).

The nutritional and phytochemical content of different parts of cucumber fruit is not well known. There is increasing evidence that the consumption of whole foods is better than isolated food components. This study aimed to assess the nutritional and phytochemical values of three fruits of cucumber varieties in Senegal and determine the content of parts of the fruit for optimal nutritional value.

MATERIALS AND METHODS

Vegetal material collection

The fruits of Green and White *C. sativus* and non-bitter *C. metuliferus* (Fig. 1) were collected at the market of Ziguinchor, Kadjinolle and Loudia Diola respectively (Fig. 2). The collection sites were located in Ziguinchor and Oussouye districts (Ziguinchor Province, Senegal). A total of ten fruits of each variety were collected.

Fig. 1. Fruit of Green (A) and White (B) *C. sativus* and Non-bitter *C. metuliferus* (C).

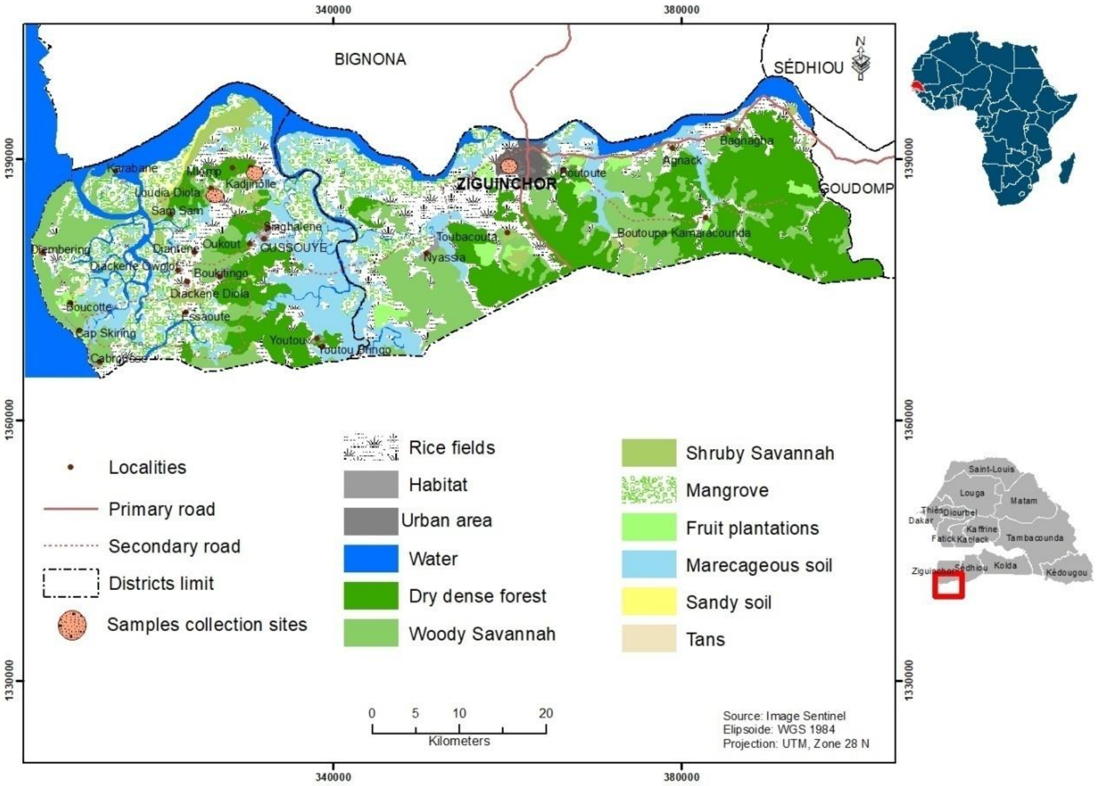

Fig. 2. Localization of collected samples.

Plant extract preparation

All the fruits were divided into three parts according to the Epicarp, Mesocarp, and Endocarp (Fig. 3). Each part was crushed for the proximate, phytochemical, vitamin, and mineral analyses.

