Phytochemical Screening and Elemental Analysis of Aqueous and Methanolic Extracts of *Datura innoxia* Seeds and Leaves

Adam A. Farah*
Associate Professor, Department of Chemistry, Faculty of Education, University of Kordofan, North Kordofa State El-Obeid, Sudan
Siddig A. N. Tota
Head Department of Forensic Science, Forensic Administration, Ministry of Interior, Khartoum, Sudan
*Correspondence Author: adam1974999@gmail.com

Doi: https://doi.org/10.47285/isr.v1i2.42

Citation: Farah, A. A. & Tota, S. A. N. (2020). Phytochemical Screening and Elemental Analysis of Aqueous and Methanolic Extracts of *Datura innoxia* Seeds and Leaves, *International Science Review*, 1(2), 1-11. Doi: https://doi.org/10.47285/isr.v1i2.42

Research Article

Abstract

The present study is aimed to screen the phytochemicals analysis and elements content of Datura innoxia seeds and leaves. The aqueous and methanol extracts were carried out by using the maceration method and soxhlet apparatus, respectively. Results of the study of Phytochemical screening revealed the presence of a high concentration of alkaloids, flavonoids, tannins, steroids and triterpines, and low concentration of saponin and coummarins. The elements in the leaves and seeds (K, Ca, S, Si, Cl, Fe, Al, P, Mg, Ti, Mn, Zn, Sr, Cu, V, Br, and Zr) were determined by energy-dispersive X-ray fluorescence (EDXRF) spectroscopy. K content was the highest in seeds (5.469 ± 0.021%), Ca and S the highest in leaves (2.461 ± 0.019 %, 1.254 ± 0.022 %, respectively). The elements Ti, Mn, Sr, V, Br, and Zr were detected in the leaves with range concentration 0.062-0.002 %. The elements Si, Cl, Fe, Al, P, Mg, and Zn concentration in seeds varied from 0.002 to 0.942% and in leaves varied from 0.014 to 0.346%. The concentration of these elements did not exceed the standard of dangerous toxic levels.

Keywords: *Datura innoxia*, Extraction, Phytochemical screening, Elemental analysis

1. Introduction

A large proportion of the world's population depends on medicinal plants as home remedies and nutritional supplements. These plants also act as a raw material for the pharmaceutical industries for the production of various medicines. According to a survey conducted by the World Health Organization (WHO), 80% of the world's population depends on traditional methods of health care [1]. Plants contain pharmacologically active compounds such as alkaloids, flavonoids, glycosides, and many other important organic compounds. Metallic ions also play a very key role in the proper functioning of the human body; hence, these are integral components of plants [2, 3]. The human body needs a variety of elements for the proper functioning of all body parts. Datura innoxia is one such herb that contains essential and traces elements which are important for proper functioning and growth of the human

body. The deficiency of these elements causes a wide range of abnormalities and metabolic disorders. Determination of metals in medicinal plants is done to establish their purity, safety, and efficiency. There is no general guideline for the permissible level of the elements in the medicinal herb, except only for cadmium (0.3 mg/kg); arsenic (1 mg/kg), and lead (10 mg/kg). The ability of these metals to affect the pharmacological activity of herbs is the most obvious reason to study the amount of these elements in plants. X-ray fluorescence is a rapid and accurate analyzing method involving minimal sample preparation and provides multi-element determination [4]. Mineral composition of plants, spices, herbs, essential oils, legumes, nuts, yogurts, and vegetables has already been studied. In medicinally important plants and herbs, the content of mineral is already reported by [5, 6,7]. Metallic mineral elements in a large number of medicinal plants were collected from Europe and the Mediterranean region and were studied by [8]. The mineral composition of medicinal plants from Sudan was studied by [9]. In Indian medicinal herbs, minerals were studied by [10, 11] and elemental analysis was carried out in some of the important medicinal herbs from India [12].

2. Material and methods

2.1 Plant samples (seeds and Leaves) were collection:

Datura innoxia (seeds and Leaves) (Figures: 1 A, B, and C) were collected from El-Obeid City. North Kordofan State, Sudan, October, (2016). The plant leaves and seeds were cleaned, shade-dried, and ground by a mechanical grinder. Extraction by petroleum ether and methanol and water was carried out according to the method described by [13]. Their aqueous and methanolic extracts were characterized using GC-MS and EDXRF techniques. In addition to chemical tests for the identification of chemical compounds present in these samples.

