Bull. Pharm. Sci., Assiut University, Vol. 44, Issue 1, 2021, pp. 49-62.

Bulletin of Pharmaceutical Sciences
Assiut University
Website: http://bpsa.journals.ekb.eg/
e-mail: bullpharm@aun.edu.eg

BULL. PHARM. SCI. Assiut Univ.

PROXIMATE AND ELEMENTAL ANALYSES, PHYTOCHEMICAL SCREENING AND ANTIOXIDANT ACTIVITIES OF AQUEOUS AND ETHANOL EXTRACTS OF *SOLANUM INCANUM* LINN. FRUITS

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Solanum incanum Linn. (Solanaceae) is a perennial bushy herb used to stained teeth among the Kanuri women and in making vegetable soups. This study determined proximate and elemental contents, phytochemical constituents and antioxidant activities of the fruit. The proximate analyses showed the presence of crude fibre, carbonhydrate and crude protein while the elemental analyses revealed the presence of magnesium, calcium and sodium. The fruit contains; saponins, tannins, flavonoids, terpenoids, cardenolite, glycosides, reducing sugars, phenolics content and flavonoids content. The results of antioxidant showed that the EC_{50} values for DPPH radicals with aqueous and ethanol fruit extracts of the S. incanum Linn. were found to be 0.02488 and 0.1000 mg/ml, respectively. The aqueous extract showed EC_{50} value lower than ethanol extract. In conclusion, this results suggested that aqueous extract of S. incanum Linn might contain more potential antioxidant compounds than ethanol extract.

INTRODUCTION

The plants and their products obtained directly or indirectly serve as an important source of food, medicinal product, energy and shelter to man and his livestock[1]. Plants consists of different chemical constituents which includes various beneficial bioactive compounds like vitamins, nutrients, antioxidants, anticarcinogens and many other compounds with medicinal value[2]. Most of these bioactive compounds or phytochemicals acts along with nutrients and dietary fibre to protect against various diseases[3]. Natural antioxidants are usually safe with fewer adverse reactions than synthetic antioxidants[4]. Many plants have been reported as a viable source of natural antioxidants such as tocopherol, vitamin C, carotenoids and phenolic compounds which helps in health maintenance[3&5].

Solanum incanum Linn. (Solanaceae) is a perennial bushy herb or shrub of 1.8 m high with spines on the stem, leaves, stalks and calyces and velvet hairs on the leaves. It is also known as bitter garden egg or apple of Sodom or bitter apple (English), "ikan or igba" (Yoruba Language), "tarku" (Bura/Babar) and "gautandaacii" (Hausa Language)[6-8]. It is widely distributed in Kaduna State, Borno State and other parts of Northern Nigeria such as Adamawa, Jos etc and South West of

Received in 3/12/2020 & Accepted in 16/1/2021

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Nigeria[9]. In Borno State, the plant is used to stained teeth among the Kanuri women and also used in making vegetable soups[10]. The Knowledge of the proximate, elemental, phytochemical constituents and antioxidant properties of *S. incanum* will be a very useful tool in maximizing the medicinal use of this fruit. Pandey *et al*.[11] reported the importance of proximate and elemental analyses of edible plant and vegetables in assessing their nutritional values and understanding the pharmacological activities of these medicinal plants. The elements present in the food at major, minor and trace levels are vital for human wellbeing with health challenges when taking in excessive or limited amount[3,12&13]. Both metallic and non-metallic elements are required for healthy growth, development and proper functioning of cells, tissues, organ and system within the human body. The phytochemical constituents of different parts of *S. incanum* revealed various secondary metabolites such as: alkaloids, steroids, resins, glycosides, flavonoids, saponins, tannins, oxalates, triterpenes, cyanogenic glycosides, cardiac glycosides, steroidal glycoalkaloids, lignans, coumarin glucoside and simple phenolics were found to be the dominant compounds in the plant[9,14-17].