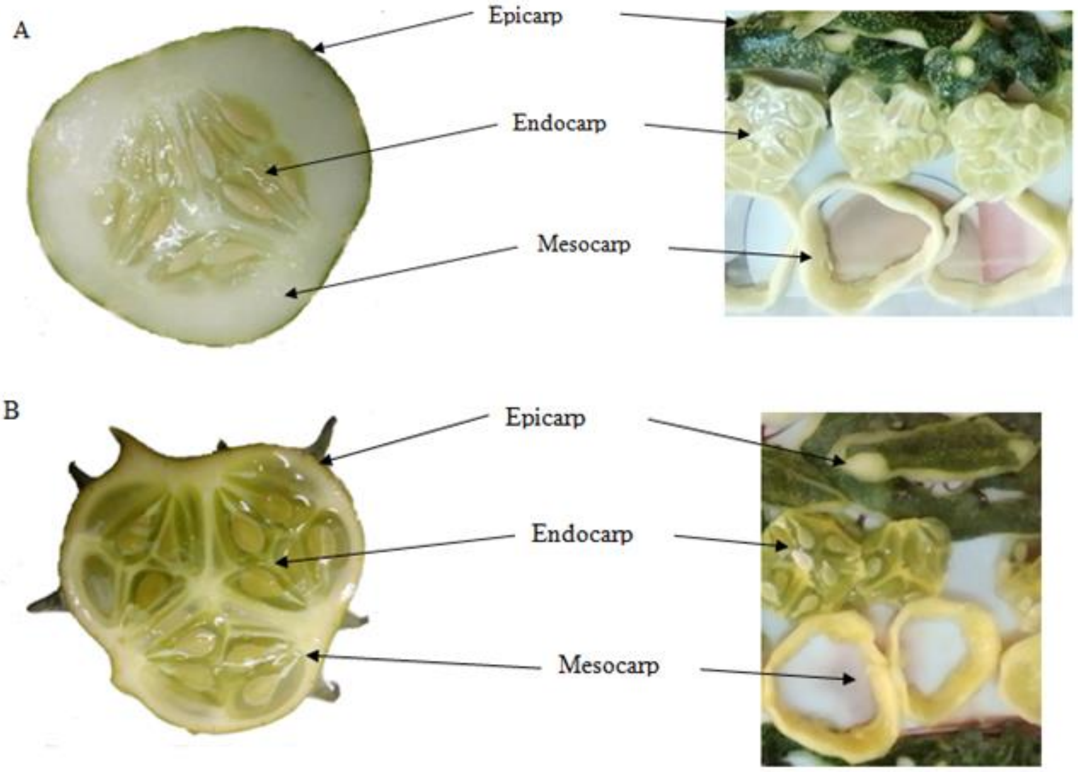

Fig. 3. Different parts of *C. sativus* (A) and *C. metuliferus* (B) fruit.

Proximate, Phytochemicals, vitamins, and minerals analysis

The different parts of fruit samples were analyzed to determine proximate (humidity, ash, sugars, proteins, and acidity), phytochemical properties (polyphenols, flavonoids, and tannins), vitamins (vitamin c), protein, and minerals (nitrogen, calcium, magnesium, sodium, potassium, and Iron).

Proximate

Samples were dried at 105^{0}C in an isothermal oven for three hours and the humidity was determined. To determine the ash, the samples were incinerated at 525 ± 25 °C for 4 hours using a muffle furnace. Total sugars were evaluated by acid hydrolysis (HCl) by the Luff-Schoorl method (Marrubini et al., 2017). Protein content was determined by the Kjeldahl method (Kirk, 1950; Sáez-Plaza et al., 2013). The acidity is the content of organic and mineral acids determined by titration according to the volumetric method.

Phytochemicals

Analytical methods were used to separate, identify and quantify nutritional components. Polyphenols, flavonoids, and tannins were analyzed by a separation technique using the Spectrophotometric method. 10 ml of the mixture of acetone and water (70/30) was added to 0.5 g of crushed sample and the mixture was agitated for 30mns to homogenize. In each extract of 50µl, 450 µl of distilled water and 2.5 ml of Folin-Ciocalteu were added. 2.5 ml of sodium carbonate is added to each mixture to extract the polyphenol, tannin, and flavonoid compounds. The homogenate mixture was filtered and the filtrates were incubated for 15 minutes at 50°C and subjected to absorbance at 760 nm. The method consists in oxidizing the oxidizable groups of phenols in the basic medium by the method of Folin-Ciocalteu developed by Georgé et al (2005). Tannins were determined by the colorimetric method of Folin Denis, described by Joslyn (1970). The Flavonoid content of the extracts is determined using the colorimetric method described by Kim et al. (2003).

Vitamin C

One gram of the sample was mixed with 10 mL of distilled water and 50mg of oxalic acid. The mixture was titrated with 2.6-DCPIP (Dichlorophenol Indophenol) solution until a persistent pale pink color appears for 30 seconds to determine the vitamin C content (Nielsen, & Nielsen, 2017).

