

Evaluation of some antinutritional and goitrogenic components of cannabis consumed in Sokoto, Nigeria

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Abstract

There is rising prevalence of abuse of cannabis in Sokoto. However, a number of studies had revealed the health effects of this drug which are supposed to be due to the contents of the cannabis drug. Therefore, the concern of this evaluation was an assessment of the concentrations of goitrogens (calcium, magnesium, chloride, fluoride, cyanide, and nitrate); antinutritional factors (phytate, flavonoids, saponins, tannins, and relations) and iodine present in cannabis drug being abused in Sokoto, Nigeria. Standard methods and procedures were utilized for the determination of goitrogens, antinutritional factors, and iodine in cannabis. The result shows the concentration of calcium (203.1 ± 0.01 to 250.3 ± 0.01 ppm), magnesium (10.1 ± 1.5 to 102 ± 5.1 ppm), and iodine (0.064 ± 0.01 to 1.70 ± 0.05 ppm) determined in cannabis. The antinutrients found are: Cyanide (47.0 ± 0.01 - 60.0 ± 2.10 ppm), chloride (1.2 ± 10.05 - 1.4 ± 10.05 ppm), fluoride (0.9 ± 0.01 - 1.9 ± 0.01 ppm), and nitrate (1.3 ± 0.1 - 2.02 ± 0.01 ppm). The observed antinutrients are: Phytate (7.1 ± 0.001 - 8.0 ± 0.1 ppm), flavonoids (200.0 ± 1.2 - 250.0 ± 1.3 ppm), saponins (30.0 ± 0.05 - 35.1 ± 0.04 ppm), tannins (200.2 ± 1.0 - 233.1 ± 1.0 ppm) and oxalate (14.2 ± 0.05 - 20.1 ± 0.5 ppm). Therefore, this drug has significant levels ($p < 0.05$) of chemicals that can elicit toxicity effects in acute or chronic consumption, care need to be taken to shun drug abuse at all cost.

Keywords: Cannabis, antinutrients, goiter, goitrogens, cyanide, calcium.

1. Introduction

Substance/ drug abuse is raising and persistent public health concern across all parts of the world. Global burden of diseases has recorded about 585,000 deaths globally as a result of the skyrocketing, and abusive behavior of various drugs or psychoactive substances [1, 2]. With particular regard to the Nigeria community; manifestation of drug or substances abuse is a worrisome trend that has led to a rise in diseases triggered by drug abuse burden. Therefore, there is need for geared efforts to conduct evidence-based studies on the various aspects surrounding the drug abuse to proffer possible solution to the this scourging trend. A trend that is common in Nigeria and Sokoto state. It is a popular notice that, the use of cannabis is famous among the youth. Cannabis is a topmost reported drug of abuse in most of the populations studied in Nigeria or Sokoto state [1]. There are many reported physical effects due to cannabis short-term or long-term use on the human body such as memory impairment, impairment of motor coordination, transmogrified drug development, paranoia, psychosis, cancer, among others [3].

However, there is indeed a diverse array of compounds/ substances that are reported resulting from various studies of cannabis which could cause a lot of effects on consumers [4]. Anti-nutrients and specifically goitrogens are some of the components in cannabis that when taken through the usual abused way can elicit effects such as inhibiting the availability of nutrients in the body and in turn leading to negative outcomes [4]. Phytate, a usual component of many plants including cannabis placates concentrations of important elements ranging from zinc, iron, etc. Insufficiency of these elements is coupled with distinguished significant effects on the body [4]. Oxalate affects calcium and iodine bioavailability and in turn leading to effects such as goiter or iodine deficiency disorders. Chloride and nitrate are toxic to the body for many reasons such as formation of compounds that impairs

