ISSN 2581 – 4303

Available Online at www.ijpba.info
International Journal of Pharmaceutical & Biological Archives 2018; 9(4):242-245

RESEARCH ARTICLE

Evaluation of Bioactive Compound from Cashew Apple Juice by Gas Chromatography–Mass Spectrum Analysis

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Received: 19 November 2018; Revised: 12 December 2018; Accepted: 18 December 2018

ABSTRACT

Cashew, *Anacardiu moccidentale* L. belongs to the family Anacardiaceae, it originates from south and central America. It produces a pseudocarp on which the nut is attached. This study was aimed to investigate the presence of bioactive phytochemical constitutions of *A. moccidentale*. *A. moccidentale* L. of methanolic extracts gives up to different phytocomponents was confirmed by gas chromatography–mass spectrum analysis. The bioactive compounds such as 9,12-octadecadienoic acid (Z, Z)-, tetradecanoic acid, and 9-octadecadienoyl acid (Z, Z)- were also present in cashew apple (CA). However, these compounds are used in same ayurvedic medicine of antimicrobial, anti-inflammatory, anticholesterol, and anticancer activities. The results ensured that the biowaste CA is a good source of various bioactive compounds which can be used to develop nutritious value-added food and beverages.

Keywords: *Anacardiu moccidentale*, cashew, gas chromatography–mass spectrum, tetradecanoic acid, and 9-octadecadienoyl acid (Z, Z)-, anticholesterol

INTRODUCTION

Anacardium occidentale L. (*Anacardiaceae*), popularly known as cashew tree, is native from Brazil. The cashew apple (CA) is not a true fruit, but a swollen peduncle to which the cashew nut is attached. It is a soft but fibrous juicy fruit. It possesses exotic flavor characteristics. Based on the external color of the fruit, CA can be broadly classified into red and yellow varieties.[1] The cashew nut is kidney shaped with an exterior, hard shell, and interior white kernel. CA is a hard, pear-shaped, green fruit that turns red, yellow, or orange during maturation.[2] The cashew nut and CA are the two morphological parts of interest from the cashew tree.

The cashew nut and CA are the fruits of the cashew tree, with the nut referred to as the true fruit and the apple referred to as the false fruit. CA juice is rich in sugar, Vitamin C[3] and is widely consumed in Brazil. CA juice has the potential to be a natural source of Vitamin C and sugar in processed foods.[4] Although CA can be consumed as juice, ice cream, and other foodstuffs, the cashew tree cultivation in Brazil and other countries is an agricultural activity that aims mainly the production of cashew nuts. The nuts represent only 10% of the total fruit weight and large amounts of CA are lost in the field after the removal of the nut.[5]

CA is very popular and highly consumed as ready to drink and concentrated juice.[6] Representing 90% of the fruit, CA has high ascorbic acid and phenols content. Thus, CA is considered a good source of antioxidant compounds.[7,8] CA is also rich in reducing sugars (fructose and glucose), minerals, and some amino acids.[9]

CA is reported to possess several biological activities such as antimicrobial,[10-12] antioxidant,[13] antitumor,[14] and antimutagenic.[15] The plant is mainly found along the coast of the Northeastern states and is of great economic and medicinal value. The main ethnopharmacological[16] applications of the species include the treatment of infectious and inflammatory diseases and pain conditions such as venereal diseases, skin diseases, diarrhea, stomatitis, aphthae, bronchitis, intestinal cramps, muscle weakness, diabetes, tooth pain, weakness, inflammation, psoriasis, and cough.[1]

CA color varied from bright red and yellow with a soft and fibrous flesh. In this present study, bioactive properties of *Anacardium occidentale* apple juicehave been evaluated..

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MATERIALS AND METHODS

Sample collection

CAs (*A. occidentale* L.) were harvested in the mature stage at crop season (April–June 2017). CAs were collected from Cuddalore district, which was highly covered with rich and fertile grimy clay.[17] CAs are immediately placed in plastic boxes only one layer of CAs protected from mechanical injury.[18]

Juice extraction

The collected cashew fruits were transported to the laboratory, where the nuts were detached. The apples were washed thoroughly with distilled water. Then, they were cut and the juice obtained by pressing the mash through a muslin cloth was used for various clarifications.

Preparation of CA juice sample for Gas Chromatography–Mass Spectrum (GC–MS)

CA juice was centrifuged at 10,000 rpm for 15–20 min. Then, the supernatant was transferred to a fresh microcentrifuge tube. Then, the 2 ml of the supernatant was mixed with 2 ml of methanol. This was mixed well and kept for some time at room temperature for separation. CA juice was extracted with methanol and that extract was analyzed using GC–MS for different bioactive components.

GC–MS analysis was carried out on a GC Clarus 500 PerkinElmer system comprising a AOC-20i autosampler and GC–MS instrument employing the following conditions: Column Elite - 1 fused silica capillary column (30 × 0.25 mm ID 1 × EM df, composed of 100% dimethylpolysiloxane), operating in electron impact mode at 70 eV; helium (99.999%) was used as carrier gas at a constant flow of 1 ml/min and an injection volume of 0.5 EI was employed (split ratio of 10:1 injector temperature 250°C; ion source temperature 280°C. The oven temperature was programmed from 110°C (isothermal for 2 min). The oven temperature was programmed from 110°C (isothermal for 2 min) with an increase of 10°C/min, to 200°C then 5 EI/min to 280°C, ending with a 9 min isothermal at 280°C. . Mass spectra were taken at 70 eV; a scan interval of 0.5 s and fragments from 40 Da to 550 Da.

