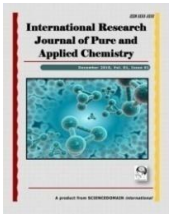

International Research Journal of Pure & Applied Chemistry
6(2): 77-83, 2015, Article no.IRJPAC.2015.036
ISSN: 2231-3443

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Proximate Analysis and Phytochemical Screening of *Psidium guajava* (Guava) and *Cucumis sativus* (Cucumber) Grown in Gashua Fadama Area of Yobe State, Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author MW designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author IAS collected the samples and managed the analyses of the study. All authors read and approved the final manuscript. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IRJPAC/2015/13775
Editor(s):
(1) Hao-Yang Wang, Shanghai Institute of Organic Chemistry, Analytical Department, China.
(2) Francisco Márquez Linares, Nanomaterials Research Group-NRG, School of Science and Technology, University of Turabo, USA.
Reviewers:
(1) Anonymous, Thailand.
(2) Anonymous, Egypt.
(3) Anonymous, Egypt.
(4) Anonymous, Philippines.
Complete Peer review History: http://www.sciencedomain.org/review-history.php?iid=892&id=7&aid=7603

Original Research Article

Received 2nd September 2014
Accepted 10th November 2014
Published 3rd January 2015

ABSTRACT

Aims: To determine the nutrient composition and phytochemical properties of *Psidium guajava* (Guava) and *Cucumis sativus* (Cucumber) fruits grown in Gashua fadama area of Yobe State, Nigeria in order to provide an up-to-date nutrient composition data and phytochemical potentials of these commonly grown and consumed fruits in the area of research.
Study Design: Collection and analysis of fruit samples from the Gashua fadama area and control samples from Mamudo, an upland area in Yobe State where fruits and vegetables irrigation farming is practiced.
Place and Duration of Study: Composite samples of the fruits were collected from the fadama and

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up land farms during the active production period between April 2013 and May 2013.
Methodology: Samples were collected from five *P. guajava* farms and nine *C. sativus* farms. Samples were identified at the herbarium of Department of Botany, University of Maiduguri, prepared and analyzed for proximate values using the recommended method of the Association of Analytical Chemists. Samples were also screened for phytochemical properties using standard procedures.
Results: The Proximate analysis showed that both fruits were good sources of carbohydrate (*C. sativus* (77.16%) and *P. guajava* (67.40%). The protein and fat contents were found to be relatively low in both fruits (1.05% protein, 0.95% fat for *P. guajava* and 2.06% protein, 0.47% fat for *C. sativus*). The moisture content of the fruits ranged from 9.90% for *C. sativus* to 13.32% for *P. guajava*. No significant differences were recorded between the proximate values of the tested fruits and the fruits from the control area. The phytochemical tests revealed the presence of alkaloids, carbohydrates, flavonoids, saponins, glycosides, steroids and tannins in *P. guajava* but saponins, tannins and alkaloids were not detected in *C. sativus*.
Conclusion: The results suggest that *C. sativus* and *P. guajava* have some nutritive and medicinal properties. The presence of phytochemicals that are biologically important contributes to the nutritive value of the fruits and thus can be potential sources of useful foods.

Keywords: Cucumis sativus; Fadama; Phytochemicals; Proximate analysis; Psidium guajava.

1. INTRODUCTION

There is growing interest and concern among people from all walks of life in foods and their relationship to nutrition and health [1,2]. Fruits form part of the balanced diet which the human body need and they are used in folk medicine for prevention and curing diseases. These reasons and the economic conditions in most parts of the developing countries led to the popularity of local fruits among consumers.

Fruits are one of the oldest forms of food known to man and they present an important part of human diet in almost any culture of the world [3]. The basic nutritional importance of fruits like other plants is assessed by their content of protein, carbohydrate, fats and oils, minerals, vitamins and water which are responsible for the growth and development in man and animals [4].

Apart from their nutritional benefits fruits also have beneficial effects such as anti-carcinogenic, anti-mutagenic, anti-viral and bacterial impacts due to their biological active substances with anti-oxidant and anti-bacterial properties [5, 6]. An inverse relationship between consumption of fruits and their juice with cardio-vascular disease, arthritis and stroke has been established [7]. These properties are associated with the presence of biologically active phytochemicals in plants which could serve as potential sources of drugs. Studies have shown that the most important bioactive constituents of plants include; alkaloids, flavonoids, tannins and phenolic compounds [8, 9]. These compounds were known to exhibit medicinal and physiological activities [6].