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thyroid gland [5]. Fluoride exposure stirs neurological effects, bone softening, skeletal, and dental fluorosis [6]. Flavonoids act as goitrogens in often cases and are implicated in the impairment of other drug's bioavailability among users [7]. Calcium and magnesium act as inhibitors of iodine availability by engaging in combination with the iodine [8-10]. Apart from acting as goitrogen, cyanide causes effects such as headache, chest tightness, irritation, dizziness, and throat discomfort [11]. Therefore, presence of the mentioned substances in cannabis can pose risk to the long-term or short-term consumers of the drug. More important effect of some of the contents of cannabis rely on their goitrogenic nature. The goitrogens act as substances that ameliorate the efforts of the thyroid gland to furnish the body with adequate iodine. Because iodine partakes in the regulation of basal metabolic rate its deficiency can instigate effects such as goiter, cretinism, mental derangement, myxedema, fatigue, weight gain, low basal temperature, etc [11-14]. Therefore, it is important to monitor the concentrations of iodine, goitrogens and other related antinutritional factors present in cannabis in Sokoto, Nigeria [15]. The determination in this study is to expunge the concentrations pertaining goitrogens (calcium, magnesium, chloride, fluoride, cyanide, and nitrate); antinutritional factors (phytate, flavonoids, saponins, tannins, and relations) and iodine present in cannabis drug being abused in Sokoto, Nigeria.

2. Material and Method

Determination of Nitrate [14]

Cannabis was bought from Sokoto state, Nigeria.

Principle

Nitrate reacts with Phenol disulphonic acid to form a nitro derivative which, in alkaline medium, develops a yellow colour. The concentration of NO_3 can be determined colorimetrically at 410 nm, since the intensity of the colour is proportional to the concentration of the nitrates in the sample

Procedure

Five millilitres (5ml) of the samples were added into triplicate beakers and heated to dryness. Then 0.2 ml of phenoldisulphuric and reagent (PDA) were added, followed by 1 ml of concentrated ammonia. Then the beakers were heated for a little period of time (30 seconds) and the contents were diluted to 5 ml, (that is, after adding 0.2 ml of PDA and 1 ml of conc. NH_3 , 3.8 ml of distilled water was added in each of the sample. Then, the absorbance was taken at a wavelength of 410 nm [14].

Determination of Cyanide according to methods and procedures reported in [14]

Procedure

Cannabis was bought from Sokoto, state Nigeria.

Principle

Following the crushing of sample thiocyanate was then allowed to react with benzidine hydrochloride and the intensity of colour thus formed was measured photometrically.

Procedure

Ten grammes of the samples were crushed with clean sand and then extracted with about 25 ml distilled water and refluxed for 20 minutes subsequently in a conical flask. The substance was cooled and filtered. The residue in filter paper was washed repeatedly with distilled water and volume of the filtrate was made up to 100 ml. An aliquot (0.5ml) of this extract containing thiocyanate was treated with trichloroacetic acid followed by saturated bromine water and arsenous trioxide and allowed to react with pyridine-benzidine hydrochloride mixture. The intensity of the colour thus formed was measured using spectrophotometer at the wavelength of 525nm [14].

Goitrogens determination

Calcium, magnesium, iodine, chloride, and fluoride were determined using methods described in [14].

Antinutrients determination and statistical analysis

Cannabis was bought from Sokoto, state Nigeria. The flavonoids, saponins, tannins, and phytate were determined as reported in the standard procedure mentioned in [16]. One-way analysis of variance was carried out for all the results of the study at $p < 0.05$ significance level.

3. Results and Discussion

The results for this study was shown in tables 1-4.