The fruits of *S. incanum* Linn. is used ethnomedicinally in the treatment of sore throat, angina, stomach pain, colic, headache, skin diseases (e.g. dandruff), infections, fever, indigestion, painful menstruation and liver pain[18&19]. In Niger, Sudan, Rwanda and Namibia the fruits are used as an ingredient of arrow poison and in Mozambique as fish poison[20]. In Ethiopia, the fruit juice is used by peasant farmers to control ticks[21]. In Borno State, *S. incanum* Linn. is used to stain teeth among the Kanuri women and also used in making vegetable soups[10]. The leaves, fruits and roots of *S. incanum* Linn. are used as memory enhancer in the South West of Nigeria[8&22]. The root of the plant has been reported with antipyretic, antinociceptive and spasmolytic effects[23]. The aqueous root extract of *S. incanum* inhibited the response to acetylcholine in a concentration-dependent manner similar to atropine in assessment of contractions of isolated guinea pig ileum induced by acetylcholine[24]. The fruits of *S. incanum* were also reported with marked broad spectrum antibacterial, antifungal activities and against multi-drug resistant strain of bacterial isolates[25-29]. The juice obtained by chewing or squeezing *S. incanum* leaves significantly reduced the postprandial glucose surge in normoglycemic humans[30]. Solamargine, an alkaloid from *S. incanum* Linn. has been reported to disrupt phosphatidylcholine or cholesterol liposomes[31] and was also reported with anticancer activity[32-34]. Hence, the present study was undertaken to investigate the proximate, elemental, phytochemical constituents and antioxidant properties of *S. incanum* fruits.

MATERIALS AND METHODS

Plant collection, identification and authentication

Fresh leaves and unripe fruits of *S. incanum* Linn. were collected from Mulbiya in Hawul Local Government Area, Borno State, Nigeria between January-March, 2017. Identification and authentication of the plant was done by plant taxonomist, Professor S. S. Sanusi of Department of Biological Science, Faculty of Sciences, University of Maiduguri and voucher specimen (Voucher No. DCPT 014) deposited in Pharmacology Laboratory, Department of Clinical Pharmacology and Therapeutics of the College of Medical Sciences, University of Maiduguri.

Drugs and chemicals

L-ascorbic acid, butylated hydroxytoluene (BHT) and 2,2-diphenyl-1-picryl hydrazyl (DPPH) radical were purchased from Sigma Aldrich, United State of American (USA). All drugs and extracts were freshly prepared in distilled water on the day of experiments. All chemicals were of analytical grades.

Preparation of extracts

The unripe fruits of *S. incanum* were washed and cleaned. They were cut into small pieces, air dried at room temperature, pulverized into a coarse powder of about 1 mm in diameter. Extraction was done using cold maceration method as described by Bandar *et al*.[35]. Five hundred gram (500 g) each of the plant material was soaked in 99.7% ethanol (2 L) and distilled water (2 L) and allowed to stand for 3 days at room temperature, with

agitation at intervals. Afterwards, each solution was sieved through a muslin cloth and filtered through a Whatman (No. 1) filter paper. The filtrates were dried in oven at 40 °C. The dried mass was stored in a sterile McCartney bottle and kept in the refrigerator until use. The percentage yield was determined using the formula below:

$$\text{Percentage Yield} = \frac{\text{Yield}}{\text{Original weight of plant used}} \times 100\,(\%)$$

Proximate analyses

The parameters determined for proximate analyses include ash, moisture, crude protein, fat, fiber and carbohydrate. Portions of *S. incanum* fruits were analyzed for their proximate compositions using the methods described by Association of Official Analytical Chemists (AOAC)[36].

Elemental analyses

The elemental analyses of *S. incanum* Linn. was done using Sp-9-single beam atomic absorption spectrophotometer (Philip/pye Unicom Ltd, England) as described by Oshodi[37] for the following metals: Mg, Zn, Fe, Cd, Cu, Pb, Ca, Cr, Hg and Co while flame emission spectrometer (Model FGA-330L; Gallenkamp, Weiss, UK) was used for the analyses of K and Na.