Psidium guajava (Guava) is known for its food and nutritional values throughout the world [10]. The fruit is very rich in antioxidants and vitamins and also high in lutein, zeaxanthine and lycopene [11]. The medicinal properties of *P. guajava*, leaf and other parts of the plant are also well known in traditional system of medicine [12].

Cucumis sativus (Cucumber) belong to the same botanical family as melons. Though research work on the health benefits of *C. sativus* is scanty compared to *P. guajava* and other fruits but it contains unique combination of phytonutrients; cucurbitacins, lignans, and flavonoids [13]. These health-benefiting substances can provide the human body with valuable antioxidant, anti-inflammatory, and anti-cancer benefits.

Fadama are low laying lands subject to seasonal flooding or water logging along the banks of streams or depressions. It is a Hausa word meaning, the seasonally flooded or flood able plains along major savannah rivers and or depressions or adjacent to seasonally or perennially flowing streams and rivers [14]. Fadama farming involves preparation of low-lying areas and flood plains for crops, agroforestry and livestock production.

Gashua fadama farmlands are richly endowed with fruits and vegetables but there are no data on the quality and quantity of the produce. *P.*

guajava and *C. sativus* are among the fruits grown in the fadama area of Gashua. They are produced in small scale and are usually consumed when ripe and fresh. *P. guajava* have been used traditionally in the treatment of diarrhea, diabetes and hypoglycemic activities [15]. *C. sativus* contain some important phytonutrients; cucurbitacins, lignans, and flavonoids which are associated with the antioxidant, anti-inflammatory, and anti-cancer properties of the fruit [16]. *C. sativus* is used by the local women in the study area as body cleanser while *P. guajava* extractis used to manage inflammation. *C. sativus* and *P. guajava* are the major ingredients used by the traditional healers in preparing concoctions used in curing diseases such as high fever, stomachache, constipation, dysentery and skin infections

Apart from the traditional use of these fruits in treatment of diseases, the consumers claim that the fruits from the Gashua fadama have unique sweet taste and are more nutritious than cultivars from other areas. In an effort to initiate a research in these highly fertile land, this study was aimed at assessing the proximate values and phytochemical properties of *Psidium guajava* and *Cucumis sativus* fruits produced in the area of study. The result is expected to attract research interest in the area and also guide the consumers on the selection of the fruit to consume based on its nutritional and health benefits.

2. MATERIAL AND METHODS

2.1 Study Area

Gashu'a is located between latitude 12.5ºN and 13.0ºN and longitude 12.3ºE and 13.1ºE. Rainy season is between June-September with rainfall range of about 500mm to 1000mm and about eight months of dry season. The hottest months in the area are between March and early May with temperature range of 38-40ºC.

2.2 Sampling

Ripe *P. guajava* and *C. sativus* fruit samples were collected from different farms within the fadama area while control samples of same fruits were collected from Mamudo, an upland area in Yobe State where irrigated fruits and vegetables are produced. The collected samples were stored in polythene bags, properly labelled and carried to the laboratory. The samples were identified at the Herbarium of the department of Botany, University of Maiduguri.

After collection of samples from the farms, they were thawed and mixed in proportions to produce the final composite sample for analysis of all nutrients and phytochemicals. Each composite was made up of 5 sub-samples of equivalent weight. This process allows a single, robust set of nutrient values to be derived for each composite, covering an appropriate cross-section of products available.

2.3 Preparation of Samples

The composite samples of each fruit were prepared separately. Each sample was thoroughly washed with distilled water to remove sand/dust particles and air dried for an hour and put in an electric oven at 80ºC for a day to remove all of its moisture. Dried samples were ground, sieved through 20-mesh sieve to a fine powder and transferred into airtight containers with proper labelling for further analysis.

2.4 Proximate analysis

The AOAC (2005) method [17] was used for the determination of moisture, ash, crude lipid and nitrogen content. Crude protein was estimated by multiplying the sample percentage nitrogen content by a factor 6.25. Carbohydrate was determined by the difference between 100% (accepted total value of nutritional status) and the sum of the values of protein, moisture, fiber, fat and ash [17].

2.5 Phytochemical screening

The phytochemical screening of the samples to determine the presence of alkaloids, steroids, saponins, terpenoids, glycosides, flavonoids, tannins, proteins and carbohydrates were carried out as described by Sofowora [6].