Table 1. Extent of iodine, calcium, and magnesium in cannabis being taken in Sokoto, Nigeria

Parameter	Calcium (ppm)	Magnesium (ppm)	Iodine (ppm)
Seed	203.1±0.01	10.1±1.5	0.064±0.01
Leave	250.3±0.01	102±5.1	1.70±0.05

Key: Values are expressed as mean ± standard deviation

The results for this study in table 1 show the concentration of calcium (203.1±0.01 to 250.3±0.01 ppm), magnesium (10.1±1.5 to 102±5.1 ppm), and iodine (0.064±0.01 to 1.70±0.05 ppm) determined in cannabis in Sokoto, Nigeria. The elements calcium and magnesium, are needed by the body in bulk amount and have to be taken from food. Failure to take them in enough amount spur abnormalities/ defects in the human body system [14]. Likewise, the iodine is required by the body as micronutrient for proper functioning of the body. However, the levels of intake of these vital elements have to be carefully monitored because elevated/excess amounts result in abnormalities such as severe hyperglycemia, weakness of muscle, polyuria, polydipsia, impaired concentration, confusion, irritability etc[17]. Magnesium surplus can lead to toxicity and in turn lead to muscle weakness, nausea, flaccid paralysis, bradycardia, hypotension, heart blockage, and cardiac arrest[18]. Often in some individuals having surplus iodine intake experience thyroid disorders such as goiter, hypothyroidism, hyperthyroidism[19]. Therefore, it is of utmost value to bio-monitor the levels of these elements in cannabis, a common drug of abuse among youths in Sokoto state to give public health advice. Because drug abusers have much tendency to accumulate these elements owing to their chronic or acute intake. The magnesium determined in seeds by this study is far less than the levels found in different Romanian alcohols, but the levels in cannabis leaves are related to that of the Romanian alcohols; and the magnesium levels can be determined by the uptake by the plant through soils [14]. The calcium observed by this study could have obtained by the cannabis from the soil it grows, and the levels are higher than the ones revealed by Romanian alcohols observed [20]. Likewise, calcium, and magnesium found by this study in cannabis are much higher than the levels observed in coffee drug analyzed from Poland [22]. Similar results showing levels of calcium and magnesium found by [21] had some similarities to levels shown by the cannabis in Sokoto [21].

With regards to the iodine (0.064±0.001 to 1.70±0.05 ppm) determined by this study in cannabis are significant because iodine in sufficient amount plays role to make thyroid hormone for proper functioning of the body; therewith, excess iodine intake can on the other hand lead to thyroid gland abnormalities. And occurrence of iodine deficiency is related to iodine intake of humans [23]. The iodine levels are higher than the levels observed in waterbodies in Ondo, Nigeria content of iodine [23]. And in similar case the iodine levels of this study are about to reach the 300 ug/L excess iodine levels biomarker in urine in children, and 500ug/L considered excess in pregnant women. Therefore, it could be possible that, this iodine level of cannabis is excess (because the initial intake could have been dissipated by first pass metabolism) in single dose or chronic doses exposure [19].

Table 2. Cyanides, chloride, and fluoride concentrations observed in cannabis in Sokoto, Nigeria

Goitrogen type	Cyanide (ppm)	Chloride (ppm)	Fluoride (ppm)	Nitrate (ppm)
Seed	47.0±0.01	1.2±10.05	0.9±0.01	1.3±0.1
Leave	60.0±2.10	1.4±10.05	1.9±0.01	2.02±0.01

Key: values are expressed as mean ± standard deviation

Table 2 shows the levels of chloride, fluoride, cyanide and nitrate in cannabis commonly taken in Sokoto, Nigeria. The chloride, fluoride, cyanide, and nitrate obtained in this study are higher than the levels obtained in water bodies in Ondo, Nigeria as reported by [23]. In this regard, it is worthy to reiterate that, the levels of these goitrogens are high and could pose health risk to the consumers of cannabis in the area either on acute or chronic basis. In a similar episode in powerful countries (with strong policies to curtail iodine deficiency) iodine deficiency occurred due to intake of goitrogens in foods or relations; but still suffer the concern. Indeed, this condition is related to the amounts of goitrogens being consumed by the population especially due to the rampant

(legalization of cannabis) drug use[24]. Thus, presence of high iodine in food failed to prevent goiter, because the goitrogens (calcium, magnesium, chloride, fluoride, nitrate, and cyanide) interact with the iodine and prevent its uptake by the body. On the other hands, the goitrogens act by attacking the thyroid gland to diminish the role of the gland. Therefore, presence of goitrogens in cannabis might elicit goiter or thyroid gland abnormalities in drug users [23].

