https://dx.doi.org/10.4314/dujopas.v10i2a.36
ISSN (Print): 2476-8316
ISSN (Online): 2635-3490
Dutse Journal of Pure and Applied Sciences (DUJOPAS), *Vol. 10 No. 2a June 2024*

Determination of Physico-Chemical Parameters, Chemical Elements and Acute Toxicity of *Eleusine Coracana* Leaf

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Abstract

Medicinal plants are a source of bioactive compounds which are responsible for their therapeutic properties that are utilized in the treatment and management of several diseases. This study aimed at investigating the phytochemical, elemental constituents and acute toxicity profile of the powdered leaf of finger millet. The percentage yield and phytochemicals of the extract were determined using standard methods. Elemental analysis was conducted using Atomic Absorption Spectophotometre. OECD (425) method was used to estimate the acute toxicity profile of the extract. The percentage yield of the extract was 7.0%. The phytochemical screening showed the presence of: alkaloids, carbohydrates, cardiac glycosides, flavonoids, phenolic compounds, steroids, saponins and tannins, while anthraquinones were found absent. Elemental analysis indicated the presence of calcium, cobalt, chromium, iron, magnesium and zinc. Cadmium and lead were below detection level while mercury was found to be below WHO limit. The LD_{50} was determined to be > 5000 mg/kg (OECD 425) with no signs of toxicity or mortality after 14 days.

Keywords: Plant-derived medicines, *Eleusine coracana* leaf, Elemental analysis, Phytochemical screening, Acute toxicity

INTRODUCTION

Plants have been used as complimentary or alternative medicine to treat different ailments for several decades. Traditional medicine is a core component of African culture since the stone age (WHO, 2004). The massive utilization of traditional medicine in Africa may be linked to high cultural acceptability, proven efficacy, ease of access, and affordability in comparison to modern medicine (Abebe *et al*., 2001).

Several compounds used in the synthesis of novel drugs with proven efficacy and minimal side effects were obtained from medicinal plants (Juárez-Rojop *et al.,* 2014). Most plants are known to be rich in minerals, vitamins and essential elements for normal body metabolism and cellular functions. Plants are also known to contain secondary metabolites such as alkaloids, tannins, flavonoids, phenols, saponins, cardiac glycosides, steroids and many other

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phytochemicals which have been proven scientifically to have medicinal properties when used in the right proportion (Edeoga *et al.,* 2005).

Finger millet (*Eleusine coracana* L.) belongs to the small millet family which serves as a wholesome food in India and some parts of Africa. Millets are mainly grown for the purpose of consumption by man or feeding animals. They have capability of slowing down digestion because of the various phytochemicals present in them. This causes sugars to be released more slowly into the bloodstream after consumption (Mall and Tripathi, 2016). Some millets are used for medicinal purposes such as *Sorghum bicolor* used in the management of retained placenta, (Mengesha, 2016) *Setaria italica* (foxtail millet) used for treating dyspepsia, *Pennisetum typhoides* (pearl millet) used as a purgative for children, *Paspalum scrobiculatum* (kodo millet) used for treating typhoid fever, *Panicum sumatrense* (little millet) used for the management of small pox and scalp infection and *Echinochloa crusgali* (barnyard millet) combined with powdered turmeric is used for the management of internal hemorrhage (Saha *et al.,* 2014).

Finger millet was reported to have different ethnomedicinal uses. The seed was used as an astringent, tonic and for cooling in Asia (Chopra *et al.* 1986). The whole plant is reported to be a diuretic, diaphoretic and vermifuge (Duke, 1983). The plant is a folk remedy for treating leprosy, liver disease, measles, pleurisy, pneumonia and small pox in Asia (Duke, 1983). These ethnomedicinal uses of finger millet have stimulated research interest in its pharmacological activities.

Various pharmacological studies have been carried out on the millet in order to validate the ethnomedicinal claims and set forth detailed pharmacological activities. The acidic methanol extracts from the seed coat of finger millet showed high antibacterial and antifungal activity (Viswanath *et al*., 2009). Likewise the ethanol leaf extracts of finger millet was shown to posses antihyperglycaemic and antihyperlipidaemic activities (Yaro *et al*., 2018) amongst other pharmacological activities. The aim of this research is to find out the acute toxicity profile, phytochemical constituents and determine the presence some important elements in the powdered leaf of finger millet (*Eleusine coracana*).

MATERIALS AND METHODS

Collection and identification of the plant

The leaves of *Eleusine coracana* were obtained from the natural habitat of the plant in Zaria local government Kaduna state, north western Nigeria. The plant was taken to the Herbarium unit of the Department of Plant Biology in Bayero University, Kano, Nigeria. It was identified and authenticated where a voucher number: BUKHAN 0299, was obtained for future reference.