3. RESULTS AND DISCUSSION

3.1 Proximate Analysis

The proximate compositions of the *P. guajava* and *C. sativus* fruits are shown in Figs. 1 and 2. The result indicates that the carbohydrate content in *C. sativus* fruit was higher when compared to the test and control *P. guajava* fruit but the differences were not significant. The observed carbohydrate content of the *P. guajava*

were lower than values reported for *P. guajava* leaves (88.9%) [18]. However, the % carbohydrate of the studied fruits were significantly high when compared to *P. guajava* and some notable fruits grown in the riverine areas of Nigeria [19] but comparable to the % carbohydrate reported in *Aloe barbadensis* (73.07%) and *Luffa. Acutangula* (66.05%) vegetables [20,21]. The observed carbohydrate content indicates that the studied fruits are good sources of energy to the body.

The ash content of the fadama *P. guajava* and *C. sativus* were found to be 17.34% and 10.41% respectively while *C. sativus* from fadama and control sites recorded 10.41% and 8.5% ash respectively. The ash content of the fadama *C. sativus* was comparable to that of Praecitrullus *fistulosus* (10.05%)[12] but values for both fruits were high when compared to the fruits from the control area (10.60% *P. guajava*, 8.5% *C. sativus*) and reported literature values [19]. The ash content in a samples is a reflection of the mineral contents preserved in that sample [4]. This indicates that the fadama *P. guajava* may contain high amounts of minerals compared to the *C. sativus.*