Minerals

Magnesium (Mg), Calcium (Ca), Sodium (Na), Potassium (K), and Iron (Fe) were analyzed by using Atomic Absorption Spectroscopy (AAS) and Inductively Coupled Plasma Emission (ICP). Nitrogen (N) content is determined by the Kjeldahl method (Kirk, 1950; Sáez-Plaza et al., 2013).

Statistical analysis

Data collected were subjected to a three-way analysis of variance (ANOVA) performed with R 4.1.3 (Team, 2015) to determine the main and interaction effects of the studied variables. When effects were significant, Tukey's test was used for multiple mean comparisons to detect the significant differences between the characteristics (varieties, parts, and varieties/parts of fruit). Statistical significance was fixed at 0.05. Considering the varieties, parts, and varieties/parts' nutritional content, all data are hence expressed as overall means ± SE.

RESULTS

Proximate and phytochemicals

Proximate and phytochemical screening on cucumber fruit samples is summarized in Table 1. The results showed a relatively high proportion of humidity (varying between 93.76±1.07 and 95.64±0.49%) and sugars (between 430.34±104.91 and 704.57±124.79 mg/100g), a moderate concentration of polyphenols, proteins and tannin (between 22.31±5.93 and 49.28±17.16 mg/100g) and a slightly present of ash and flavonoids (between 0.50±0.11 and 7.52±1.92 mg/100g). There was significant variation in proximate and phytochemical content between varieties. Comparing proximate and phytochemical parameters of the whole fruit of cucumber, the fruit of green *C. sativus* contained more humidity (95.64±0.49%) than the white variety (94.45±0.70%) and non-bitter *C. metuliferus* (93.76±1.07%). For ash, white *C. sativus* (7.35±0.78 mg/100g) and non-bitter *C. metuliferus* (7.52±1.92 mg/100g) had higher content than green *C. sativus*, while proteins content was significantly high in green *C. sativus* (35.65±5.12 mg/100g) and white *C. sativus* (31.96±2.60 mg/100g). The lower content of proteins was recorded in non-bitter *C. metuliferus* (27.72±5.88 mg/100g). White *C. sativus* contented significantly more polyphenols (133.05±21.26 mg/100g), flavonoids (1.07±0.46 mg/100g), tannin (43.26±5.18 mg/100g), and sugars (704.57±124.79 mg/100g) than non-bitter *C. metuliferus* and green *C. sativus* (Table 1). There was a significant difference in acidity between the fruits of cucumbers with higher acidity content recorded in non-bitter *C. metuliferus* fruit (6.5±1.45 meq/100g) (Fig. 4).

There was a significant difference in proximate and phytochemical values between and within different parts of cucumber fruit (Table 1, Fig. 4). Humidity (96.34±0.19%) and sugars (663.50±12.10 mg/100g) were higher in the mesocarp. For ash and tannins, a high content was found in epicarp. Endocarp contented more proteins (39.76±5.07 mg/100g), polyphenols

(104.12±28.67 mg/100g), flavonoids (1.10±0.45 mg/100g), and acidity (7.25±2.21 meq/100g). But the parts content of flavonoids and acidity depended on species. There were fewer flavonoids and acidity in the endocarp for green *C. sativus*, non-bitter *C. metuliferus*, and white *C. sativus* respectively (Table 1).

Table 1. Proximate and phytochemical content of cucumber fruit according to cucumber varieties, parts, and varieties/parts.