Preliminary phytochemical evaluation of the extract

The phytochemical analyses of both aqueous and ethanol extracts were carried out as described by Brain and Turner[38]; Vishnoi[39]; Markham[40]; Silver *et al.*[41]; Khandelwal[42]; Sofowora[43]; Evans[44].

Determination of total phenolic content

The total phenol content of the extracts was determined using the Folin-Ciocalteu's method of Singleton and Rossi[45] as described by Gulcin *et al.*[46].

Determination of total flavonoid content

The estimation of the total flavonoid content of the extracts were based on the aluminium chloride colorimetric method according to the method of Zhilen *et al.*[47].

Assessment of antioxidant activities of the extracts

DPPH (1,1-diphenyl-2-picrylhydrazyl) radical scavenging activity

The total free radical scavenging activity of each extract was determined using the DPPH assay[48]. The EC_{50} value is the concentration of extract that decreases the initial DPPH concentration by 50%.

Ferric reducing antioxidant power (FRAP) assay

The FRAP assay uses antioxidant as reductants in redox linked colorimetric method with absorbance measured with a spectrophotometer[49]. The principle of this method is based on the reduction of a colourless ferric-tripyridyltriazine complex to its blue ferrous coloured form owing to the action of electron donating in the presence of antioxidants. All measurements were taken at room temperature with samples protected from direct sunlight. The reducing power was expressed as ascorbic acid equivalents concentration which is defined as the concentration of antioxidant that gave a ferric reducing ability equivalent to that of ascorbic acid standard[50].

Evaluation of total antioxidant capacity (TAC)

The total antioxidant assay was carried out based on the reduction of Mo (VI) to Mo (V) by the extracts and subsequent formation of a green phosphate/Mo (V) complex at acidic pH[51]. The antioxidant activity was expressed as mg ascorbic acid equivalent (mg AAE/g extract).

Statistical analyses

Data obtained were expressed as mean ± standard error of mean (SEM) and subjected to statistical analyses using computer software GraphPad® InStat version 5.01[52]. Differences among means were shown as P-values. Values of $p \geq 0.05$ considered non-significant.

RESULTS AND DISCUSSION

Results

Percentage yields of the extracts

The percentage yield of both aqueous and ethanol fruits extract of *S. incanum* was 34.5

and 30.64% w/w, respectively as shown in figure 1 ($p > 0.05$).

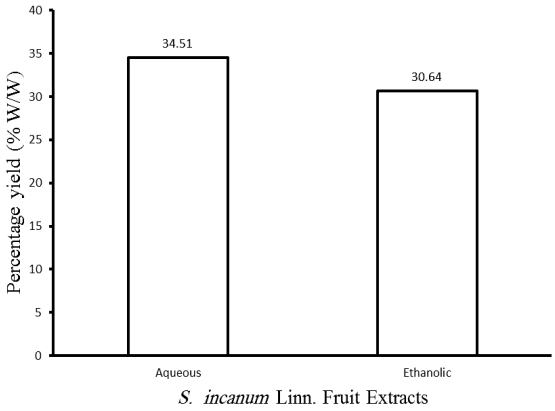

Fig. 1: Percentage yields of the aqueous and ethanol fruit extracts of *S. incanum* Linn ($p > 0.05$).

Proximate compositions of the fruits

The proximate compositions determined in the fruit of *S. incanum* are summarized in table 1. The fruits revealed the presence of dry matter, carbohydrate, crude fiber, crude proteins, moisture and ash contents.

Table 1: Proximate composition of *Solanum incanum* Linn. Fruits.

Parameter	Composition (mean±SEM)
Ash content	4.00 ± 0.34
Carbohydrate	52.50 ± 0.14
Crude fibre	28.00 ± 1.00
Crude protein	10.89 ± 0.42
Dry matter	95.40 ± 0.31
Ether extract/fat	6.00 ± 0.35
Moisture content	4.60 ± 0.24

Each value is an average of three determinations.

