

Elemental Profile of Selected Plant Species used for the Treatment of Epilepsy in Idah Local Government, Kogi State, Nigeria

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ABSTRACT

Epilepsy is a disorder in the brain, in which clusters of nerve cells, or neurons, occasionally signal abnormally and cause strange emotions, sensations, and behavior, or sometimes muscle spasms, convulsions, and loss of consciousness. The study was conducted to identify the effect of medicinal plants used for the treatment of epilepsy in Idah LGA of Kogi State. To determine the mode of treatment, their mode of treatments, plant parts used for treatments, and the appropriate dosage, as well as to analyze the phytochemical constituents of the plants and the demographic status of the respondents indicated that Twenty (20) herbal practitioners were interviewed. The male respondents were 13 while the women were 7. The disease was more prevalent among the males than in females in the study area, only a few of the respondents (3) acquired tertiary education. Most of the respondents (15) were rural residents. Majority of the respondents (10) were Muslims, while only 2 were Christians. Four (4) plants (*Ocimum gratissimum*, *Solanum physalifolium*, *Asplenium scolopendrium* and *Spathodea campanulata*) were identified. Only the leaves of the plants were used for the treatment of epilepsy. The best mode of treatment was established to be boiling and compressing to extract the liquid (juice) from the leaves across the plant tested. The phytochemical constituents of the plants studied revealed the presence of alkaloids recorded the highest phytochemical constituents (9.250), followed by saponin (2.370) while tannins recorded the lowest (0.528). It can be concluded that Idah LGA has a diverse plant species with antiepileptic properties that could be used holistically for the treatment of several diseases notably epilepsy. The various methods of administration of these plants for possible treatment of epilepsy will be discussed.

Keywords: Epilepsy, Convulsions, Phytochemical, Administration

Introduction

One of the many health issues in societies is epilepsy. Epilepsy is a long-term neurological disorder that results in episodes of seizures or convulsions. A seizure is a phenomenon with an unordinary change in movement, function, sensation, awareness, or behavior following an abnormal electrical activity in the brain. They range from brief blurring of the senses to sudden brief spells of unconsciousness or explicit staring spells to convulsions (tonic chronic seizures). A person can experience only one kind of seizure whereas in other cases, the types may be more than one [1]. Seizure disorder is synonymous with

epilepsy. Epilepsy is a lifelong disorder that is not an infection that can be passed from one individual to another [1]. It can also be described by the National Institute of Neurological Disorders and Stroke, as a chronic neurological disorder that involves the clusters of nerve cells, or neurons in the brain, that sometimes signal abnormally and cause seizures [2].

Epilepsy has been present during the entire development of humankind from prehistory to the present time [3]. There are over 50 million sufferers in the world today, 85% of whom live in developing countries. Approximately 10 million people are affected in Africa. An estimated 2.4 million new cases occur every year world-wide [4].

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Even with the technology of the 20th century, epilepsy remained a virulent social problem attached to deep historical notions of a supernatural or sacred disorder. The disorder is associated with witchcraft and people with the disorder are widely labeled as being possessed. Severe legal and social penalties were worsened by widespread ignorance, fear, misunderstanding, and stigma [3].

Historically, the stigma about epilepsy began in ancient times when epilepsy was thought to come from malignant causes and to be linked to sin or demonic possession. It was thought that epileptic seizures were a bad omen [5].

Nevertheless, even with all the available information, common diseases, such as epilepsy are still loaded with social stigma. The more devastating and harmful than the disease itself found were stigma and discrimination against people with epilepsy, and negative social attitudes towards epilepsy [6]. Misconceptions about the disease plus fear and freight of the public in confronting an epileptic seizure account for much of the social discrimination against people with epilepsy.

Teachers' knowledge and attitudes towards epilepsy were found to have a direct impact on students with epilepsy in terms of school performance, social skill development, success in finding employment after school, as well as finding friends. If children living with epilepsy are discriminated against by their teachers at school, it will negatively affect their lives in the future and vice versa [7].