Parameters	Proximate				Phytochemicals		
	Humidity (%)	Ash (mg100g)	Proteins (mg/100g)	Sugars (mg/100g)	Polyphenols (mg/100g)	Flavonoids (mg/100g)	Tannins (mg/100g)
Varieties							
Green *C. Sativus*	95.64±0.49^{a}	4.82±0.97^{a}	35.65±5.12^{a}	430.34±104.91^{a}	28.39±5.89^{a}	0.50±0.11^{a}	22.31±5.93^{a}
White *C. Sativus*	94.45±0.70^{b}	7.35±0.78^{b}	31.96±2.60^{b}	704.57±124.79^{b}	133.05±21.26^{b}	1.07±0.46^{b}	43.26±5.18^{b}
Non-bitter C. Metuliferus	93.76±1.07^{c}	7.52±1.92^{b}	27.72±5.88^{c}	469.99±71.44^{c}	49.28±17.16^{c}	0.94±0.18^{b}	23.03±3.90^{a}
P value	*2.33e-05*	*0.018721*	*0.000116*	*2.70e-09*	*4.87e-08*	*0.000733*	*4.45e-08*
Parts							
Endocarp	94.62±0.61^{a}	4.63±0.64^{a}	39.76±5.07^{a}	491.99±187.07^{a}	104.12±28.67^{a}	1.10±0.45^{a}	27.78±9.10^{a}
Epicarp	92.88±0.80^{b}	10.20±1.22^{b}	23.38±4.12^{b}	449.41±13.80^{b}	55.33±25.91^{b}	0.83±0.21^{ab}	40.19±1.99^{b}
Mesocarp	96.34±0.19^{c}	4.850.54^{a}	32.19±2.07^{c}	663.50±12.10^{c}	51.28±13.01^{b}	0.57±0.13^{b}	20.63±2.78^{c}
P value	*1.45e-07*	*0.000139*	*2.75e-07*	*2.90e-08*	*1.11e-05*	*0.001577*	*2.22e-07*
Varieties/Parts							
Green *C. Sativus*							
Epicarp	94.14±0.24^{a}	7.76±0.93^{b}	23.89±0.00^{a}	469.43±5.39^{a}	34.66±0.58^{a}	0.85±0.00^{a}	40.99±0.05^{a}
Endocarp	96.05±0.01^{b}	3.20±0.17^{a}	50.98±0.00^{b}	125.53±3.95^{b}	40.06±4.39^{a}	0.26±0.02^{a}	11.64±0.21^{b}
Mesocarp	96.72±0.08^{b}	3.50±0.41^{a}	32.07±2.67^{c}	696.06±1.96^{c}	10.45±1.78^{b}	0.39±0.02^{a}	14.28±0.40^{b}
White *C. Sativus*							
Epicarp	94.08±0.47^{a}	9.72±0.74^{b}	34.37±1.11^{a}	407.33±6.04^{a}	133.89±10.52^{a}	0.30±0.01^{a}	44.38±3.99^{a}
Endocarp	92.77±0.00^{a}	6.42±0.00^{a}	24.22±0.00^{b}	1076.47±36.1^{b}	190.27±2.87^{b}	2.53±0.00^{b}	56.49±0.67^{b}
Mesocarp	96.48±0.26^{b}	5.89±0.00^{a}	37.29±2.48^{a}	629.90±0.00c	74.99±3.64^{c}	0.37±0.07^{a}	28.90±1.88^{c}
Non-bitter *C. Metuliferus*							
Epicarp	90.41±0.43^{a}	13.12±2.49^{a}	11.87±0.00^{a}	471.47±11.50^{a}	2.58±2.12^{a}	1.33±0.33^{a}	35.19±0.11^{a}
Endocarp	95.03±0.08^{b}	4.26±0.79^{b}	44.07±0.00^{b}	273.95±11.91^{b}	82.03±16.94^{b}	0.51±0.03^{b}	15.20±0.19^{b}
Mesocarp	95.82±0.03^{b}	5.16±1.07^{b}	27.22±0.00^{c}	664.54±0.00^{c}	68.38±0.57^{b}	0.96±0.11^{ab}	18.70±0.13^{b}
P value	*1.08e-05*	*9.86e-05*	*2.69e-07*	*1.08e-10*	*2.99e-05*	*2.22e-06*	*1.58e-06*

Results are expressed as mean ± SE, letters a, b and c are groups (groups with different letters are significantly different).