Elemental compositions of the fruits

The elemental compositions of *S. incanum* fruits are shown in table 2. All the elements detected were far below the WHO/FAO maximum permissible limits.

Phytochemical constituents of the extracts

The phytochemical constituents of aqueous and ethanol extracts of *S. incanum* fruits are presented in table 3. The qualitative phytochemical analyses showed the presence of carbohydrates, cardiac glycosides, terpenoids, flavonoids, saponins, tannins and alkaloids in both extracts while the presence of cardenolites is only in the aqueous extract. Total phenolic and total flavonoid contents of the aqueous and ethanol extracts of *S. incanum* fruits are presented in table 4. There was no significant difference in the total phenolic and flavonoid content of the aqueous and ethanol extracts of the fruits ($p > 0.05$).

Antioxidant activities of the fruit extracts

DPPH (1,1-diphenyl-2-picrylhydrazyl) radical scavenging activity

The DPPH radical scavenging activity of the fruit extracts are expressed as the mg ascorbic acid equivalent/g (Table 5). The results of both ethanol and aqueous fruit extracts showed a significant radical scavenging activity in a dose dependent manner ($p < 0.05$). The aqueous extract inhibited DPPH over 70% at concentrations 0.2-0.5 mg/mL that were not significantly different from those of the positive control ($p > 0.05$). The EC_{50} values for DPPH radicals with aqueous and ethanol fruit extracts of the *S. incanum* Linn. were found to be 0.02488 and 0.1000 mg/ml, respectively.

Ferric reducing antioxidant power and total antioxidant capacity

The results of ferric reducing antioxidant power (FRAP) as expressed as mg of Ascorbic acid equivalent/g and total antioxidant capacity (TAC) of the fruit extracts are presented in table 6. There is no significant difference between the FRAP of aqueous and ethanol extracts ($p > 0.05$) whereas, the TAC showed a significant difference between both extracts ($p < 0.05$). However, the TAC is higher than FRAP for both extracts ($p < 0.05$).

Discussion

The present study determined the proximate components, elemental contents and phytochemical constituents and antioxidants activities of aqueous and ethanol fruit extracts of *S incanum* Linn. The similarity in the percentage yields of both solvents is an indication that both distilled water and ethanol are equally effective for the extraction of phytoconstituents of *S. incanum.* Previously, studies have demonstrated that water and ethanol are ideal solvents for extraction of constituents of plants[53&54].

The protein, fiber, ash, moisture, fat and carbohydrate that were observed in this plant showed its medicinal properties. The presence of carbohydrate indicated that the fruit could serve as source energy required by the body and supplied energy to cells such as brain, muscle and blood[55&56]. Low fat and high dry matter composition of the *S. incanum* Linn. fruits may be helpful in preventing such diseases as constipation, carcinoma of the colon and rectum, diverticulitis and atherosclerosis as reported by Odetola *et al.*[57]; Showemimo and Olarewaju[58] and Edijala *et al.*[59]. The presence of protein in the fruit could serves as various body functions such as body development, maintenance of fluid balance, formation of hormones, enzymes and sustaining strong immune function[56].