Table 3. Iodine per goitrogens values determined in cannabis in Sokoto, Nigeria

Goitrogen type	I/Calcium	I/Chloride	I/Fluoride	I/Nitrate	I/Cyanide
Seed	0.00315	0.533333	0.071111	0.049230	0.001362
Leave	0.0006792	1.214286	0.894737	0.841584	0.028333

Key: values are expressed as mean \pm standard deviation

Table 3 shows the iodine/ goitrogens ratio value found in cannabis abused in Sokoto, Nigeria. It expressed the linked between the available iodine in the drug and the goitrogens constituents of the drug. The values are considerably higher than the values obtained from a study in Ondo, Nigeria [23, 25]. They reveal the bioavailable iodine concentrations that are reserved for the thyroid gland possible utilization.

Table 4. Concentrations of some antinutritional substances present in cannabis in Sokoto, Nigeria

Goitrogen type	Phytate	Flavonoids	Saponins	Tannins	Oxalate
Seed	7.1 \pm 0.001	200.0 \pm 1.2	30.0 \pm 0.05	200.2 \pm 1.0	14.2 \pm 0.05
Leave	8.0 \pm 0.1	250.0 \pm 1.3	35.1 \pm 0.04	233.1 \pm 1.0	20.1 \pm 0.5

Key: values are expressed as mean \pm standard deviation

Table 4, shows the concentrations of some antinutritional substances, namely, phytate, tannin, saponins, and oxalate found in cannabis drug being taken in Sokoto, Nigeria. The presence of these antinutrients could propel more effects on the cannabis users (when care was not taken). Parable, oxalate forms insoluble salts that cause kidney stones, and also prevent calcium utilization. Tannins reduces bioavailability of essential amino acids by making complexes; phytate inhibits enzymes (like trypsin, pepsin) and also impedes bioavailability of several mineral element. Flavonoids impede the absorption of elements such as iodine, iron, and zinc; and likewise, saponins hinders the vitamins A, E and fats uptake[26-30]. It is worthy to note, tannins revealed in this study are similar to what was revealed [21] and phytate, saponins are lower than the revelations in the same study. Generally, from the findings divulged in this study it is evident that the cannabis contains some factors such as antinutrients, and goitrogens that people need to be careful about them. The youth and adults that engage in substance abuse in the state especially with regards to cannabis should shun the drug to safeguard their health.

4. Conclusion

Cannabis is a common drug of abuse among youths in Sokoto, therefore they are bound to have much health effects on the users because of the chemical contents of the plant. This study has now revealed that, the cannabis contains chemical components such as goitrogens (calcium, oxalate, magnesium, fluoride, chloride, nitrate, flavonoids), antinutritional factors (such as phytate, saponins, tannins) that are in significant levels and could in turn spur health problems to the users especially according to their status of body development, longer life expectancy, and risky activities. Therefore, there is need to enlighten the public on the possible effects of drug abuse in the state.

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References

- [1] Jatau AI, Shaaban A, Gulma, KA., Shitu, Z., Khalid, G.M., Isa, A., Wada, A.S., & Mustapha, M. The burden of drug abuse in Nigeria: A scoping review of epidemiological studies and drug laws. *Public Health Review* 2021; 42 (1603960), 1-11.