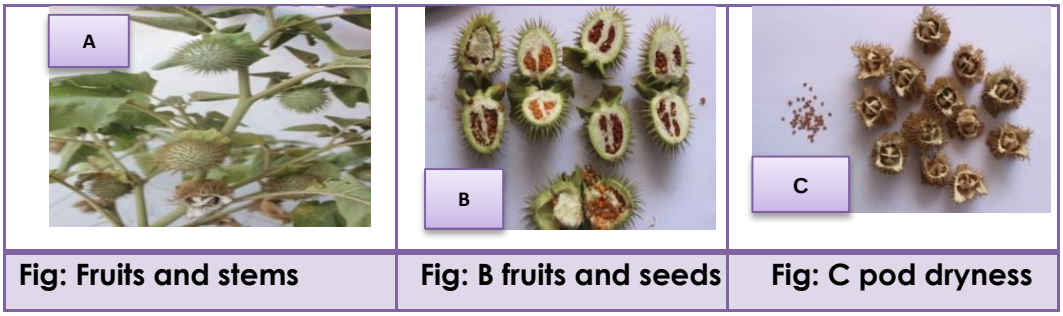

Fig: Fruits and stems	Fig: B fruits and seeds	Fig: C pod dryness

Figure 1: Leaves and flowers of *Datura innoxia*.

2.2 Phytochemical screening of seeds and leaves:

The phytochemicals of the plant samples were estimated following the procedure adopted by screening for the active constituents was carried out using the methods described by [14, 15, 16].

2.3 Test for tannins:

0.5 g of each extract was washed three times with petroleum ether, dissolved in 10 ml hot saline solution, and divided into two test tubes. To one tube 3 drops of ferric chloride reagent were added and to the other one 3 drops of gelatin, salts reagent were added. The occurrence of a blackish-blue color in the first test tube and turbidity in the second one denotes the presence of tannins.

2.4 Test for sterols and teriterpines:

0.5 g of each extract was washed three times with petroleum ether and dissolved in 10 ml of chloroform. To 5 ml of the solution, 0.5 ml acetic anhydride was added followed by 3 drops of conc. Sulphuric acid at the bottom of the test tube. At the contact zone of the two liquids, a

gradual appearance of green to blue color was taken as evidence of the presence of sterols and pink to purple color for the presence of teriterpines in the sample.

2.5 Test for alkaloids:
0.5 g of each extract was heated with 10 ml of 2N HCl in a water bath, stirred for about 10 minutes, cooled, filtered, and divided into two test tubes. To one test tube, few drops of Mayer's reagent were added while to the other tube a few drops of Valser's reagent were added. Slight turbidity or heavy precipitate in either of the two test tubes was taken as presumptive evidence for the presence of alkaloids.

2.6 Tests for flavonoids:
0.5 g of each extract was washed three times with petroleum ether, dissolved in 30 ml of 80% ethanol. The filtrate was divided into three test tubes and used for the following tests:

a. To 5 ml of the filtrate in a test tube 1ml of 1%, aluminum chloride solution was added. The appearance of a yellow color indicated the presence of Flavonoids.
b. To 5 ml of the filtrate in a test tube 1ml of 1%, a potassium hydroxide solution was added. The appearance of a yellow color indicated the presence of Flavonoids.
c. To 5 ml of the filtrate in a test tube 1ml of 10 % lead, acetate solution was added. The appearance of a yellow color indicated the presence of Flavonoids.

2.7 Test for saponins:
0.5 g of each extract was placed in a clean test tube. 10 ml of distilled water was added, vigorously shaken for about 30 seconds. The tube was then allowed to stand and observed for the formation of foam, which persisted for at least an hour, was taken as evidence for the presence of saponins.

2.8 Test for coummarins:
0.5 g of each extract dissolved in 10 ml distilled water in a test tube. A filter paper is attached to the test tube to be saturated with the vapor after a spot of 0.5N KOH is put on it. Then the filter paper was inspected under UV light. The absorption of UV light by the spot indicated the presence of coummarins.

2.9 Test for anthraquinone glycoside:
0.5 g of each of the three extracts was boiled with 10 ml of 0.5N KOH containing 1 ml of 3% hydrogen peroxide solution. The mixture was extracted by shaking with 10 ml of benzene. To 5 ml of the benzene solution, 3 ml of 10% ammonium hydroxide solution were added and the two layers were allowed to separate. The appearance of pink or red color in the lower layer indicated the presence of anthraquinones.

2.10 Test for cyanogenic glycoside:
0.5 g of each extract was placed in Erlenmeyer flask and sufficient distilled water was added to moisten the sample, followed by 1ml of chloroform. A piece of freshly prepared sodium picrate paper was carefully inserted between a split crock which was used to stopper the flask, a change in the color of the sodium picrate paper from yellow to various shades of red was taken as an indication of the presence of cyanogenic glycoside [16].

2.11 Determination of elements in seeds and leaves using EDXRFS:
Three grams of each of the dried samples were ground into fine powder by a mechanical grinder. The powder sample of each plant part was then prepared and pressed into a thick

pellet. The samples were analyzed by an energy-dispersive X-ray fluorescence (EDXRFS) spectrometer. This equipment runs under PCEDX pro software. The elements were analyzed according to the Shimadzu set condition.

2.12 GC-MS of methanolic and aqueous extracts:

0.1 g of each extract was dissolved in 1 ml of analytical grade methanol (99.8%), shook well by using a centrifuge for 3 minutes; 1µl of it was taken for GC-MS injector.