For chronic conditions that don't respond well to conventional or modern drug treatment, people rely on traditional and other forms of complementary and alternative medicine. These include neurological disorders, like anxiety, pain, or epilepsy [8]. Except for a handful of modern 'drugs' like opiates, virtually all medicines existed centuries before modern medicine, the pharmaceutical industry, and synthetic chemistry [9]. These medicinal plants represent an important source for the discovery of new bioactive compounds that have or continue to be used as lead molecules for the development of new drugs [10]. Aspirin, atropine, scopolamine, taxol, theophylline, tubocurarine, vincristine, and vinblastine are a few examples of valuable therapeutic tools for present-day physicians [11]. One of the major neurological disorders is epilepsy, which affects approximately 0.8% of the population [12]. Over the past few decades, pharmacotherapy for epilepsy has made great progress, and new antiepileptic drugs including felbamate, and lamotrigine, have been introduced [13]. However, current drug therapy for epilepsy is complicated with side effects, teratogenic effects, long long-term toxicity and about a third of patients are refractory to pharmacotherapies; furthermore, no drug prevents the development of epilepsy post-head trauma and no presently available drug is a synthetic molecule [14,15].

Medicinal plants used for the therapy of epilepsy in traditional medicine practice possess promising anticonvulsant activities in animal models of anticonvulsant screening and these can be an invaluable source for search for new antiepileptic compounds [16].

A large agent called antiepileptic drugs is available to treat various types of seizures to reduce seizure frequency and severity within

a framework of an acceptable level of side effects. The ideal anti-seizure drug would suppress all anti-seizures without causing any unwanted effects. Unfortunately, the drugs used currently not only fail to control seizure activity in some patients, but they frequently cause side effects. Traditional herbs are very useful and indispensable in the struggle for seizure management and future anti-epileptic drug development.

However, epilepsy is one of the most common neurological disorders, defined as recurrent seizures which are caused by abnormal electrical activity in the brain. Epilepsy has an estimated global prevalence beyond 50 million, and although there are still no universal treatments, the socio economic and psychological impacts cannot be underestimated. While such treatments work for many, they're often ineffective universally, creating an increasing interest in alternative and complementary therapies. Traditional herbal remedies have attracted recent interest because of their widespread historical use for the management of epilepsy and other neurological disorders.

The plant species traditionally used in ethnomedicine have a rich morphological and biochemical diversity with various available anticonvulsant potential bioactive compounds. The elemental composition of these plants may greatly affect their therapeutic efficacy and safety. In recent years it has been increasingly recognized that essential trace elements and minerals, particularly magnesium, zinc, and iron, could affect neuronal excitability and neurotransmitter activities, thereby regulating seizure threshold. Toxic elements can however counter beneficial effects and further leads to adverse health outcomes. The purpose of this study is to explore the elemental profile of a few selected plant species used traditionally for the treatment of the anticonvulsant properties. With the use of advanced analytical techniques, we will describe the macro and micro elemental composition of these plants and correlate them with previously reported pharmacological effects. Through this research, we aim to further the understanding of how some of these elemental constituents play into the therapeutic potentials of these botanical treatments for epilepsy. Finally, this investigation not only adds to what is known in the field of herbal medicine, but this work further sets the stage for the discovery and development of novel, safe and effective treatments for epilepsy from plant sources.

Materials and Methods.

Sample Collection and Extraction

The fresh leaves of the samples were collected from Idah Local government, the freshly collected samples are *Ocimum gratissimum*, *Solanum physalifolium*, *Asplenium scolopendrium* and *Spathodea companulata*. The plants extract was prepared by blending and macerating the fresh leaves of the samples with distilled water at room temperature for 24 hours. The mixture was filtered, and the extract was obtained by concentrating the filtrate to dryness using a freeze-dryer. The dried aqueous extract, herein referred to as the extract, was stored in a refrigerator at 0°C. During experimentation, the dried aqueous extract was always suspended in distilled water for administration.

Qualitative photochemical analysis

Qualitative phytochemical analysis was carried out to identify the secondary metabolites present in the various extract of leaves, using standard procedures.

Determination of flavonoids

1ml of extract in a test tube mixed with 5ml of dilute ammonia and 1 ml of concentrated sulfuric acid was added to the mixture. A yellow colour indicated the presence of flavonoids [17].

Determination of Tannins

1 ml extract in a test tube 5 minutes to boil thereafter to job 15% fabric chloride was added a blue-black coloration indicated the presence of tannins [17].