Extract preparation

Eleusine coracana leaves were then air-dried under the shade to obtain a constant weight. Later, the dried leaves were then pulverized to produce a fine powder and macerated with ethanol. The extract was then concentrated and stored separately in a dessicator until further use. The resultant extract was termed ECE meaning *Eleusine coracana* extract.

Percentage yield of the extract

The percentage yield was calculated as : $\frac{\text{Final weight of the extract}}{\text{Initial weight of dried material}} x100$

Phytochemical Screening of the powdered leaf of *Eleusine coracana*

Phytochemical screening was carried out on the powdered leaves of *Eleusine coracana* using standard methods involving simple chemical tests Sofowora, (1982); Evan, (2002). It was done to find out the presence or absence of some secondary metabolites in the leaves like; alkaloids, anthraquinones, carbohydrates, cardiac glycosides, flavonoids, phenolic compounds, saponins, steroids and tannins.

Elemental analysis

The powdered leaves of *Eleusine coracana* were analysed using Atomic Absorption Spectrophotometer (210 VGP BUCK, scientific, U.K) at the Central Laboratory, Bayero University, Kano, Nigeria.

Acute toxicity

Acute oral toxicity studies using the up-and-down procedure were conducted according to the Organization for Economic Co-operation and Development (OECD) 425 guidelines (OECD, 2001). Limit test at a dose of 5000 mg/kg body weight was carried out in rats. The animals were observed during the first 30minutes after dosing and periodically during the first 24hours and then for 14days.

Experimental animals

Male Wistar rats (150-200g) were obtained from the Animal facility, Department of Pharmacology and Therapeutics, Bayero University, Kano. The animals were maintained in a well-ventilated room, fed on standard feed and granted access to water *ad libitum*.

Ethical approval

Ethical approval was sought from committee on animal ethics, Bayero University, Kano. It was issued with authorization number (Ref No: BUK/CHS/REC/117) by the University's Committee on the utilization of animals.

Statistical analysis

Data was analyzed using the SPSS software (version 26). The results obtained were expressed as mean ± standard error of the mean (SEM). The results were in tables.

RESULTS

Percentage yield of *Eleucine coracana* leaf extract (ELEC)

The percentage yield of ELEC was calculated to be 7%.

Preliminary phytochemical constituents

The phytochemical screening carried out on the ethanol extract of the powdered leaf of *Eleusine coracana* as shown in table 1, revealed the presence of carbohydrate, tannins, flavonoids, alkaloids, phenolic compounds, cardiac glycosides, saponins and steroids while metabolites like anthraquinones were found to be absent.

Table 1: Preliminary Phytochemical Constituents

Phytochemical constituents	Inference
Alkaloids	+
Saponins	+
Tannins	+
Flavonoids	+
Carbohydrates	+
Cardiac glycosides	+
Phenolic compounds	+
Steroids	+
Anthraquinones	-

+ represents the presence of components, - represents the absence of components

Elemental analysis of the plant

The result of the elemental analysis in table 2 showed that calcium, cobalt, chromium, iron, magnesium and zinc. Lead and cadmium were below detection level while mercury was below the WHO limit in the leaves of EC.

Table 2: Elemental analysis of the plant

Metals	Concentration (ppm)	Standard Deviation (ppm)	WHO Limit (ppm) (Heavy Metals)
Calcium	17.85	0.148	-
Cobalt	0.840	0.445	-
Chromium	1.349	0.011	2.00
Iron	17.85	0.046	-
Magnesium	43.24	0.039	-
Zinc	0.680	0.095	-
Cadmium	-0.001	0.001	0.21
Mercury	0.381	0.156	1.00
Lead	-0.006	0.001	10.0

Oral median lethal dose (LD_{50}) of ethanol leaf extract of crude *Eleusine coracana*

The acute toxicity studies showed that oral doses greater than 5000 mg/kg body weight of ELEC produced no toxic effects on the animals and no mortality was recorded even after two weeks of observation (Table 3).

Table 3 Oral median lethal dose (LD_{50}) of ethanol leaf extract of *Eleusine coracana*

Extracts	Rats (mg/kg)
ELEC	> 5000

DISCUSSION

The percentage yield was calculated to be 7%. *Eleusine coracana* leaf being a grass has a very high fiber content. The phytochemical analysis carried out on the powdered leaves of *Eleusine coracana* indicated the presence of phytochemicals which include carbohydrate, tannins, flavonoids, alkaloids, phenolic compounds, cardiac glycosides, saponins and steroids which contribute to the pharmacological activities generally observed in medicinal plants. The fact that these phytochemicals are present indicates that the leaves of *Eleusine coracana* have some important pharmacological activities. Anthraquinones were found to be absent. The results obtained from this phytochemical screening were similar with those reported by Yaro *et al*., (2018). Regular consumption of finger millet is known to reduce the risk of diabetes mellitus and gastrointestinal tract disorders and these properties were attributed to its high polyphenols and dietary fiber contents (Chethan *et al*., 2008). The beneficial effect of phenolics is due to partial inhibition of amylase and α-glucosidase during enzymatic hydrolysis of

complex carbohydrates and delay the absorption of glucose, which ultimately controls the postprandial blood glucose levels (Shobana *et al*., 2009).