- [2] El-Sohaimy SA., Androsova, NV, Toshev AD, El-Enshasy HA. Nutritional quality, chemical, and functional characteristics of hemp (*cannabis sativa* ssp. *sativa*) protein isolate. *Plants* 202; 11(2825), 1-13.<https://doi.org/10.3390/plants11212825>.
- [3] Volkow ND, Baler RD, Compton WM, Weiss, SRB. Adverse health effects of marijuana use. *The new England Journal of Medicine* 2014; 370(23), 2219-2226.
- [4] Alonso-Esteban JI, Torija-Isasa ME, Sanchez-Mata, M. Mineral elements and related antinutrients , in whole and hulled hemp (*Cannabis sativa* L) seeds. *Journal of Food Composition and Analysis* 2022; 10991045160.
- [5] Bonga M, Cousins F, Lean ME, Combet E. Influence of goitrogenic foods intake on thyroid functions in healthy females of childbearing age with low habitual iodine intake. *Proceedings of the Nutrition Society* 2015; 74, 39-39.[doi.10.1017/s00296651150000](https://doi.org/10.1017/s00296651150000).
- [6] Kumar R, Sinha, R, Sharma, PK, Ivy N, Kumar P, Kant N, Jha A, Jha PK, Gupta PK, Sharma P et al Bioaccumulation of fluoride in plants and its microbially assisted remediation: a review of biological processes and technological performances. *Processes*, 2021; 9(2154), 1-24.
- [7] Guven H, Arici A, Simsek O. Flavonoids in our foods: A short review. *Journal of Basic Clinical Health Science* 2019; 3(96), 96-106.
- [8] Hassan LG, Sokoto AM, Ngaski, MA, Anka, SA, Chanchangi, B.M., Umar, K.J., and Ogbiko, C. Nutritional and ant-nutritional analyses of *Hura Crepitans* seeds cultivated in Sokoto North L.G.A. North Western Nigeria. *Bayero Journal of Pure and Applied Sciences* 2018; 11(1), 126-130. [Http://dx.doi.org/10.4314/bajopas.v11i1.22](http://dx.doi.org/10.4314/bajopas.v11i1.22).
- [9] Abu Bashar MD, Begam . Role of dietary factors in thyroid disorders: A primary care perspective. *Medical Research and Innovations* 2020; 4,1-4.
- [10] Sarkingobir Y, Hamza A, Dikko M, Abubakar M, Yabo AG, Muhammad BI. Antibacterial study of guava leaves on some enteric bacteria (*E. coli* and *Shigella dysenteriae*) from Sokoto, Nigeria. *International Research Journal of Science, Technology, Education, and Management* 2022; 2(4), 1-7. <https://doi.org/10.5281/zenodo.7136432>.
- [11] Mahernia S, Amanlou A, Kiaee G, Amanlou M. Determination of hydrogen cyanide concentration in mainstream smoke of tobacco products by polarography. *Journal of Environmental Health Science* 2015; 13(7), 1-6.[doi.10.1186/s40201-015-0211-1](https://doi.org/10.1186/s40201-015-0211-1).
- [12] Oladejo, AAF, Okesola MA, Oyerinde AS, Jaiyesimi K, Kolawole JA. Evaluation of goitrogenic content of common vegetables in South West Nigeria. *Asian Food Science Journal*, 2018; 4(1), 1-6.
- [13] Mwadzombo SM, Chimbevo LM, Oshule PS, Essuman S, Wambura FM. A relationship between goiter prevalence and cassava (*Manihot esculenta* Crantz) consumption in Kilifi County, Coast Province of Kenya. *Science Journal of Public Health* 2019; 7(6), 206-213
- [14] Umar AI, Labbo AM, Sumayya AA, Zainab HB, Sarkingobir Y, Umar AI, Dikko M. Effects of Some Goitrogens on Iodine distributions in Pipe-borne Water, Borehole Water and Well Water of Sokoto State, Nigeria. *International journal of Pure and Applied Science* 2021; 21 (9), 29 – 40.
- [15] Sarkingobir Y, Umar, AI, Miya, YY, Hamza A, Tambari, U., Sule, IF, & Magori DZ. Determination of Selected Essential (Copper, Zinc) And Non-Essential (Lead, Chromium, Cadmium) Heavy Metals in Some Single-Use Plastics from Sokoto Metropolis, Nigeria. *Journal of Materials and Metallurgical Engineering* 2022; 12(3), 29-37.
- [16] Shehu S, Kurya, AU. Nutritional, antinutritional and therapeutic potentials of *Solanum incanum* Linnaeus fruit cultivated in Sokoto, northern Nigeria. *Nigerian Journal Pure and Applied Science* 2019; 32(2), 3462-3468.
- [17] Sadiq N, Nganathan S, Badireddy, M. Hypercalcemia. In; StatPerals [internet] Treasure Island (FL); SttaPerals Publishing; 2022 Jan.
- [18] Ajib, FA Childless JM (2022 Nov 7). In: StatPearls [internet]. Treasure Island (FL): StatPearls Publishing; 2022, Jan.