Determination of cardiac glycosides

1 ml of extract in a test tube was mixed with 2 ml of glacial acid, after which 1 drop of 15% ferric chloride and 1 ml of concentrated sulphuric acid were added to the mixture and shaken vigorously. a brown coloration formed at the interface confirmed the presence of cardiac glycoside [17].

Determination of total saponin

1ml of extract in a test tube was mixed with 5 ml of distilled water. The mixture was shaken vigorously and observed for frothing which indicated the presence of Saponin [17].

Determination of total alkaloids

Wagner's test: 1ml of extract in a test tube is mixed with 3 drops of Wagner's reagent (2g of iodine and 6g of potassium iodine dissolved in 100 ml of distilled water). a reddish-brown colouration confirms the presence of alkaloids [18].

Determination of total phenol

2ml of distilled water was used followed by few drops of 10% ferric chloride were added to 1ml of the extract in a test tube, formation of blue-black colour indicates the presence of total phenols [19].

Quantitative phytochemical Analysis**Determination of total phenolic content**

Folin-ciocalteu assay method always used for the determination of the total final content. The reaction mixture consists of 1ml of extract and 9 ml of distilled water was taken in a volumetric flask (25 ml). 1 ml of Folin ciocalteu phenol reagent was treated to the mixture and shaken well. After minutes, 10 ml of 7% sodium carbonate (Na_2CO_3) solution was treated to the mixture. The volume was made of 25 ml. a set of standard solution gallic acid (20,40,60,80 and 120 g/ml) were prepared in the same manner as described earlier. Incubated for 90 min at room temperature and the absorbance for test and standard solution were determined against the reagents blank at 550 nm with a ultraviolet (UV) visible spectrophotometer. The total phenol content was expressed as mg of GAE/g of extract [20].

Determination of total flavonoid Content

Total flavonoid content was measured by the aluminium chloride colorimetric assay. The reaction mixture consists of 1 ml of extract and 4ml of the distilled water was taken in a 10 ml volumetric Flask. To the flask 0.30 ml of 5% sodium nitrate was treated and after 5 minutes, 2ml of 1m hydroxide of 10% aluminium was treated and diluted to 10 ml with distilled water. A set of reference standard solution will quercetin (20, 40,60 80 and 100ug/ ml) were prepared in the same manner as described earlier. The absorbance for test and standard solution were determined against the reagent blank at 510 nm with a Visible

spectrophotometer. the total flavonoid content was expressed as mg of QE/g extract [21].

Determination of total Tannin content

The tannins were determined by Follin-Oiocateu method. about 0.1ml of the sample extract was added to a volumetric Flask (10 ml) containing 7.5ml distilled water and 0.5 ml of Folin Phenol reagent, 1 ml of 35 % Na_2CO_3 solution and dilute to 10 ml with distilled water. The mixture was shaken well and kept at room temperature for 30 min. A set of reference standard solutions of gallic acid (20, 40, 60, 80 and 100 pg/ml) were prepared in the same manner as described earlier. Absorbance for test and standard solutions were measured against the blank at 725 nm with an UV/visible spectrophotometer, the total tannin content was expressed in terms of mg of GAE/g of extract [21].

Determination of Saponin

About 4. 10 mg crude saponin extracts were dissolved in 5 ml 50% aqueous methanol. 250 of ml aliquot was transferred to test tubes Into Which an equal volume of vanillin reagent (8 %) was added followed by 72% (v/v) sulphuric acid. The mixture was mixed and placed in a water bath adjusted at 60 °C for 10 min. The tubes were cooled on an ice-cold water bath for 3 to 4 min and absorbance of yellow colour reaction mixture was measured It 544 nm using a UV-Vis spectrophotometer (UV-1800 Shimadzu) against a blank containing 50% aqueous methanol instead of sample extract. The Saponin concentrations were calculated from standard curve and expressed as mg diosgenin equivalents (DE) per g crude extract [22].

Determination of cardiac glycosides

Cardiac glycosides of each generation of suspension culture were quantitatively determined, for cardiac glycosides, a 10% extract of each generation and total extract of seeds were mixed with 10 mL freshly prepared Baljet's reagent (95 mL of 1% picric acid + 5 mL of 10% NaOH). After an hour, the mixture was diluted with 20 mL distilled water and the absorbance was measured. at 495 nm by Shimadzu UV/VIS spectrophotometer model 160A [23].