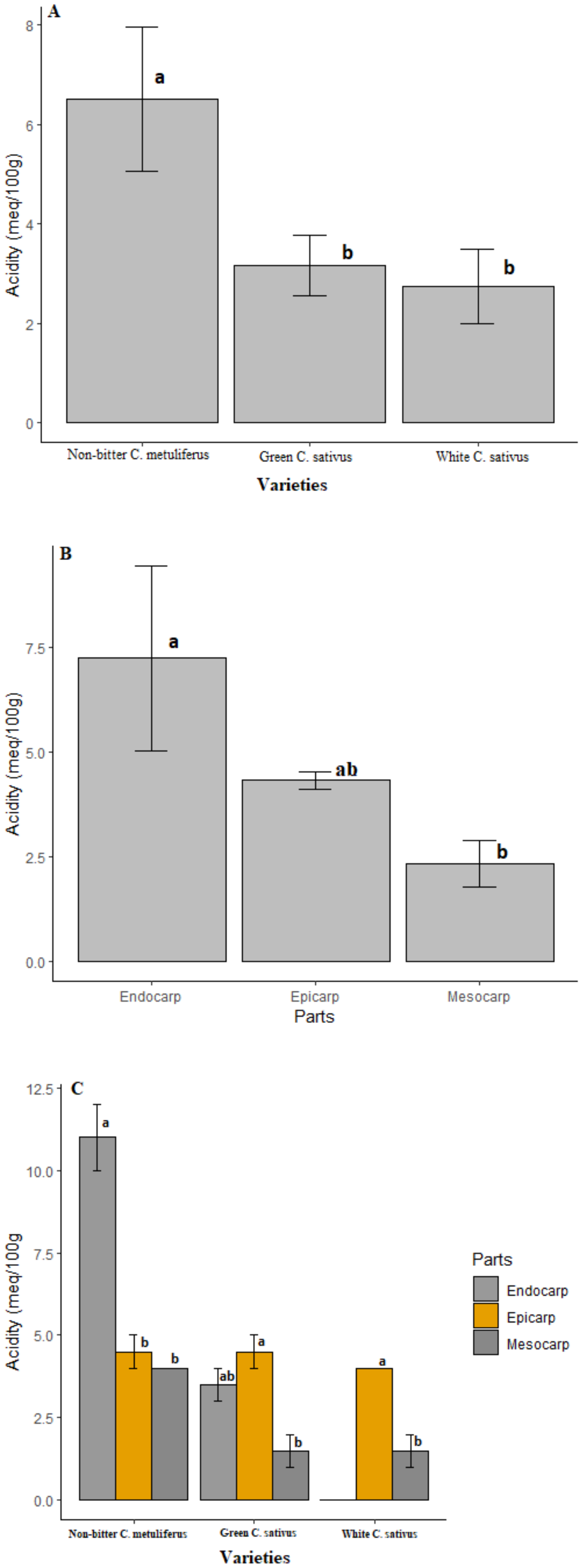

Fig. 4. Acidity content of cucumber fruit according to varieties (A), parts (B), and varieties/parts (C). Values are means ± SD; significant differences are indicated with different letters.

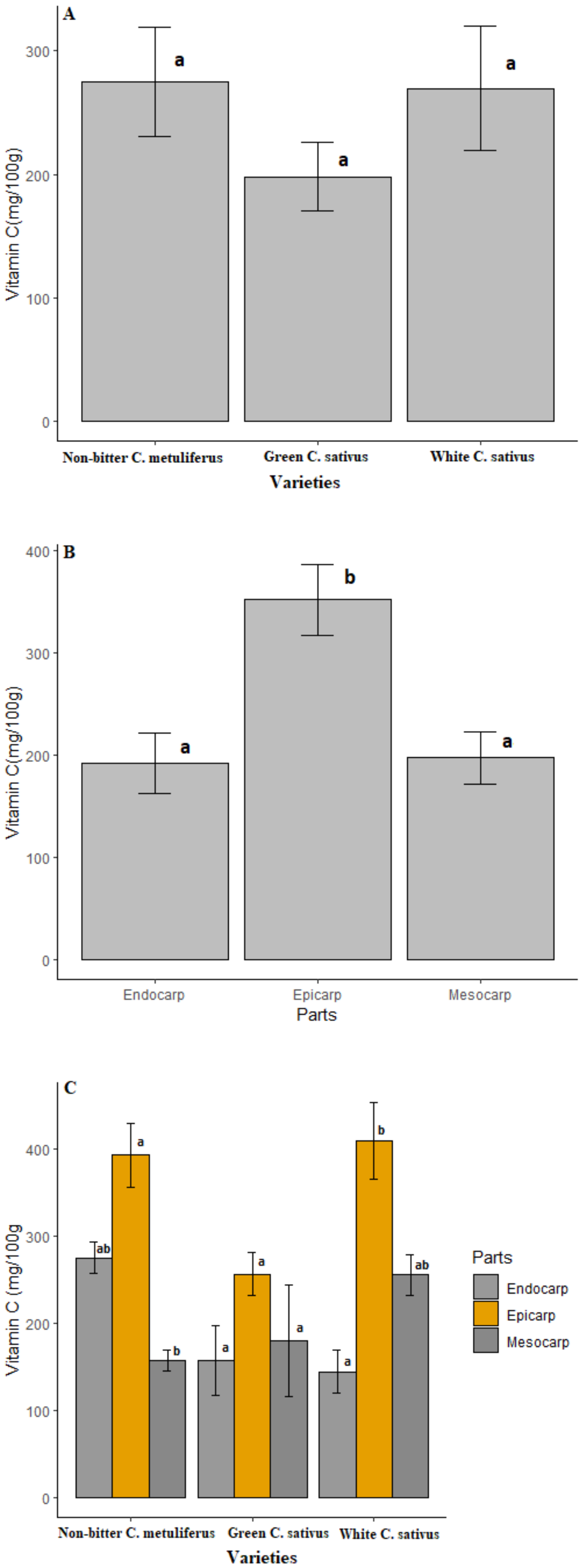

Fig. 5. Vitamin C content of cucumber fruit according to species (A), parts (B), and species/parts (C). Values are means ± SD; significant differences are indicated with different letters.