S. incanum Linn. showed the presence of Ca, Na and Mg. The high concentration of certain metals, Ca, Na and Mg in the plants are essential for proper growth and normal functioning of the plant[60]. *S. incanum* fruits exhibited Ca levels that were within the recommended range for plants[61]. In this study, the concentration of Na in the *S. incanum* fruits is within the permissible limits of 2, 000 mg/day by WHO or 1,500 mg/day by American Heart Association (AHA)[62]. It also exhibited Mg levels within the recommended range for plants. Thus, the plant species is a good source of dietary Ca, Na and Mg. Mg which activates many enzyme systems, including those involved in energy metabolism plays an essential role in the production of adenosine triphosphate (ATP), which is fully functional only when chelated to magnesium[63]. Low levels of magnesium have been associated with a number of chronic and inflammatory diseases, such as Alzheimer's disease, asthma, attention deficit hyperactivity disorder (ADHD), insulin resistance, type-2 diabetes mellitus, hypertension, cardiovascular disease (e.g., stroke), migraine headaches and osteoporosis[64-66]. The ionized magnesium concentrations were significantly related to cognitive function and not physical function[65]. This suggested that *S. incanum* Linn. fruit may be helpful in preventing such diseases and in maintaining the osmotic equilibrium in the plasma and extracellular fluid[67] due to the presence of Mg and Na, respectively. *S. incanum* fruits also possessed a considerable amount of potassium (K), iron (Fe), copper (Cu), zinc (Zn), lead (Pb), chromium (Cr) and mercury (Hg) within permissible limits. Potassium as a useful macronutrient, plays a vital role in the regulation of action potentials and intercellular signaling in electrically active cells. In both excitable and non-excitable cells, K channels regulate various functions which include: regulation of membrane potential, signal transduction, insulin secretion, hormone release, regulation of vascular tone, cell volume and immune response[68]. Optimal Fe concentration is required for the endurance of plants, animals and microorganisms[69]. Obesity which predisposes an individual to various diseases is controlled by oxidation of biomolecules that is facilitated by presence of Fe. Fe is also essential for hemoglobin formation[67]. It plays a role in energy transfer within the plant and also an essential constituent of certain enzymes and proteins[70]. It is also essential for the normal functioning of central nervous system[71&72]. Copper is an essential element for plants and animals which is vital for various human metabolic systems. It regulates various biological systems such as: production, connective tissue formation, iron metabolism and neurotransmitter synthesis[68]. Deficiency of copper can lead to anemia, bone changes and neutropenia in animals[73]. Cu toxicity can cause kidney and liver damage[69]. Zn is the basic component of a large number of different enzymes and plays structural, regulatory and catalytic functions. It also has very important role in DNA synthesis, normal growth, brain development, bone formation and wound healing[74]. It is found in almost all body tissues[68] and acts as anti-inflammatory, antioxidant, bone resorptive, as well as important for cell signaling, release of hormones and in apoptosis. Acute zinc toxicity causes abdominal pain, nausea, vomiting and diarrhea. Chronic exposure to zinc also contributes to copper deficiency and neurotoxicity[69,75&76].

Some heavy metal elements (Pb, Cr and Hg) were detected in the fruits, however, they were within the permissible limits[77-79]. Cr acts as an activator in most of the enzymes and helpful in lipoproteins, carbohydrate and nucleic acid metabolism[73]. Chromium plays a vital role in the biosynthesis of fatty acids and cholesterols, metabolism of carbohydrates,

proteins, lipids and has been shown to facilitate the action of insulin[73&75].

The phytochemical analyses revealed that *S. incanum* fruit extracts contain different biologically active compounds which could serve as potential source of medicine. The presence of alkaloids, tannins, steroids, saponins and reducing sugars have been reported in most of the plants of Solanaceae[15,80&81]. The results of the qualitative phytochemical screening are in agreement with the previous work done by Sambo *et al.*[81]; Manal *et al.*[82]; Sahle and Okbatinsa[83]. Bitterness of *S. incanum* fruits could be attribute to the presence of alkaloids. Saponins found in the fruits are important dietary supplements and nutraceuticals. Glycoalkaloids and saponins are known to exhibit antimicrobial activities and protect plants from microbial pathogens. In addition, studies have reported that saponins present in traditional medicine preparations cause hydrolysis of glycoside from terpenoid to avert the toxicity associated with the intact molecule[84]. *Solanum incanum* fruits contain flavonoids and tannins which are potent antioxidants and free radical scavenger and they have been shown to protect cell membranes from damage[81&85]. *In-vitro* studies have also shown that flavonoids have anti-allergic, anti-inflammatory, anti-microbial and anti-cancer activities[86&87]. Thus, this fruit can be used as medicinal agent.