Determination of alkaloid

The alkaline precipitation gzaivem's method was employed. A measured weight (1g) of the processed sample was dispersed in 30ml of 10% acetic acid in ethanol solution [24]. The mixture was shaken well and allowed to stand for 4h at room temperature. The mixture was shaken periodically at 30min interval. At the end of this period, the mixture was filtered through Whatman No.42 grade of filter paper. The filtrate (extract) was concentrated by evaporation, to a quarter of its original volume. The extract was treated with dropwise addition of concentration NH_3 solution to precipitate the alkaloid. The dilution was done until the NH_3 was in excess. The alkaloid precipitate was removed by filtration using Whatman No.42

Filter paper. After washing with 1% NH_4OH solution, the precipitate in the filter paper was dried at 60° C in an oven (Gallenkamp hot box oven) and weighed after cooling in a desiccator [24].

Results**Demographic Characteristics of the Respondents.**

The demographic distribution of respondents were represented in the figures below.

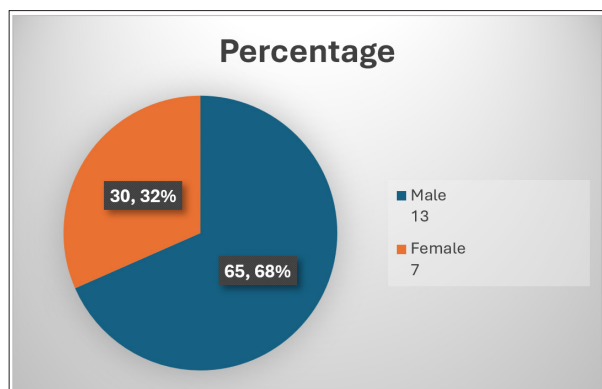


Figure 1: Sex distribution of respondent

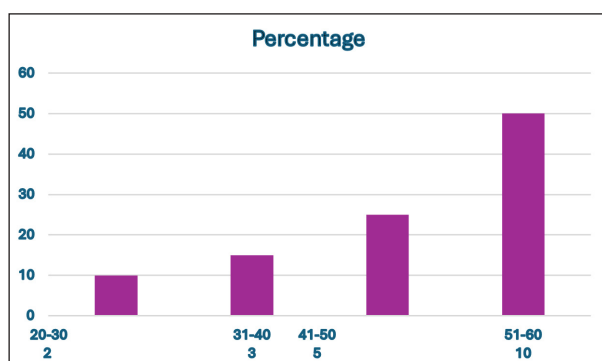


Figure 2: Age distribution of respondents

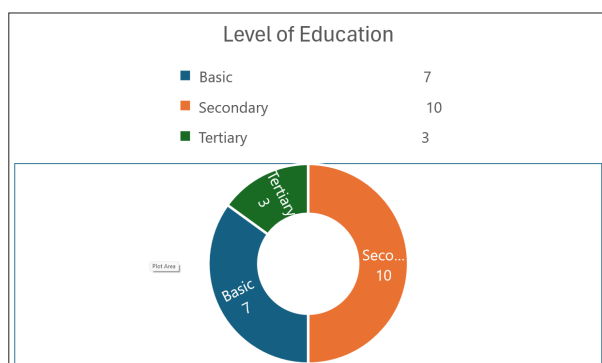


Figure 3: Education distribution

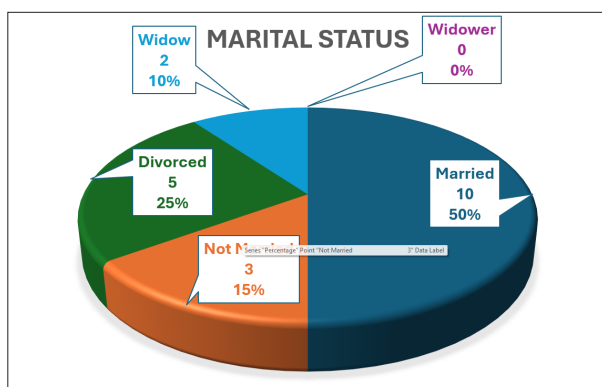


Figure 4: Marital status of respondents

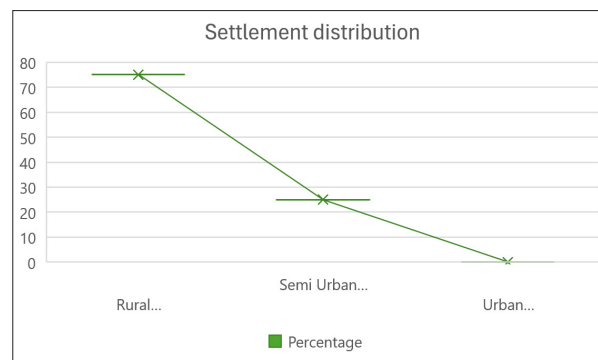


Figure 5: Settlement distribution of respondents

Traditional healers visited

Table 1 below shows the number of traditional healers visited. Two (2) traditional epilepsy healers were assessed in the study area (Mrs. Peter Ugbe and Mr. Abdul Isah). Mrs. Peter treated 10 patients and only three (3) patients were healed completely while thirteen (13) got healed completely among twenty (20) patients treated by Mr. Abdul at the time of the study.

Table 2: Number of Traditional healers visited