Vitamin C

Cucumber fruits were an important source of vitamin C varying between 198.05±27.91 and 275.07±44.23 mg/100g (Fig. 5). There was no significant difference in vitamin C content between species. However, there was more vitamin C in non-bitter *C. metuliferus* (275.07±44.23 mg/100g) and white *C. sativus* (269.57±50.52 mg/100g).

The repartition of vitamin C within different parts of fruit varied from 192.40±29.33 to 352.50±34.50 mg/100g (Fig. 5). Epicarp contained significantly more vitamin C (352.48±34.54 mg/100g) than mesocarp (197.81±25.83 mg/100g) and endocarp (192.40±29.33 mg/100g).

Minerals

No significant difference in Nitrogen (N), Magnesium (Mg), Calcium (Ca), Potassium (K), and iron (Fe) content between varieties was recorded (Table 2). In absolute value, non-bitter *C. metuliferus* fruit contented more Mg (47.87±10.53 mg/100g) and Ca (21.25±25.40 mg/100g) while higher K (286.58±25.40 mg/100g) and Fe (4224±5.44 mg/100g) were recorded respectively in white and green *C. sativus*. There was more Nitrogen in green *C. Sativus* (5.70±0.81%) followed by white *C. sativus* (5.11±0.41%) and non-bitter *C. metuliferus* (4.43±0.94%) (Fig. 6). Sodium (Na) content recorded in white (28.52±1.37 mg/100g) and green *C. Sativus* (19.89±5.98 mg/100g) were significantly higher than non-bitter *C. metuliferus* (17.02±2.51 mg/100g).

Comparing the mineral content of different parts of the fruit, there was no significant variation of Mg, Ca, Na and Fe. Epicarp contained more minerals (Mg, Ca, Na and Fe) than endocarp and mesocarp. While there was a significant difference between parts for N and K content. Endocarp (6.36±0.81%) contented more than mesocarp (5.15±0.33%) and epicarp (3.74±0.65%). But for white *C. sativus*, the endocarp (3.87±0.00%) contented less N than the mesocarp and Epicarp (Fig. 6). K content was significantly higher in epicarp (312.66±13.84 mg/100g) than in endocarp (222.84±57.40 mg/100g) and mesocarp (169.04±84.05 mg/100g) (Table 2).

Table 2. Minerals content of cucumber fruit according to species and parts.

Parameters	Mg (mg/100g)	Ca (mg/100g)	Na (mg/100g)	K (mg/100g)	Fe (mg/100g)
Varieties					
C. Sativus var. Green	43.72±10.22[a]	6.74±2.48[a]	19.89±5.98[ab]	214.07±112.81[a]	4.22±5.44[a]
C. Sativus var. White	46.12±12.19[a]	9.79±12.95[a]	28.52±1.37[b]	286.58±25.40[a]	1.27±1.08[a]
C. metuliferus	47.87±10.53[a]	21.25±25.40[a]	17.02±2.51[a]	203.90±82.92[a]	1.00±0.31[a]
P value	*0.75519*	*0.362*	*0.0241*	*0.178*	*0.378*
Parts					
Endocarp	43.44±8.19[a]	3.58±1.55[a]	20.62±7.64[a]	222.84±57.40[ab]	0.82±0.14[a]
Epicarp	56.51±2.94[a]	28.21±20.72[a]	25.05±5.28[a]	312.66±13.84[a]	4.79±4.98[a]
Mesocarp	37.75±4.86[a]	5.99±3.04[a]	19.75±6.39[a]	169.04±84.05[b]	0.88±0.30[a]
P value	*0.05629*	*0.105*	*0.2016*	*0.0483*	*0.247*

Results are expressed as mean ± SE, and letters a and b are groups (groups with different letters are significantly different).