Results obtained from the elemental analysis to determine the presence of heavy metals and also essential and non-essential minerals showed heavy metals like; lead (Pb) and cadmium (Cd) were below detection level and mercury was below the WHO allowable limits (0.21 – 1.60 ppm), while mercury (Hg) a little above the WHO limit. This shows that the leaves of EC are safe for consumption and does not have the potential of causing health hazards associated with the consumption of foods and food products containing a high concentration of heavy metals.The analysis also revealed the presence of essential minerals like; iron, magnesium, calcium, cobalt, chromium and zinc. Similar elements were detected by Oseghale *et al*., (2020). They are important for normal biological functions in the body (Soetan *et al*., 2010) and also take part in the pharmacological activities expressed in medicinal plants (Jasper *et al*., 2017). The indication of this is that the consumption of EC would help resolve health issues associated with the deficiency of certain essential and non-essential minerals Wada, (2004).
The oral median lethal dose of (acute toxicity studies) ELEC in rats was found to be greater than 5,000mg/kg, which suggests ELEC is non-toxic when administered orally using the up-and-down procedure according to OECD 425 guidelines.

CONCLUSION

Eleusine coracana leaves also known as finger millet is a promising seed that has shown good phytochemical and mineral profile. The presence of useful phytoconstituents and essential minerals is an indicator that these seeds may have great potential in the management of different illnesses. The acute toxicity profile and the absence of heavy metals show that the seeds are safe and could be formulated as compounds for the management of diseases.

REFERENCES

Chethan S, Sreerama YN, Malleshi NG (2008) Mode of inhibition of finger millet malt amylases by the millet phenolics. *Food Chem* 111:187–19.

Chopra. R.N., Nayar.S.L., Chopra.I.C., Glossay of Indian Medicinal Plants *(Including the Supplements)*. Council of Scientific and Industrial Research, New Delhi. 1986

D. Abebe, M. Zewdu, and A. Demissei, "The role of medicinal plants in health care coverage of Ethiopia, the possible integra- tion,"inConservation andSustainable Use of Medicinal Plants in Ethiopia, proceeding of the national work shop, pp. 6–21, 2001.

Duke, J.(1983) Handbook of Energy Crops Published only on the internet, excellent information on wide range of plants p.269.

Edeoga HO, Okwu DE, Mbaebie BO. Phytochemical constituents of some Nigerian medicinal plants. *Afr J Biotechnol*. 2005; 4(7):685-688.

Jasper, E.E., Yakubu, M.B. and Baganjiya, Y.P., (2017). Levels of essential and non-essential elements in commercially available moringa herbal teas sold in Nigeria. *Nigerian Journal of Chemical Research*, 22(1), pp.1-8.

Juárez-Rojop IE, Tovilla-Zárate CA, Aguilar-Domínguez DE, Roa-de la Fuente LF, Lobato-García CE, Blé-Castillo JL, López-Meraz L, Díaz-Zagoya JC, Bermúdez-Ocaña DY (2014). Phytochemical screening and hypoglycemic activity of Carica papaya leaf in streptozotocin-induced diabetic rats. *Braz J Pharmacog*; (24):341-347.

Mall TP and Tripathi SC.(2016) Millets-the nutrimental potent ethno- medicinal grasses: a review. *World J Pharm Res.*; 5(2):495-520.

Mengesha GG (2016). Ethnobotanical survey of medicinal plants used in treating human and livestock health problems in Mandura Woreda of Benishangul Gumuz, Ethiopia. *Adv Med Plant Res*.; 4(1):11-26.

Saha A, Hoque A, Mallick SK, Panda S. (2014); Medicinal uses of grasses by the tribal people in West Bengal - An Overview. *Int J Basic Appl Sci.*; 3(3):63-70.

Shobana S, Sreerama Y.N, Malleshi NG (2009) Composition and enzyme inhibitory properties of finger millet (Eleusine coracana L.) seed coat phenolics: mode of inhibition of α-glucosidase and pancreatic amylase. *Food Chem* 115:1268–1273.

Viswanath V, Urooj A, Malleshi NG (2009) Evaluation of antioxidant and antimicrobial properties of finger millet polyphenols (Eleusine coracana). *Food Chem* 114:340–346.

Wada O. (2004).What are Trace Elements?their deficiency and excess states.*Journal of the Japan Medical Association*, 47(8), pp.351–358.

WHO, World Health Report, Geneva, 2004.

Yaro AH, Aliyu M, Borodo SB, Nazifi AB (2018). Antihyperglycaemic and antihyperlipidaemic activities of ethanol leaf extract of Eleusine coracana (Lim) Gaertn. In alloxan-induced hyperglycaemic rats. *J. Applied Pharm. Sci.* 8(7): 28-32.