- [19] Leugn AM, Braverman L. Consequences of excess iodine. *Nutrient Review* 2013; doi:10.1038/nrend002013.251.
- [20] Bora, F., Ripanu, O., Donici, A, Bunea, Cl., Pop, N, Lung, M., Popescu, D(2016). Influence of micro-, and macroelements and heavy metals on wine quality. *Annals of Food Science and Technology*, 17(10), 1-11.
- [21] Farinon B, Molinari R, Costantini L, Merendino N. The seed of industrial hemp I(cannabis sativa Lio: Nutritional quality and potential functionality for human health and nutrition. *Nutrients* 2020; 12(19350),1-59.doi.10.339/nu12o71935.
- [22] Arnold, A. Primary hyperparathyroidism? Molecular genetic insights and clinical implications. Presented at Society for Endocrinology BES 2017, Harrogate, UK. Endocrine abstracts SOPL1.
- [23] Salawu SO, Adu OC, Akindahunsi AA. Distribution of iodine and some goitrogens in two selected waterbodies in Ondo-state, Nigeria. *Global Journal of Pure and Applied Sciences* 2003; 10(10), 161-164.
- [24] Htatch-McChesney A, Lieberman HR. Iodine and iodide deficiency: A comprehensive review of a Re-emerging issue. *Nutrients* 2022; 14(3474):1-14.http://doi.org/10.3390/nu14173474.
- [25] Akindahunsi AA, Salawu, SO, Adu, OC. Dynamics of the iodine-goitrogen balance in the thyroid status of catfish from selected fresh and brackish waterbodies. *Nutrition and Health*, 2016; 17940, 1-10. Doi.org/10.117710260100401700405.
- [26] Parca F, Koca YO, Unay A. Nutritional and antinutritional factors of some pulses Seej and their effects on human health. *International Journal of Secondary Metabolite* 2018; 5(4), 331-342. Doi.10.21448/ijsm.488651.
- [27] Pathaw N, Devi, KS, Sapam R, Sanasam, J, Moheshori S, Phurailat S, Devi HC, Chann WT, Wangkhem B, Mangang NL. A comparative review on the antinutritional factors of herbal tea concoctions and their reduction strategies. *Frontiers of Nutrition*,2022; 9(988964) 1-14. Doi.10. 3389/frnt.2022.988964.
- [28] Yebpella GG, Oladipo MOA, Magonya AM, Abechi, SE, Udiba UU, Kamba EA. Multi-element analysis of selected brands of cigarettes in Nigerian market. *Archives of Applied Science Research* 2103; 5(6), 61-67.
- [29] Gada ZY, Ismaila A. Assessment of some selected edible wild fruits (EWFs) as potential remedy to malnutrition in the rural areas of Sokoto state, Nigeria. *Journal of Agriculture and Environment* 2021; 17(2),123-131.
- [30] Hamza A, Gumi AM, Aliero, AA, Umar A, Sarkingobir Y, Tambari U. Potential of Neem Leaves on Preservation of Selected Elemental Compositions in Two Tomato Cultivars from Sokoto, Nigeria. *Journal of Bioresources and Environmental Sciences* 2023; 2(1),15-20. doi:10.14710/jbes.2022.17343.