Identification of components

Interpretation on mass spectrum GC–MS was conducted using the database of National Institute of Standards and Technology (NIST) having >62,000 patterns. The spectrum of the unknown component was compared with the spectrum of the known components stored in the NIST library.

RESULTS AND DISCUSSION

Biological Activity of phytocomponents identified in the methanol extract of CA juice by GC–MS

The studies on the active principle in the methanolic extract of *A. occidentale* L. by GC–MS analysis

Table 1: The bioactive phytocomponents identified in the methanolic CA juice extract by GC–MS analysis

Peak no	Retention time	Identified compounds name	Biological activity	Molecular formula	References authors
1	12.66	Phenol, 2,4-bis (1,1-dimethylethyl)	Antifungal activity	$C_{14}H_{22}O$	[19]
2	12.62	Tetradecanoic acid	Anti-inflammatory and cancer preventive	$C_{14}H_{28}O_2$	[20]
3	14.83	n-Hexadecanoic acid	Antibacterial, antioxidant, and antidiabetic activity hypocholesterolemic	$C_{16}H_{32}O_2$	[21]
4	15.35	2,6,10-trimethyl, 14-ethylene-14-pentadecne	Antiproliferative	$C_{20}H_{38}$	[22]
5	16.12	9-octadecenoic acid (Z)-Methyl Ester	Antiviral and antibacterial activity	$C_{18}H_{32}O_2$	[21]
6	16.32	Oleic acid	Antitumor	$C_{18}H_{34}O_2$	[23]
7	16.45	Trans-13-octadecenoicacid	Urine acidifier	$C_{18}H_{34}O_2$	[23]
8	16.56	octadecenoic acid (Z)-, methyl ester	Antiarthritic, antioxidant activity, and antiviral activity	$C_{18}H_{36}O_2$	[24]
9	16.79	9,12-octadecenoic acid (Z)-, methyl ester	Antioxidant activity	$C_{18}H_{32}O_2$	[25]
10	49.32	2,3-dihydroxypropyl ester	Antioxidant, antieczemic activity	$C_{21}H_{42}O_4$	[26]

GC–MS: Gas chromatography–mass spectrum, CA: Cashew apple

clearly showed the presence of 11 compounds. The result showed that the compounds (Table 1) phenol,2,4-bis(1,1-dimethylethyl) (3.22%), tetradecanoic acid (5.67%), oleic acid (13.01%), n-hexadecanoic acid (14.65%), trans-13-octadecenoic acid (17.01%), 9-octadecenoic acid (Z)-, methyl ester (18.3%), octadecenoic acid (Z)-, methyl ester (19.01%), 9,12-octadecenoic acid (Z)-, methyl ester(19.38%), 2,3-dihydroxypropyl ester (17.30%), and 2,6,10-trimethyl,14-ethylene-14-pentadecane (8.93%). The spectrum profile of GC–MS confirmed the presence of 11 major components with retention time 12.66, 12.62, 14.83, 15.35, 16.32, 16.45, and 16.12, respectively. The results suggested that the four compounds belongings to unsaturated fatty acid group which is 9,12-octadecenoic acid (Z), 9-octadecenoic acid(Z), methyl ester, trans- 13 octadecanoic acids and tetradecanoic were found in cashew apple juice extract. polyunsaturated fatty acids have a wide range of biological functions, especially 9,12-octadecadienoic acid which belongs to the family of n-6 polyunsaturated fatty acids and (Z, Z, Z)-9,12,15-octadecatrienoic acid which belongs to n-3 family of polyunsaturated fatty acids,[27] plays an important role in control of infectious diseases. In terms of percentage amounts, n-hexadecanoic acid, tetradecanoic acid, 9-octadecanoic acid, oleic acid, and 9,12-octadecanoic acid were predominant in CA juice extract. These major compounds have all shown to have antiarthritic, hypocholesterolemic activity, antitumor, antioxidant,[28] and anti-eczema activity. Anticancer and antiproliferative are shown by tetradecanoic acid and 2,6,10-trimethyl-14-ethylene-14-pentadecane, while other compounds show antimicrobial and anti-inflammatory activities. The multidrug-resistant bacterial pathogens were potentially inhibited by microbially synthesized silver nanoparticles.[29]

CONCLUSION

CA juice was evaluated to the bioactive compounds analyzed. CA is a waste of biomass in the environment. CA used in same ayurvedic medicine. We report the presence of some of the important components resolved by GC–MS analysis and their biological activities. The bioactive compound found in the extract of CA octadecadienoic acid (Z, Z) family groups is found to be higher quantity. Hence, the biowaste of CA can act as a source of antioxidant and mineral supplement in food as allied products.

ACKNOWLEDGMENT

This work was funded by UGC under the Rajiv Gandhi National Fellowship for SC/ST Candidate Scheme, New Delhi, India.

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