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Evaluation of the Anticonvulsant Potency of the Combined Ethanol Extract of *Garcinia kola* (Bitter Kola) and *Elaeis guineensis* (Palm Kernel Oil) in Mice

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ABSTRACT: Nigeria has a long history of treating a wide range of illnesses with various herbs, spices, and herbal ingredients. Agents derived from plants are anticipated to be less harmful and less expensive in light of non-compliance, drug costs, and toxicity that synthetic pharmaceuticals have caused over the years. An irregular and sporadic occurrence of seizures is the hallmark of convulsions, a neurodisorder in brain activity. Children frequently experience it, particularly when they have a fever or a high body temperature. In eastern Nigeria, the majority of indigenous people utilize *Elaeis guineensis* oil (palm kernel oil) and *Garcinia kola* (bitter kola) either separately or in combination to treat children's convulsions. To support or refute this practice, the purpose of this study was to examine the anticonvulsant qualities of these two plant extracts. The bitter kola fruits and palm kernel nuts were gathered, verified, dried, and ground. The palm kernel was boiled to extract the oil, and the powdered *Garcinia kola* (bitter kola) was macerated in ethanol for 72 hours. The resulting crude extract was concentrated, and phytochemical analyses showed that G kola and palm kernel oil contained flavonoids, tannins, saponins, alkaloids, glycosides, phlobannins, anthroquinone, and deoxy-sugars, respectively. The presence of lignin, carbohydrate, protein, mucilage, cellulose, gutin, and suberin was discovered using chemomicroscopic analysis. The anticonvulsant effects of palm kernel oil and *Garcinia kola*, both independently and together, were tested in mice using convulsion models induced by pentylene tetrazol (PTZ) and isoniazid. It was found that the various regimens significantly ($p<0.005$ - 0.01) protected against convulsions caused by PTZ and isoniazid in mice, even if the combined products' activity was lower than that of the individual products.

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1. Introduction

A convulsion is a medical condition in which the muscles in the body regularly and quickly contract and release, causing uncontrollable twitching. Convulsion is sometimes used as a synonym for seizure since epileptic seizures usually involve convulsions. Nevertheless, not all convulsions are brought on by epileptic seizures, and not all epileptic episodes generate convulsions [1,2]. Non-epileptic seizures are the source of non-epileptic convulsions, which are unrelated to epilepsy. Epilepsy, infections, brain damage, and other illnesses can all result in convulsions. They can also be brought on by an electric shock or scuba diving air that isn't adequately enriched. Sometimes the convulsion can be caused by genetic abnormalities or very low blood sugar or a shortage of vitamin B6 (pyridoxine). Convulsion pathogenesis is still unclear.

Rarely, it could be brought on by adverse drug reactions to stimulants, antidepressants, and antihistamines [3].

The World Health Organization defines traditional medicine as all of the skills, knowledge, and methods

that come from indigenous theories, beliefs, and experiences in different cultures, regardless of whether they can be explained. In addition to preventing, diagnosing, treating, or improving bodily and mental illness, it is used to maintain health [4]. Traditional medicine provides primary medical care for up to 80% of the population in certain Asian and African countries. When used outside of its traditional culture, traditional medicine is often considered an alternative medical approach [5,6].

Investigations into other plant-based sources have been prompted by the growing interest in natural substances that may have health benefits. *Garcinia kola* and *Elaeis guineensis* have long been employed for their therapeutic qualities, which include their effectiveness as independent anticonvulsants [7,8,9]. Nevertheless, there is a dearth of thorough scientific data supporting their concurrent usage as anticonvulsants. Thus, the goal of the current study was to evaluate the anticonvulsant potential of *Garcinia kola* and *Elaeis guineensis* (palm kernel oil).

Elaeis guineensis yields two types of oil: palm oil from the fleshy mesocarp and palm-kernel oil from the kernel, with a volume ratio of 10:1. The majority of palm oil is used to prepare food (industrial frying oils, margarines, snack foods, etc.). Because of its higher melting point, palm kernel oil, which shares composition and properties with coconut oil, is used in confections. Igbos in Eastern Nigeria and other tribes in South-South Nigeria use a lot of the dark-brown to black palm kernel oil that is produced by heat extraction to treat a variety of ailments, including convulsions [10,11].