3. Result and Discussion

The yield percentage of leaves and seeds extracts by methanol and water were shown in tables 1and 2. The results in the tables showed a high yield percentage of leaves than seeds in methanol and aqueous extracts. This means that leaves have more polar compounds than seeds. The small difference in yield percentage may be attributed to the high concentration of methanol which had been used in our extraction. Deep green crude extract color is similar to relevant literature [17, 18].

Table 1: Yield percentage of methanol extract:

Sample	Weight of sample	Weight of extract	Yield %
Seeds	600 g	42.882g	7.147

Table 2: Yield percentage of aqueous extract:

Sample	Weight of sample	Weight of extract	Yield %
Seeds	600 g	15.84g	2.64

3.1 Phytochemicals Detection of the Active Components in *Datura innoxia* Leaves Powder and Extract

Active components in *Datura innoxia* plant leaves powder, and in its methanolic extract, and their method of detection were listed in table 3. The chemical analysis by GC-MS of *Datura innoxia* seeds and leaves (aqueous and methanol) extracts and biological specimens revealed the presence of important pharmacological bioactive compounds mainly tropane alkaloids which are toxic at high concentrations, fatty acids, phenyls, phenylpropanoids, amino acids, amides, terpenoids, esters, ketones, coummarins, quinones, and flavonoids. The aqueous and methanol extracts of seeds and leaves have a similar effect to the experimental rats because they all contain main alkaloidal compounds (atropine, Hyoscyamine, Tropacocaine, scopolamine, Apoatropin) which have a toxic effect. The results showed a high concentration of alkaloids, flavonoids, and triterpenes in methanol seed extract. Aqueous seed extract showed a high concentration of alkaloids. Methanol leaves extract showed a high concentration of tannins and steroids. Alkaloids used as parasympatholytics have critical pharmaceutical applications in small doses, for instance, they are used in making muscle relaxants, painkillers, tranquilizers, and psychotropic drugs [19]. Flavonoids used to enhance the renal excretion, treatment of senile cerebral insufficiency, treatment of problems of memoryless, used as effects including antibacterial, anti-viral, anti-oxidant, anti-cancer, and anti-inflammatory [20]. Tannins traditionally used as agents for converting animal hides to leather is one manifestation of the most obvious activity of the tannins, their ability to precipitate proteins, alkaloids, and gelatin, tannins are water-soluble phenolic compounds have molecular weights 300-500. Steroids and triterpenes are not detected in aqueous extracts. Cyanogenic and anthraquinone groups not detected in both aqueous and methanolic extracts, this corresponding to the results of [21] who recorded that the phytochemical screening of the plant *Datura innoxia* showed that the leaves and seeds had alkaloids, atropine, hyoscyamine,

scopolamine, flavonoids, essential oils, tannins, and saponins. Alkaloid, phenol, and tannins were seemed to be found in a high level in the crude extract [22] reported that nearly all of the identified components of the plant which are known by their activity against microorganisms are aromatic or saturated organic compounds, they are most often obtained through ethanol or methanol extraction. The presence of alkaloids, phenol, steroids, resins, saponins, flavonoids, tannins, and glycosides in *Datura innoxia* 95% ethanolic extract were confirmed by finding of Uma Reddy [23].

Table 3: Results of phytochemical screening

Sample	Saponin	Cumarin	Alkaloids	Flavonoids	Tannins	Steroids	Triterpenes	Anthraquinone	Cyanogenic
Aqueous Leaves Extract	++	+	++	++	++	-	-	-	-
Aqueous Seeds Extract	+	+	+++	+	+	-	-	-	-
Methanol Leaves Extract	++	+	++	++	+++	+++	++	-	-
Methanol Seeds Extract	+	+	+++	+++	++	+	+++	-	-

Key:

- (+++) means a high presence of the chemical group.
- (++) means the medium presence of the chemical group.
- (+) means a low presence of the chemical group.
- (-) means a negative result of the chemical group.

3.2 Determination of Elements in *Datura innoxia* Seeds and Leaves using EDXRF technique

The concentrations of the elements analyzed using EDXRF are shown in table 4.

Table 4: Contents of elements in percentage (%) in *Datura innoxia* leaves and seeds analyzed using EDXRF technique

Elements	Seeds	Leaves
	% ±SD	% ±SD
K	5.469± 0.021	0.570±0.003
Ca	0.037±0.001	2.461±0.019
S	0.037±0.002	1.254±0.022
Si	0.942±0.015	0.051±0.001
Cl	0.647±0.011	0.078±0.002
Fe	0.008±0.000	0.346±0.003
Al	0.012±0.005	0.226±0.008
P	0.08±0.001	0.080±0.007
Mg	0.012±0.007	0.068±0.015
Ti	0.000±0.000	0.062±0.003
Mn	0.000±0.000	0.035±0.001
Zn	0.002±0.000	0.014±0.000
Sr	0.000±0.000	0.011±0.001
Cu	0.001±0.000	0.008±0.001
V	0.000±0.000	0.005±0.002
Br	0.000±0.000	0.005±0.000
Zr	0.000±0.000	0.002±0.001