Traditional healer	Number of patients treated	Number healed
Mrs. Peter	10	3
Mr. Abdul	20	13

Plants used for the Treatment of Epilepsy

Table 2 below shows a detail presentation of the plants used for the treatment of epilepsy in Idah LGA of Kogi state. Four (4) plants were identified in all. Two (2) plants *Ocimum gratissimum* and *Solanum physalifolium* were gotten from Mrs. Peter while *Asplenium scolopendrium* and *Spathodea companulata* were gotten from Mr. Abdul. Only the leaves of the plants are used for the treatment of epilepsy. The mode of treatment is by boiling and compressing of the leaves to extract the liquid (juice) from the leaves.

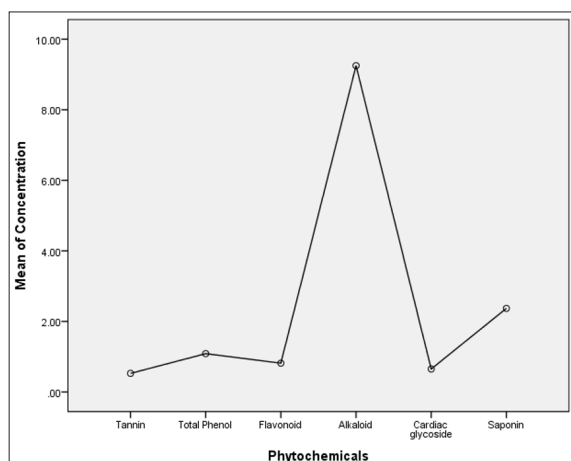
Table 3: Plants used for the Treatment of Epilepsy in Idah LGA of Kogi State

Local names	Scientific names	Family	Mode of treatment
Anyeba	<i>Ocimum gratissimum</i>	Lamiaceae	boiling, compressing
Ebeh	<i>Solanum physalifolium</i>	Solanaceae	boiling, compressing
Okopi	<i>Asplenium scolopendrium</i>	Aspleniaceae	boiling and oral intake
Ogele	<i>Spathodea companulata</i>	Bignoniaceae	boiling and oral intake

The qualitative phytochemical analysis of the plant extracts revealed the presence of Tannin, Cardiac glycoside, Flavonoid, Total Phenol, Saponin and Alkaloid in all the plant samples while the quantitative phytochemical screening of the extracts of *Spathodea companulata* (observed by the healer as the most prudent) was as presented in table 4 and Fig 6 below using harmonic mean sample.

Table 4: Post- Hoc analysis showing homogenous subset of phytochemicals

Concentration				
Duncan				
Phytochemicals	N	Subset for alpha = 0.05		
		1	2	3
Tannin	4	0.5275		
Cardiac glycoside	4	0.6525		
Flavonoid	4	0.8175		
Total Phenol	4	1.0875		
Saponin	4		2.3700	
Alkaloid	4			9.2500
Sig.		0.071	1.000	1.000
Means for groups in homogeneous subsets are displayed.				
a. Uses Harmonic Mean Sample Size = 4.000.				