In Southern Nigeria, *Garcinia kola* is widely chewed as a masticatory, and it is served to guests with open arms as a show of goodwill and acceptance, particularly to the Igbo group in Eastern Nigeria. In West Africa, the plant's root is a popular bitter chewing stick [12]. The Eastern Nigerian locals employ the stem bark as a purgative in their folk treatments, and the latex is used topically to newly opened wounds to help them recover by preventing sepsis. For promoting sleeplessness and nervous alertness, it is also well-liked by Nigerians. *Garcinia kola* is prized for its therapeutic properties.

This plant has been referred to as a "wonder plant" because every component of it is of medicinal importance [12,13]. As an aphrodisiac, the seeds are chewed and used to treat a variety of ailments, including gonorrhea, laryngitis, bronchitis, cough, diarrhea, chest colds, liver problems, and diarrhea [12,13,14]. In addition to treating headaches, stomachaches, and gastritis, the seed is used to prevent and cure colic [15]. Additionally, it has been used as a purgative, to cure jaundice, and to treat high fever [16]. The bark and roots are used as a remedy for male sexual dysfunction in Sierra Leone. To increase the potency of palm wine, the bark is also added [12,15,16].

In Nigeria, especially in the Ogoni region, traditional healers cure burns, fever, inflammation, and dysmenorrhea with a decoction of *Garcinia kola* stem bark. Bitter kola aids in system detoxification and has anti-poison properties [14,15,16]. Thus, this study aimed at investigating the anticonvulsant properties of these two plant products to give credence to this practice or otherwise.

2. Materials and Methods

2.1. Plant Material Collection and Identification

Fresh *Garcinia kola* seeds and *Elaeis guineensis* nuts were purchased from a food market in Elele, Rivers State, Nigeria. A taxonomist from Madonna University Elele's Pharmacognosy department identified them, and a voucher number was provided.

2.2. Preparation of *Elaeis guineensis* (Palm kernel oil)

Palm kernel 2.0 kg was weighed and crushed into smaller pieces. The crushed kernels were heated to release the oil, which was then collected and filtered with muslin clothes to remove impurities. The filtrate was transferred into a 1000 mL beaker.

2.3. Preparation of *Garcinia kola*

Two kilograms of *Garcinia kola* were weighed, broken up, and then dried. After adding 95% (300 mL) of ethanol to the crushed kola in a conical flask while stirring continuously for 72 hours, the mixture was filtered. When the liquid filtrate was concentrated under vacuum at 40 °C, all of the ethanol was removed. The extract was stored in a refrigerator at 4 oC prior to being used in the various trials.

2.4. Phytochemical Analysis

Preliminary phytochemical tests were carried out on the crude ethanol extract of *Elaeis guineensis* and *Garcinia kola* using standard phytochemical screening procedures and reagents [16].

2.5. Qualitative Chemo-Microscopic Evaluation and Proximate Analysis

Chemo-microscopic evaluation and proximate analysis were carried out using standard techniques [16,17].

2.6. Experimental design

Albino Swiss mice of both sexes, weighing 19–28 grams, were purchased from the Animal House at Madonna University. They had unrestricted access to water and were fed standard animal feed. They were kept in a well-ventilated room in plastic cages. In order to administer different concentrations of *Elaeis guineensis* and *Garcinia kola* alone and together, the mice were divided into eight groups of five at random, two of which served as the positive and negative controls and the remaining group as the treatment group.

2.7. Acute toxicity

Nine animals were divided into three groups of three in phase one, and each group was given different doses of *Garcinia kola* and *Elaeis guineensis* (10, 100, and 1000 mg/kg) both alone and together. Following that, the animals were watched for a whole day to study their behavior and determine whether any death would occur. Three animals were divided into three groups of one animal each in phase two, and they were administered larger doses of *Garcinia kola* and *Elaeis guineensis* (1600, 2900, and 500 mg/kg) both alone and together. After that, the animals were observed for a whole day to observe their behavior and determine whether they perished [18,19].