Datura innoxia seeds and leaves have been studied to determine the essential and trace elements content and their correlation with the toxicity of the plant. The energy-dispersive X-ray fluorescence (EDXRF) spectroscopy has been used for the determination of the elements. The

analytical method allows the determination of 17 elements (K, Ca, S, Si, Cl, Fe, Al, P, Mg, Ti, Mn, Zn, Sr, Cu, V, Br, and Zr). Among the considered elements, K content was the highest in seeds (5.469 ± 0.021 w/w %), Ca the highest in leaves (2.461 ± 0.019 w/w%), and S has the highest content in leaves (1.254 ± 0.022 w/w%). The elements Ti, Mn, Sr, V, Br, and Zr were not detected in the plant seeds but detected in the plant leaves with range concentration between 0.062-0.002 w/w%. The range of elemental concentration of the elements Si, Cl, Fe, Al, P, Mg, and Zn in seeds varied from 0.002 to 0.942 w/w% in leaves varied from 0.014 to 0.346 w/w%. The concentrations of these elements did not exceed the standard dangerous toxic levels. Some of these elements are of vital importance for human metabolism and some are well known for curing diseases [24].

3.3 Chemical compounds of methanol extract of *Datura innoxia* seeds

The study of the chemical composition of methanol extract of *Datura innoxia* seeds using GC-MS analysis showed the presence of 20 compounds. The chemical compounds with their retention time (RT), chemical formula, and molecular weight are presented in table 5. They are as alkaloid compounds (scopolamine, atropine, tropine, 3-tropanone, pseudoecgonine methyl ester, apoatropin, hyoscyamine, tropacocaine, tiglypseudotropin, homatropine, aziridine,1-methyl), fatty acids, esters (oleic acid, azelaic acid, acetic acid bromo-, 2-methylpyrazine-5-carboxylic acid, benzoicacid,3,5-dichloro-,8-aza-8-methylbicyclo {3,2,1}oct-3-ylester) and and 8-azabicyclo{3,2,1}octane-3,6-diol,acetate (ester) and amines (benzonitril, 2-amino).

Table 5: Chemical compounds of methanol extract of *Datura innoxia* seeds

Compound name	Formula	M.wt	Base ions	RT
Scopolamine.	$C_{17}H_{21}NO_4$	303	108-138	15.48
Aziridine,1-methyl.	C_3H_7N	57	42-55	6.08
Tropinone.	$C_8H_{13}NO$	139	42-96	15.48
3-Tropanone.	$C_8H_{13}NO$	139	96-82	4.93
Propanamide.	C_3H_7NO	73	44-73	3.56
Methyl vinyl carbinol.	C_4H_8O	72	43-57	3.56
Pseudoecgonine methyl ester.	$C_{10}H_{17}NO_3$	199	96-199	4.93
Atropine.	$C_{17}H_{23}NO_3$	289	124-82	14.383
Apoatropin.	$C_{17}H_{21}NO_2$	271	124-271	14.384
Hyoscyamine.	$C_{17}H_{23}NO_3$	289	124-289	14.377
Tropacocaine.	$C_{15}H1_9NO_2$	245	124-82	14.381
8- Azabicyclo{3,2,1} octane- 3,6-diol,acetate (ester).	$C_{12}H_{19}NO_4$	241	94-154	15.48
Tigloidine.	$C_{13}H_{12}NO_2$	223	124-82	14.37
Homatopine.	$C_{16}H_{21}NO_3$	275	124-275	14.36
Benzonitril,2-amino-	$C_7H_6N_2$	118	91-118	7.73
Oleic acid.	$C_{18}H_{34}O_2$	282	111-83	7.43
Azelaic acid.	$C_9H_{16}O_4$	188	11-152	7.433
Acetic acid,bromo-.	$C_2H_3Bro_2$	138	43-94	14.37
2-methylpyrazine carboxylic acid.	$C_6H_6N_2O_2$	138	138-94	15.47
Benzoic acid, 3,5-dichloro-,8-aza-8-methylbi cyclo {3,2,1} oct-3- ylester.	$C_{15}H_{17}Cl_2NO_2$	313	124-82	14.38