**Figure 6: Qualitative Phytochemical Screening of the plant extracts (Post Hoc Tests)**

Discussion

Demographic Characteristics of the Respondents indicated that there were more male (68%) than female (32%) contacted during the study (figure 1). This could be attributed to the fact that more of the male were more involved in holistic medical care of the patients at home than the female as epilepsy always come with societal stigma as also observed by Fernandes et. al [25].

The age distribution in figure 2 indicated that the largest age group mostly involved has the highest percentage (50%) in the 51-60 age range, followed by the 41-50 range (25%), then 31-40 (15%), and finally 20-30 (10%). The high age range of 51-60 could be due to the inactivity of this age group as they are mostly not in their active life stage and are usually found doing menial trades within the locality.

The education background of the respondent indicated that tertiary institution has the lowest of respondent with only 15% in figure 3. The highest was recorded at secondary school level with 50% while those with basic grades recorded 35%. This indicated that education level has no much significance on the knowledge acquisition of the local treatment methods.

This agreed with Hopkins, et. al., who noted that there was no insignificant relationship between in-degree and competence scores among practitioners investigated [26].

In figure 4, the demographic data revealed that 50% of the respondents are married while the least was observed among the widow with 2% representative. This could be attributed to the fact that the widow might be going through some psychological stress and religious confinement for some time. This was pointed out by Idoniboyeobu and Obiechina, who decried widowhood practices implication and rights of women in Nigeria [27].

Most of the respondents are rural residents with 75% representatives as presented in figure 5, while there was non in the urban settlements. This agreed with the work of Awoyemi et. al., who noted that allopathic medicine is now taking recourse to traditional medicine because of its less expensive and availability to a greater percent of the world population [28].

Table 2 indicated that the healer (Abdul) who utilized *Asplenium scolopendrium* and *Spathodea companulata* recorded the higher healing rate of 13 (65%) out of 20 patients taking care while Peter healed 3 (30%) out of 10 patients taking care from him up until the time of this research.

In table 3, a total of 4 medicinal plant species that were used for the treatment of epilepsy were recorded. This number recorded from 10 communities is quite low as compared to the observation made by, Birhan who investigated on 96 species [29]. These species were distributed in four families: *Ocimum gratissimum* (Lamiaceae) also found by Ito et. al. to have anti-schistosoma efficacy, *Solanum physalifolium* (Solanaceae), found to be a strong anti-fungus by Anderson et. al., *Asplenium scolopendrium* (Aspleniaceae), reported also by Petkov et. al. to demonstrate an anti-cancer property and *Spathodea companulata* (Bignoniaceae) has been reported in traditional medicine for the management of hepatic disorders by Muhammed [30-33]. Apart from *Asplenium scolopendrium* (tree) all other plants identified were shrubs. This could be because this growth form is available in almost all seasons as they are relatively drought resistant and are not affected by seasonal variations [34]. This may be related to the fact that woody species are readily available all year long, unlike herbs which are limited by the scarce rain fall [35]. This was pointed out too in the results of Noumi and Fozi where *Spalhodea companulatata* was identified among the plants used for the treatment of epilepsy in Fongo-Tongo Village, Western Province, Cameroon [36]. The use of plant species like those used by other African people, such as *Asystasia gangetica*, *Biophytum*, *Solanum torvum*, *Solanum americanum*; is indicative of the authenticity of their potential usefulness in the treatment of epilepsy [29].

From figure 6, Alkaloid has the highest mean concentration (9.250), followed by saponin (2.37) while tannin recorded the least (0.528).

From figure 6 above, there is no significant difference between the concentration rate of tannin, cardiac glycoside, flavonoid and Total phenol but there is a significant difference between the concentration of the afore mentioned phytochemicals with Saponin (1.00) as well as Alkaloid (1.00). It can also be deduced

from the figure that Alkaloid has the highest mean concentration (9.250) in the study followed by saponin (2.370) while Tannin recorded the least (0.528).

This result has however suggested that Alkaloid appeared to be the phytochemical more potent for the treatment of epilepsy, although this is subject to more studies on the molecular and cell signalling protein interactions with the phytochemical to determine the best fit. The study has also suggested that the leaf part of the plant is the most utilized while boiling and compression is the best method of preparations, having oral intake the most appropriate method of administration. The dosage then depends on the severity of the cases to be treated at any point in time, and in this regard, a lot needed to be done to fully understand the best dosage requirements for most cases.

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