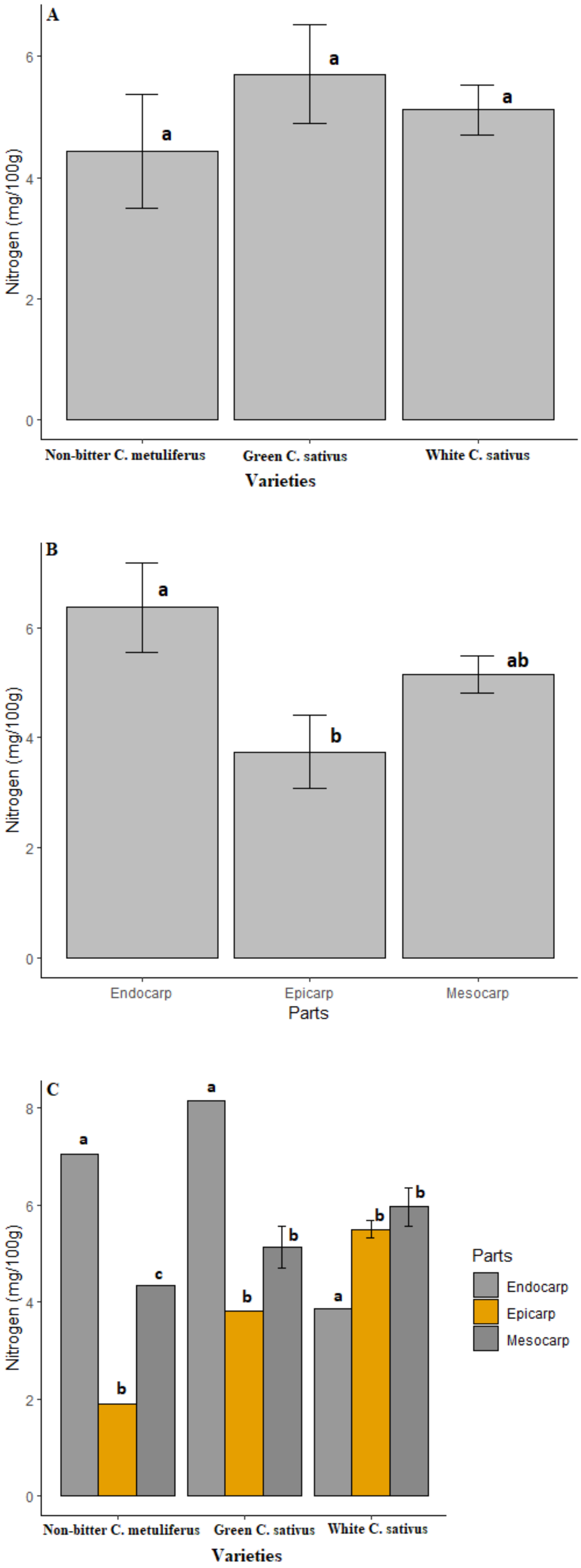

Fig. 6. Nitrogen content of cucumber fruit according to species (A), parts (B), and species/parts (C). Values are means ± SD; significant differences are indicated with different letters.

DISCUSSION

Proximate, physicochemical, vitamin C and minerals content of fruit

Proximate and phytochemical analysis on cucumber fruit samples showed a relatively high proportion of humidity and sugars, a moderate concentration of polyphenols, proteins, and tannins, and a slightly present of ash and flavonoids. For vitamins and minerals, high concentrations of N and K, and moderate and slight concentrations of Mg, Na, Ca, and Fe were recorded. The high humidity of the whole cucumber (*C. sativus* and *C. metuliferus*) fruit varying between 89 and 96.4% was recorded (Agatemor et al., 2018; Ferrara, 2006; Romero-Rodriguez et al., 1992; Mukherjee et al., 2013). Cucumber is a rich source of important nutrients and bioactive compounds; it has been used not only as food but also in therapeutic medicine and as an ornamental plant (Dixit & Kar, 2010; Kapoor, 2001; Uthpala et al., 2020). Cucumber considered a fruit and vegetable crop is rich in polyphenolics and other phytochemicals (Agatemor et al., 2018). Uthpala et al. (2018) have conducted a phytochemical screening on cucumber (*C. sativus*) homogenate samples and they have found that relatively higher amounts of steroids, terpenoids, glycosides, and resins are present in cucumber while moderate amounts of saponins, alkaloids, and flavonoids have been reported. Quantitative amounts of the proximate and phytochemicals found reducing sugars in the highest amount (574.4mg/g) relatively compared to other phytochemicals followed by polyphenols (8.51 mg/g), flavonoids (2.14 mg/g), and tannins (1.26 mg/g) were the lowest available phytochemicals (Agatemor et al., 2018). The analytical composition of *C. metuliferus* pulp showed that are present proteins, lipids, sugars, and minerals including magnesium with high concentration, calcium, potassium, and iron; vitamin C which concentration is four times higher in lemon (Usman et al., 2015; Hussein, 2009). The phytochemicals present in the fruit of *C. metuliferus* revealed the presence of useful secondary metabolites such as alkaloids, Flavonoids, saponins, tannins, steroids, and terpenoids (Jimam et al., 2011; Gotep, 2011; Usman et al., 2014).