3.4 Chemical compounds of methanol extract of *Datura innoxia* leaves

The chemical compounds identified in the methanol crude extract are listed in table 6. The analysis by GC-MS revealed **30** compounds. The total chemical constituents that were present in

methanol crude extract are as follows: Alkaloidial compounds (8-abicyclo{3,2,1}octane,3-chloro-8-methyl, scopolamine, atropine, hyoscyamine, apoatropin, tropacocaine, tigloidine, benzoicacid,3,5-dichloro-,8-aza-8-methylbicyclo{3,2,1}oct-3-ylester, d1-phenylephrine), phenol compounds (phenol,3-(1,1-dimethyl), phenol, m-tert-butyl-), coummarins compounds (4-H-pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl), Pyranone, 4H-pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl, phosphorodiamidous fluoride tetra methyl, ketone compounds (4-Acetophenone, 4-methoxy, 2-hydroxy-5-methyl acetophenone, 3-methoxyacetophenone, 4-hydroxy-3-methylacetophenone,4-hydroxy-2-methylacetophenone) and amines and amides compounds (2-hexanamine,4-methyl (forthane), acetamide, 2-cyano,4-H,1,2,4-triazol-4-amine, acetamide,N-(aminocarbonyl)-2-chloroacetylurea, 1,2-Propanediamine, L-glutamine, alanine (2-aminopropanoicacid), aminopyrazine, (hexylamine,1,5-dimethyl), and methy loxime.

Table 6: Chemical compounds of methanol extract of *Datura innoxia* leaves:

Compound name	Formula	M. wt	Base ions	RT
Alanine (Amino acid).	$C_3H_7NO_2$	89	40-44	18.15
8-Abicycl{3,2,1}octane,3- chloro-8- methyl	$C_8H_{14}C1N$	159	124-44	14.38
Atropine.	$C_{17}H_{23}NO_3$	289	124-67	14.380
Tropacocaine.	$C_{15}H_{19}NO_2$	245	124-82	14.382
Benzoic acid,3,5-dichloro-,8-aza-8-bicycle {3,2,1} oct-3-yl ester.	$C_{15}H1C1_2NO_2$	313	124-94	14.384
Acetamide,2-cyano.	$C_3H_4N_2O$	84	40-84	8.60
Phosphorodiamidous Fluoride, tetramethyl.	$C_4H_{12}FN_2P$	138	94-138	15.47
d1-phenylephrine.	$C_{19}H_{13}NO_2$	167	167-148	11.95
4-Hydroxy-2-methylaceto phenone.	$C_9H_{10}O_2$	150	150-107	5.950
Phenol,m-tert-butyl-	$C_{10}H_{14}O$	150	135-77	5.951
4-H-pyran-4-one,2,3- 3,5-dihydroxy-6- methyl.	$C_6H_8O_4$	144	144-72	4.26
4-Acetophenone,4-methoxy	$C_9H_{10}O_2$	150	135-92	5.954
2-Hydroxy-5-methylaceto phenone.	$C_9H_{10}O_2$	150	150-135	5.952
Hyoscyamine.	$C_{17}H_{23}NO_3$	289	124-82	13.26
Apoatropin.	$C_{17}H_{21}NO_2$	271	94-124	14.38
4-Hydroxy-3-methyl, acetophenone.	$C_9H_{10}O_2$	150	135-121	5.953
4-Hydroxy-2-methylaceto phenone.	$C_9H_{10}O_2$	150	150-77	5.945
4H-pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl.	$C_6H_8O_4$	144	140-101	4.26
Acetamide,N-(aminocarbonyl) -2-chloroacetylurea.	$C_3H_5C1N_2O_2$	136	87-136	11.946
Scopolamine.	$C_{17}H_{21}NO_4$	289	124-94	14.36
Pyraanone.	$C_6H_8O_4$	144	73-101	4.25
Phenylephrine.	$C_9H_{13}NO_2$	167	162-146	11.952
L-Glutamine.	$C_5H_{10}NO_3$	146	41-84	6.223
Aminopyrazine	$C_4H_5N_3$	95	43-95	10.95
3-Methoxy Acetophenone.	$C_9H_{10}O_4$	150	77-135	5.948
Hyoscyamine.	$C_{17}H_{23}NO_3$	289	124-82	13.26
Phenol,3-(1,1-dimethyl).	$C_{10}H_{14}O$	150	135-150	5.949
1,2-Propanediamine.	$C_3H_{10}N_2$	74	44-71	13.48
Tigloidine.	$C_{13}H_{21}NO_2$	223	82-124	14.38

2-Hexanamine,4-methyl	$C_7H_{17}N$	115	44-84	8.60

3.5 Chemical compounds of aqueous extract of *Datura innoxia* seeds:

The chemical compounds identified in the aqueous crude extract are listed in table 7. The aqueous crude extract was analyzed by using GC-MS leading to the identification of 24 different compounds. These compounds are as follows: Alkaloidial compounds (scopolamine, atropine, tropine, 3-tropanone, pseudoecgonine methyl ester, apoatropin, hyoscyamine, tropacocaine, tiglypseudotropin, tiglypseudotropine (tigloidine), homatropine, 8-azabicyclo{3,2,1}octane,3-chloro-8-methyl, benzoyl ecgonine, and benzoic acid,3,5-dichloro-,8-aza-8-methyl{3,2,1}oct-3-ylester, 3,3- dimethyl piperidine, 2-Piperidinone,1-methyl), amides compounds (3-nitrobenzlbromide, greatine (glycine,N-(aminoiminomethyl)-N-methyl), fatty acids and esters (n-butyric acid, 2-ethylhexylester, hexylisobutyl carbonate (carbonicacid) hexylisobutylester, butanoic acid,octylester, 3-hydroxy-4-methoxybenzoic acid (isovanillic acid), uric acid and vaniLlic acid, ketone compounds (gllaceto phenone), coummarin compounds (2,4-dihydroxy-2,5-dimethyl-3(2H)-furan-3-one, 4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl, terpenoidal compounds (limonene oxide trans) and carbohydrates (sucrose).