In recent years, natural antioxidants have drawn much attention due to their health benefits. Most of the available antioxidant-based drug formulations are used for the prevention and treatment of many complex diseases. Plants have been reported to produce a wide range of secondary metabolites with antioxidant activities[88]. The *S. incanum* fruit extracts demonstrated antioxidant characteristics, evident by demonstration of FRAP, TAC and scavenging properties of both aqueous and ethanol fruit extracts. This could be associated to the phenolic constituents of the fruits[89&90]. The total antioxidant capacity (TAC) evaluates both water-soluble and fat-soluble antioxidants[91]. In FRAP, the antioxidant was determined by the reductive ability of the extracts, it has been found that the Fe^{3+}–Fe^{2+} transformation occurred in the presence of extract samples[92]. It has been earlier reported that there is direct correlation between antioxidant activity and reducing power of certain plant extracts[93]. Hence, *S. incanum* fruit extracts showed potent scavenging activity comparable to that of ascorbic acid especially that of aqueous extract.

In conclusion, the present study reveals the presence of important phytochemicals, moisture, carbohydrates and crude proteins, crude fat and considerable calorific value in the fruit of *S. incanum*. The elements such as calcium, potassium, magnesium, zinc and sodium are present in appreciable levels. The extracts showed antioxidant property and this confirms the medicinal and nutritive potential of *S. incanum* fruits.

Table 2: Elemental compositions of *Solanum incanum* Linn. Fruits.

Elements	Concentration (mg/kg)	FAO/WHO Maximum Permissible Limit (mg/kg)	References
Mg	77.0	2000	Omokehinde *et al.*[94]
Ca	201.0	614	Khan *et al.*[68]
K	4.0	32500	Nkuba and Mohammed[95]
Na	180.0	51340	Khan *et al.*[68]
Fe	0.50	20.0	WHO[77]; Niaz *et al.*[79]
Cu	0.16	10.0	Niaz *et al.*[79]
Zn	0.084	50	Khan *et al.*[96]; Niaz *et al.*[79]
Pb	0.4	10.0	WHO[77]; Niaz *et al.*[79]
Cd	Not detected	0.3	Niaz *et al.*[79]
Cr	0.06	1.5	WHO[77]; Niaz *et al.*[79]
Hg	0.006	0.1	Maobe *et al.*[78]
Co	Not detected	3.50	Odoh and Ajiboye[97]

WHO: World Health Organization FAO: Food and Agriculture Organization

Table 3: Qualitative Phytochemical constituents of aqueous and ethanol fruit extracts of *Solanum incanum* Linn.

Plant Constituents/Test	Aqueous Extract	Ethanol Extract
Test for Alkaloids		
Dragendoff's reagent	+	+
Mayer's reagent	+	+
Carbohydrates		
General test (Molisch's Test)	+	+
Test for free reducing sugars (Fehling's Test)	−	+
Test for combined reducing sugars	+	+
Test for Ketoses	+	+
Test for Cardenolites		
Keller-Killani's test	+	−
Test for Cardiac Glycosides		`
Salkowski's test	+	+
Lieberman-Burchard's test	+	+
Test for Flavonoids		
Shinoda's test	+	+
Ferric Chloride	−	+
Lead Acetate	+	−
Sodium hydroxide	−	+
Test for Saponin Glycosides		
Frothing test	+	+
Test for Tannins		
Ferric Chloride	−	+
Lead acetate	+	−
Test for Terpnoids	+	+

+ Present − Absent

Table 4: Total phenolic content (mg GAE/g) and flavonoid content (mg RE/g) of *S. incanum* Linn. Fruits.