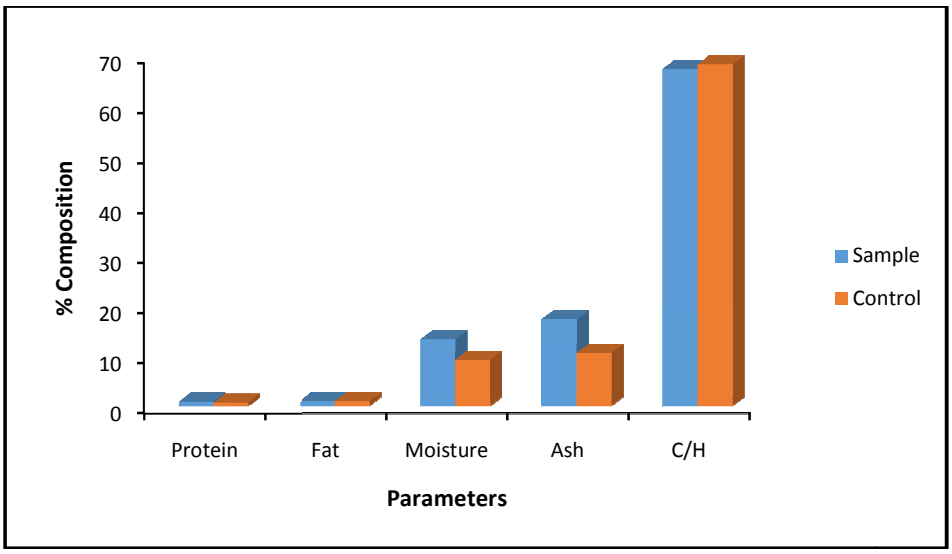

Fig. 1. Proximate Values of *Psidium guajava*

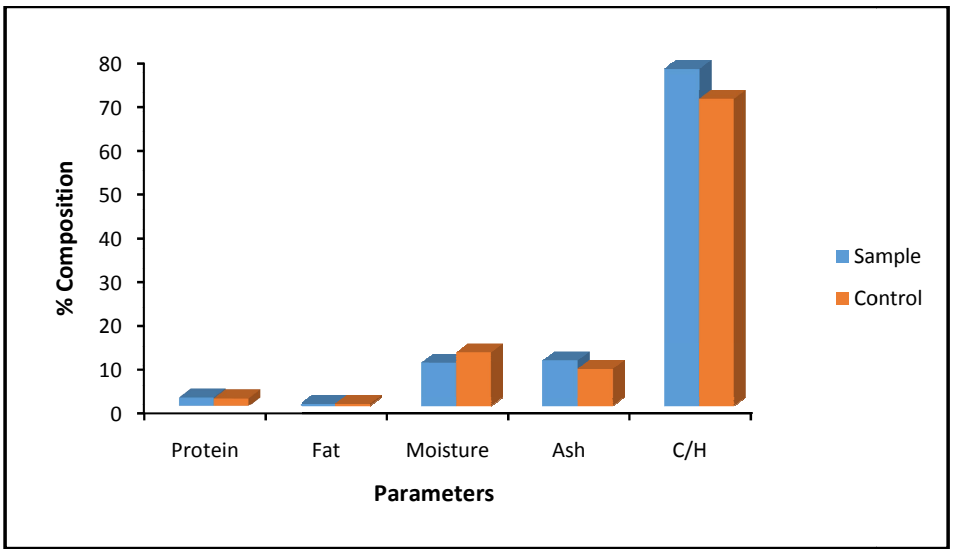

Fig. 2. Proximate Values of *Cucumis sativus*

The moisture levels of the studied and control fruits were low (Figs. 1 & 2) when compared with those reported in literature [4]. Though lack of storage facilities is a major problem in the area of research but the low % moisture will help in storage of the fruits though for a short period. The % fat were found to be 0.47% and 0.95% for the test *P. guajava* and *C. sativus* respectively. The % protein in both fruits are higher than their respective fat content but lower than reported values [4, 19]. The low levels of fat and protein in both fruits are good indicators of nutritive quality as excess fat consumption is implicated in certain cardiovascular disorders such as atherosclerosis, cancer and aging [22].

3.2 Phytochemical Screening

In most parts of the developing world, synthesized drugs are either not readily available or not within the reach of the local poor man, while drugs from plants are easily available, less expensive, safe, and efficient and are believed to have less side effects. Therefore the local man relied on various types of health oriented foods such as fruits and vegetables for their health needs.

The results of the qualitative screening of the tested fruits are shown in Table 1. Alkaloids and saponins were present in *P. guajava* but absent in *C. sativus.* The importance of alkaloids and saponins in various antibiotics used in treating common infections has been reported [23]. Alkaloids have been reported to have antibacterial, analgesic and antispasmodic properties [24]. Its activities have been widely studied for their potential use in the elimination and reduction of human cancer cell lines [7]. The presence of saponins has supported the usefulness of the fruits in managing inflammation. The inhibitory effect of saponins on inflamed cells and its ability of precipitating and coagulating red blood cells have been reported [25]. Several health beneficial properties of dietary flavonoids have been recognized for their antioxidant and antiproliferative effects which may protect the human body from various diseases, such as cancers, cardiovascular and inflammatory diseases [26]. The presence of flavonoids in both fruits may be the reason why the people use *P. guajava* extract in treating wound infections and managing inflammation. Glycosides and steroids tested positive in the test and control samples but terpenoids were not detected in the control fruits. Glycosides have been reported to lower blood pressure while steroids and terpenoids have been associated with antibacterial properties. Glycosides, steroids and terpenoids are also known to have curative activity against several pathogens [27]. The presence of the tested secondary metabolites support the traditional use of the fruits in treatment of some diseases but further investigations are required to confirm this claim.

Table 1. Qualitative Phytochemical screening of *P. guajava* and *C. sativus*

Phytochemicals	*P. guajava*		*C. sativus*	
	Ts	**Ctr**	**Ts**	**Ctr**
Proteins	+	+	+	+
Carbohydrate	+	+	+	+
Phenols	+	+	-	+
Flavonoids	+	-	+	+
Saponins	+	-	-	-
Glycosides	+	+	+	+
Steroids	+	+	+	+
Terpenoids	+	-	+	-
Alkaloids	+	-	-	-

Ts= test sample, Ctr= control sample

4. CONCLUSION

This study provides an evidence that *Psidium guajava* and *Cucumis sativus* may serve as constituents of human diet supplying the body with the required nutrients. The phytochemical properties exhibited by the studied fruits support their traditional use in treatment of some diseases. The absence of important phytochemicals in the control fruits indicates that the studied fruits have desirable health benefits beyond basic nutrition when compared to the control and they have high potential protective vices against diseases than the control fruits. The result is also expected to guide the consumers in area of study, on the nutritional benefits and health status of the studied fruits which will also help them in selection of the fruits to plant and consume. This study only provided a preliminary investigation but further studies will investigate the quantitative phytochemical properties, the anti-nutritive properties, heavy metal contents and toxicity of the fruits.

ACKNOWLEDGEMENTS

The authors are grateful to Idris Garba of Chemistry department, Yobe State University

and staff of NAFDAC Zonal Laboratory Maiduguri for their assistance during the period of analysis.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=892&id=7&aid=7603