Table 7: Chemical compounds of aqueous extract of *Datura innoxia* seeds:

Compounds name	Formula	M. Wt	Base ions	RT
4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl.	$C_6H_8O_4$	144	144-101	4.253
2,4-Dihydroxy- dimethyl-3(2H)-furan-3-one.	$C_6H_8O_4$	144	144-101	4.254
Sucrose.	$C_{12}H_{22}O_{11}$	342	163-85	6.82
3-Nitrobenzl bromide.	$C_7H_6BrNO_2$	215	215-90	7.08
Uric acid.	$C_5H_4N_4O_3$	168	168-125	8.082
Vanilic acid	$C_8H_8O_4$	168	168-125	8.084
Gllacetophenone.	$C_8H_8O_4$	168	168-125	8.083
3-Hydroxy-4-methoxy benzoic acid.	$C_8H_8O_4$	168	168-125	8.078
2-Piperidinone, 1-methyl-	$C_6H_{11}NO$	113	113-57	8.18
Limonene oxide trans.	$C_{10}H_{16}O$	152	94-108	15.48
3,3-Dimethyl piperidine	$C_7H_{15}N$	113	113-84	8.17
Butanoic acid, octylester.	$C_{12}H_{24}O_2$	200	112-71	8.254
n-Butyric acid,2-ethyl hexylester.	$C_{12}H_{24}O_2$	200	112-71	8.252
Atropine.	$C_{17}H_{23}NO_3$	289	289-124	14.433
Scopolamine	$C_{17}H_{23}NO_4$	303	94-138	15.46
Pyranone.	$C_6H_8O_4$	144	101-73	4.253
Hyoscyamine	$C_{17}H_{23}NO_3$	289	289-124	14.434
Tropacocaine.	$C_{15}H_{19}NO_2$	245	124-82	14.431
Tigloidine.	$C_{13}H_{21}NO_2$	223	124-82	14.435
(Glycine,N-(aminoimino methyl)-N-methyl	$C_4H_9N_3O_2$	131	113-84	8.184
Benzoic acid,3,5-dichloro-8-aza-8-methyl {3,2,1} oct-3-ylester .	$C_{15}H_{17}Cl_2NO_2$	313	82-128	14.392
Benzoyl ecgonine	$C_{16}H_{19}NO_4$	289	124-289	14.391
8-Azabicyclo{3,2,1 octane,3- chloro-8-	$C_8H_{14}ClN$	159	82-124	14.393
Benzoyl ecgonine.	$C_{16}H_{19}NO_4$	289	124-289	14.385

3.6 Chemical compounds of aqueous extract of *Datura innoxia* leaves:

The chemical compounds identified in aqueous crude extract are shown in table 8. Analysis by GC-MS revealed 31 compounds. These are as follows: Alkaloidial compounds **(s**copolamine, atropine, tropine, 3-tropanone, pseudoecgonine methylester, apoatropin, hyoscyamine, tropacocaine, tiglypseudotropin, tigloidine, scopolamine, homatropine, 8-azabicyclo{3,2,1}octane,3-chloro-8-methyl, 1H-1midazole,1-acetyl, benzoyl ecgonine, benzoic acid,3,5-dichloro-,8-aza-8-methyl{3,2,1}oct-3-ylester1, 3,3-dimethylpiperidine, 3-nitrobenzlbromide, 2-piperidinone,1-methyl, 1,3-dimethyl,-3,4,5,6-tetrahydro-2(1H)-primidinone,

Table 8: Chemical compounds of aqueous extract of *Datura innoxia* leaves:

Compound name	Formula	M.Wt	Base ions	RT
d1-beta-phenyllatic acid. **(**DL-alpha-Hydroxyhydro cininnamic acid**)**.	$C_9H_{10}O_3$	166	91-106	7.661
n-Hexadecanoic acid.	$C_{16}H_{32}O_2$	256	256-213	12.030
1,3-Dimethyl,-3,4,5,6-tetrahydro-2(1H)-primidinone	$C_6H_{12}N_2O$	128	84-128	6.882
5-Aminovaleric acid.	$C_5H_{11}NO_2$	117	30-98	3.461
Azlaic acid.	$C_9H_{16}O_4$	188	60-171	7.400
9,12-Octadecadienoic Acid (Z,Z),methylester.	$C_{19}H_{34}O_2$	294	81-67	13.200
3-Methyladipicacid.	$C_7H_{12}O_4$	160	114-142	7.050
Hyoscyamine.	$C_{17}H_{23}NO_3$	289	124-289	13.294
Atropine.	$C_{17}H_{23}NO_3$	289	124-289	13.923
Benzoicacid,3,5- dichloro,8-aza-8-methyl.	$C_{15}H_{17}Cl_2N$	313	94-124	14.54
Scopolamine.	$C_{17}H_{21}NO_4$	303	94-138	15.541
Scopolamine, TMSderivative.	$C_{20}H_{29}NO_4$	375	94-138	15.542
1H-1midazole,1-acetyl.	$C_5H_6N_2O$	110	68-129	6.491
5,6-dihydro-5-methyluracil.	$C_5H_8N_2O_2$	128	56-138	6.866
9,12-Octadienoic acid(Z,Z).	$C_{18}H_{32}O_2$	280	81-95	10.922
1,3-Dimethyl-3,4,5,6-tetrahyro- 2(1H)-pyridinone	$C_6H_{12}N_2O$	128	128-84	6.872
Isocamphopinone.	$C_{10}H_{16}O$	152	41-122	3.835
Isovaleric acid, propyl ester.	$C_8H_{16}O_2$	144	103-85	5.844
Butanoic acid,3-hydroxy-3-methyl-	$C_5H_{10}O_3$	118	103-85	5.843
Valeric acid,3-methyl.	$C_6H_{12}O_2$	116	87-60	3.611
Aceticacid, phenyl.	$C_8H_8O_2$	136	91-136	5.241
Oleic acid.	$C_{18}H_{34}O_2$	282	282-82	7.402
Azelaic acid.	$C_9H_{16}O_4$	188	111-83	7.400
Tropacocaine.	$C_{15}H_{19}NO_2$	245	124-82	14.431
Benzoyl ecgonine.	$C_{16}H_{19}NO_4$	289	124-289	14.390
8-Azabicyclo {3,2,1}octane,3-chloro-8-methyl-.	$C_8H_{14}ClN$	159	82-124	14.392
Apoatropin.	$C_{17}H_{21}NO_2$	271	94-124	14.381
Homatropine.	$C_{16}H_{21}NO_3$	275	124-82	14.372
2-methylpyrazine-carboxylic acid.	$C_6H_6N_2O_2$	138	138-94	15.483
Pyrrolidine,1-(2-methylpropenyl)-	$C_8H_{15}N$	125	110-124	14.387
9,12-Octadecadieneylchloride, (Z, Z).	$C_{18}H_{31}ClO$	298	81-95	10.921

benzoicacid,3,5-dichloro,8-aza-8-methyl), fatty acids and esters (2-methylpyrazine-5-carboxylic acid, azelaic acid, oleic acid, acetic acid, phenyl (benzeneacetic acid), valeric acid, 5-aminovaleric acid, 3-methyl-, 3-methyladipicacid, butanoic acid,3-hydroxy-3-methyl-, isovaleric acid,propyl ester, 9,12-octadienoic acid(Z,Z), 9,12-octadeca dieneylchloride,(Z,Z), 5,6-dihydro-5-methyluracil, 9,12-octadecadienoicacid(Z,Z), methylester, n-hexadecanoic acid (palmitic acid), d1-beta-phenyllatic acid (dl-alpha-hydroxy hydrocininnamic acid), (isovanillic acid), hexanoic acid (13), dehydroacetic acid, ,vaniLlic acid), coummarin compounds (3-dimethyl-3,4,5,6-tetrahyro-2(1H)-pyridinone, pyrrolidine,1-(2-methyl-1-propenyl). presence of ketone compounds (gllacetophenone and isocamphopinone), (and hydrocarbon compounds (1-fluorononane).

4. Conclusion

The phytochemical screening of the *Datura innoxia* revealed the presence of important pharmacological bioactive substances as well as medicinal and nutritional potentials in the leaves, and seeds such as saponin, coumarin, flavonoids, tannins, steroids, teriterpines, and alkaloids. The alkaloidal compounds are mainly toxic. The analysis of seeds and leaves showed the presence of Fe (0.346 w/w %), Al (0.226 w/w %), P (0.080 w/w %), Mg (0.068 w/w %), Ti (0.062 w/w %), Mn (0.035 w/w %), Zn (0.014 w/w %), Sr (0.011 w/w %), Cu (0.008 w/w %), V (0.005 w/w %), Br (0.005 w/w %), and Zr (0.002 w/w %). The K concentration was the highest in seeds (5.469 w/w %), Ca was rather high in leaves (2.461w/w%) and S was rather high in leaves (1.254 w/w%). These plants are important for pharmacological research and drug development, not only when bioactive phytocompounds are used directly as therapeutic agents, but also as starting materials for the synthesis of drugs or as models for pharmacologically active compounds [25].