Extract	TPC (mg GAE /g)	TFC (mg RE/g)
	Mean ± SEM	
Ethanol	1.810 ± 0.07322	0.8589 ± 0.4280
Aqueous	1.595 ± 0.0624	1.260 ± 0.1311

GAE: Gallic acid equivalent RE: rutin equivalent $p > 0.05$

Table 5: DPPH radical scavenging activity of aqueous and ethanol extracts of *S. incanum* Linn. Fruits.

Concentration mg/ml	Percentage inhibition (%)		
	Ascorbic Acid	Ethanol extract	Aqueous extract
0.1	92.20 ± 1.20	30.86 ± 1.10^{***a}	66.78 ± 1.32*
0.2	93.00 ± 2.20	36.12 ± 2.31^{***a}	72.70 ± 1.81
0.3	93.92 ± 1.23	39.03 ± 2.21^{***a}	73.85 ± 1.02
0.4	94.27 ± 2.11	52.35 ± 1.45**	75.30 ± 1.72
0.5	95.54 ± 1.34	56.16 ± 1.52**	77.71 ± 1.64
EC_{50}	0.002313 ± 0.00010	0.02488 ± 0.00123	0.1000 ± 0.00512

$^{*}p < 0.05$, $^{**}p < 0.01$ and $^{***}p < 0.001$ when compared with the Ascorbic acid and $^{a}p < 0.01$ when compared with aqueous extract.

Table 6: Ferric reducing antioxidant power and total antioxidant capacity of aqueous and ethanol extracts of *S. incanum* Linn. Fruits.

Tests	Standard equivalent in ethanol extract (mg AAE/g)	Standard equivalent in aqueous extract (mg AAE/g)
FRAP	$1.210x10^{-3} \pm 1.429\ x10^{-4}$	$1.257x10^{-3} \pm 2.186x10^{-4}$
TAC	6.767 ± 0.096	$3.508 \pm 0.064^{*}$

$^{*}p < 0.05$

Acknowledgments

The authors thank Mr. Justus Jibrin (Department of Clinical Pharmacology and Therapeutics, College of Medical Sciences, University of Maiduguri, Nigeria) and Mr. Fine (Department of Chemistry, Faculty of Sciences, University of Maiduguri, Nigeria) for providing technical supports during the course of work.

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نشرة العلوم الصيدلية
جامعة أسيوط

BULL. PHARM. SCI. Assiut Univ.

التحليلات التقريبية والتحليلات للعناصر ، والفحص الكيميائي النباتي وأنشطة مضادات الأكسدة للمستخلصات المائية والإيثانولية لثمار نبات الحدق الغباري

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الحدق الغباري (الباذنجانيات) هو عشب كثيف معمر يستخدم لصباغة الأسنان بين نساء الكانوري وفي صنع حساء الخضار. حددت هذه الدراسة المحتوى التقريبي ومحتوى العناصر ، والمكونات الكيميائية النباتية وأنشطة مضادات الأكسدة لثمار النبات. أظهرت التحاليل التقريبية وجود ألياف خام وكربوهيدرات وبروتين خام بينما أظهرت التحليلات للعناصر وجود المغنيسيوم والكالسيوم والصوديوم. تحتوي الثمار على ؛ السابونين ، التانينات ، الفلافونويد ، التربينويدات ، الكاردينوليت الجليكوسيدات ، السكريات المختزلة ، محتوى الفينولات ومحتوى الفلافونويد. أظهرت نتائج مضادات الأكسدة أن قيم التركيز المؤثر على نصف العينة EC50 مع DPPH مع مستخلصات الثمار المائية والإيثانولية لنبات الحدق الغبار وجد أنها ٠,٠٢٤٨٨ و ٠,١٠٠٠ مجم / مل على التوالي. أظهر المستخلص المائي قيمة EC_{50} أقل من مستخلص الإيثانول. تشير هذه النتائج إلى أن المستخلص المائي لـ نبات الحدق الغباري قد يحتوي على مركبات محتملة مضادة للأكسدة أكثر من مستخلص الإيثانول.