Comparing the proximate and phytochemicals between varieties, green *C. sativus* contented more humidity and proteins than white *C. sativus* and non-bitter *C. metuliferus*. White *C. sativus* contained significantly more polyphenols, flavonoids, tannins, and sugars followed by non-bitter *C. metuliferus*. For the acidity and ash, the higher values were recorded in non-bitter *C. metuliferus*. For vitamin C and minerals (N, Mg, Ca, K and Fe), there was no significant variation between varieties. But more vitamin C, Mg, and Ca were recorded in non-bitter *C. metuliferus* followed by white *C. sativus* while higher K, Fe, and Na were recorded respectively in white and green *C. sativus*. The humidity of the whole fruit of cucumber varied from 89% for *C. metuliferus* and 96.4% for *C. sativus* (Agatemor et al., 2018; Ferrara, 2006; USDA, 2015; Romero-Rodriguez et al., 1992; Mukherjee et al., 2013). Higher ash (5 mg/g) of *C. metuliferus* (Romero-Rodriguez et al., 1992) and lower (0.94 mg/g) of *C. sativus* (Agatemor et al., 2018) were recorded. Agatemor et al. (2018) found high polyphenols (8.51 mg/g) and sugars (574.36 mg/g) content in *C. sativus* fruit than in *C. metuliferus* with respectively 0.89 mg/g (17) and 16.10 mg/g (Benzioni et al., 1993). Comparing the minerals content between species, Ferrara (2006) found higher Mg (40 mg/100g) and Fe (1.13 mg/100g) content of *C. metuliferus* than *C. sativus* with respectively 16 mg/100g and 0.70 mg/100 (Agatemor et al., 2018). These authors found higher content of K (249 mg/100g) and Ca (15 mg/100g) of *C. sativus* (Agatemor et al., 2018) than *C. metuliferus* with respectively 123 mg/100g and 13 mg/g (Ferrara, 2006).

Proximate, physicochemical, vitamin C and minerals content of parts of the fruit

The relative content of proximate and phytochemicals varied from epicarp to endocarp. The epicarp contained more ash and tannins while the high humidity and sugar content were recorded in the mesocarp. Proteins, polyphenols, flavonoids, and acidity content were found higher in the endocarp. For vitamin C and minerals, there was a slight difference in content between the parts of cucumber fruit. Epicarp contained more vitamin C, Mg, Ca, Na, K, and Fe. But endocarp was richer in N. There were significant differences among the samples. A comparison of the epicarp and other parts of cucumber fruit showed that epicarp had higher values for ash, proteins, fat, fiber, and carbohydrate while others were more concentrated in moisture content (Abulude et al., 2007). For minerals, epicarp had also a higher concentration of Mg, Fe, and Ca while endocarp and mesocarp contained more K and Na respectively (Abulude et al., 2007).

CONCLUSION

Cucumber fruits are a rich source of important nutrients and phytochemical compounds. The nutritional values of cucumber fruits varied according to the species and variety and the parts of the fruit. Based on the species and varieties, white cucumber was richer in sugars, polyphenols, flavonoids, tannins, sodium, and potassium. But other varieties are also rich in proteins and iron (green cucumber), acidity, vitamin C, magnesium, and calcium (non-bitter wild cucumber). Cucumbers are recognized as fruits and vegetables with multiple nutritional values including, proteins, polyphenols, flavonoids, tannin, sugars, vitamin C and minerals. The nutritional content varied significantly within the fruit parts. An important concentration of acidity, proteins, nitrogen, polyphenols, and flavonoids in the Endocarp, sugars in the Mesocarp, and Tannin in the Epicarp were recorded. But the Epicarp concentrated more minerals. In Senegal, cucumber fruit is consumed as a healthy food but most people in their habits consumed only the mesocarp. The knowledge of the nutritional value of each part of the fruit was necessary for better valorization. It is important to consume whole fruit to maximize the nutrient supply.

Conflict of interest

The authors declare no conflict of interest to report.

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