REFERENCES

1. Bodeker G, and Kronenberg F. (2002). A public health agenda for traditional, complementary, and alternative medicine. Am J Public Health; 92 Pp:1582-1591.
2. Marscher H. (1995). Mineral Nutrition of Higher Plants. 2nd ed. San Diego: Academic Press. p. 889.
3. LÜttge U, Kluge M, Thiel G. (2010). Botanik Die Umfassende Biologie der Pflanzen. Weinheim, Germany: Wiley-VCH. Pp: 367-404.
4. Raman. P., Gupta. R. C, Pradhan, S. K. (2017). Elemental analysis and Biological studies of Physalis Angulta L. using wave length-Dispersive X-Ray Fluorescence techniques, from Rajasthan, Asian Journal Pharm Clinic Research, 10 (8), Pp: 220-224.
5. Salaman I, Hecl J, Haban M. (2001). Heavy metal determination of several medicinal plants in the central Zemplin. In: World Conference on Medicinal and Aromatic Plants, Budapest, Hungary. Poster PII/47. p. 187.
6. Ražić S, Dogo S, Slavković L. (2008). Investigation on the bioavailability of some essential and toxic elements in medicinal herbs. Journal Nat Med; 62 Pp: 761-777.
7. Ražić S, Onjia A, Dogo S, Slavković L, Popović A. (2005). Determination of metal content in some herbal drugs-empirical and chemo-metric approach. Talanata; 67 Pp: 233-239.
8. Chizzola R. (2011). Metallic mineral element and heavy metals in medicinal plants. Med Aromatic Plant Science Biotechnology volume; 6 Pp:39-53.
9. Yagi S, Rahman A. E, Elhassan G. O, Mohammed A. M. (2013). Elemental analysis of ten Sudanese medicinal plants using x-ray fluorescence. Journal Applied Industrial Science; 1 (1), Pp:49-53.
10. Swamy G. Y and Sivanarayanan P. (2014). Quantitative determination of essential and trace elements in Indian Ayurveda medicinal herbs by WD-XRF spectrometry. International Journal Ayurveda Pharma Chemistry 1 Pp:52-62.
11. Babu N. G, Srinivasu C. C, Raju T. P, Das N. L. (2013). Estimation of trace element concentration in anti-epileptic medicinal plants by using EDXRF. International Journal Science Research; 4(2) Pp: 211-216.
12. Al-Bataina B. A, Maslat A. O, Al-Kofahi M. M.(2003). Element analysis and biological studies on ten oriental spices using XRF and Ames test. Journal Trace Element Medical Biological; 17 Pp: 85-90.
13. Sukhdev, S. H. Suman. P. S. K. Gennaro, L., and Dev, D. R. (2008). Extraction technologies for medicinal and aromatic plants. United Nations Industrial Development Organization and the International Center for Science and High Technology. P: 116

14. Harborne, J. B. (1984). Phytochemical methods a guide to modern techniques of plant analysis. Chapman and Hill, London.

15. Harborne J. B., (1998). Phytochemical Methods Guide to Modern Techniques of Plants Analysis. Springer.

16. AOAC (2000). Official Methods of Analysis of the Association of Official's Analytical Chemists, (17th Edn.) Arlington, Virginia Pp; 96-105.

17. Guleria, S., and Kumar, A. (2006). Antifungal activity of some Himalayan plants using direct bioautography. Journal of Cell and Molecular Biology, 5 Pp: 95-98.

18. Bako, S.P.; Bakfur, M.J.; John, I. and Bala, E.I. (2005). Ethnomedicinal and phytochemical profile of some savanna plant species in Nigeria. International Journal of Botany, 1(2) Pp: 147-150.

19. Hopkins, W. G. (2003). Scholarly articles psychotropic drugs. http://www.biopsychiatry.com/secobarbital/index.html.

20. Sopchak, C. A. Stork, C. M. Cantor, R. M., and Ohara, P. E. (1998). Central anticholinergic syndrome due to Jimson weed: Physostigmine therapy revisited. Journal of Toxicology and Clinical Toxicology, (36); Pp: 43-45.

21. Victoria O. A. (2004). Toxicities and Sedative Effects Of Toloache, Datura innoxia Miller, ON The African Catfish Clarias Gariepinus Burchell, Fingerlings, Ph.D. Thesis in the Department of Zoology, Faculty of Natural Sciences, University of Jos. P:18.

22. Cowan, M. (1999). Plant products as antimicrobial agents Clinical Microbiology Reviews. 12(4) Pp: 564-582.

23. Uma Reddy, B. (2009). Antimicrobial Activity of Datura Stramonium L.and Tylophora Indica (Burm.F.) Merr. Pharmacology online, 1 Pp: 1293-1300.

24. Martin. M. H. and Coughtrey. P. J. (1982). Biological Monitoring of Heavy Metal Pollution: Land and Air. London. Applied Science. P: 475.

25. Kalam. M. A. and Rifat. I. (2020). Datura species (Dhatura Safed and Dhatura Seyah): A Review with special emphasis on single-use and compound formulations and pharmacological studies relevant to Unani System of Medicine. Indian Journal Integr Medicine 2 (1) Pp: 1-9.