2.8. Anticonvulsant activity

2.8.1. Pentylene tetrazol-induced Convulsion

Anticonvulsant action of the extract was examined using a modified method of Vellucci and Webster (1984) on overnight starved mice [20]. Eight groups of five mice each were created, and the mice were given different combinations of *Garcinia kola* extract and palm kernel oil. Group I received only 10 mL/kg of distilled water; Group 2 received 40 mg/kg of phenobarbitone orally; Group 3 received palm kernel oil (5 mL/kg) and *Garcinia kola* (100 mg/kg) concurrently; Group 4 received palm kernel oil (10 mL/kg) and *Garcinia kola* (100 mg/kg); Group 5 received palm kernel oil (5 mL/kg) and *Garcinia kola* (200 mg/kg); Group 6 mice received oral palm kernel oil (10 mL/kg) and *Garcinia kola* (200 mg/kg); and Groups 7 and 8 received oral palm kernel oil (10 mL/kg) and *Garcinia kola* (200 mg/kg). Every therapy was carried out an hour prior to the convulsion being induced. Pentylene tetrazol (PTZ) at a dose of 70 mg/kg intraperitoneally (i.p.) was used to cause seizures in each group of mice. The mortality rate and the beginning of clonic/tonic convulsions were noted and contrasted with the corresponding control groups. The capacity of the different treatments or combinations to stop or postpone the animals' hind limb extension was seen as a sign of anticonvulsant activity [24]. The following parameters were recorded during the 120-minute observation period following PTZ administration: (1) the number of mice dead or alive after 30 minutes; (2) the time to onset of myoclonic jerks in minutes; (3) the time to death during the 120-minute experimental period; and (4) the time to onset of tonic convulsions in minutes [20,21].

2.8.2. Isoniazid (INH)-induced seizures in mice

With minor adjustments, the Madhu (2009) approach was applied to assess the impact of the different therapies on isoniazid-induced convulsions [22]. Eight groups of five mice each were created, and the mice were given different combinations of *Garcinia kola* extract and palm kernel oil. Group I received only 10 mL/kg of distilled water; Group 2 received 40 mg/kg of phenobarbitone orally; Group 3 received palm kernel oil (5 mL/kg) and *Garcinia kola* (100 mg/kg) concurrently; Group 4 received palm kernel oil (10 mL/kg) and *Garcinia kola* (100 mg/kg); Group 5 received palm kernel oil (5 mL/kg) and *Garcinia kola* (200 mg/kg); Group 6 mice received oral palm kernel oil (10 mL/kg) and *Garcinia kola* (200 mg/kg); and Groups 7 and 8 received oral palm kernel oil (10 mL/kg) and *Garcinia kola* (200 mg/kg). Every therapy was carried out an hour prior to the convulsion being induced. Isoniazid (300 mg/kg i.p.) was used to produce seizures in each group of mice. Both the mortality rate and the beginning of clonic/tonic convulsions were noted and contrasted with the corresponding control group. The time to death throughout the 120-minute trial, the number of mice dead or alive after 30 minutes, the time to commencement of myoclonic jerks in minutes, and the time to onset of tonic convulsions in minutes were also recorded [22, 23, 24].

3. Results:

3.1. Qualitative phytochemical analysis of *Elaeis guineensis* and *Garcinia kola*

Qualitative phytochemical analysis of *Elaeis guineensis* and *Garcinia kola* revealed the occurrence of several bioactive constituents. As evident from Table 1, the screening indicated the occurrence of flavonoids, tannins, carbohydrates, saponins, alkaloids, glycosides, anthraquinones, and deoxy-sugars in the plant extracts. Phlobatannins were not present in the two samples. These results suggest that both *Elaeis guineensis* and *Garcinia kola* are highly phytochemically diverse, with most of these compounds exhibiting pharmacological activities. The observation that flavonoids and tannins, for instance, suggest potential antioxidant and anti-inflammatory

activities, saponins and alkaloids have a tendency to be involved in antimicrobial and therapeutic effects, respectively. The presence of anthraquinones and glycosides also suggests the potential for laxative and cardiotonic effects, respectively. The absence of phlobatannins implies that not all tannin forms are present, which may affect the individual bioactivities of the extracts.

Table 1: Qualitative phytochemical analysis for *Elaeis guineensis* and *Garcinia kola*

TEST	RESULT
Flavonoids	+
Tannins	+
Carbohydrates	+
Saponins	+
Alkaloids	+
Glycosides	+
Phlobatannins	-
Anthraquinone	+
Deoxy-sugars	+

3.2. The qualitative chemo-microscopic analysis of *Elaeis guineensis* and *Garcinia kola*

The qualitative chemo-microscopic analysis of *Elaeis guineensis* and *Garcinia kola* revealed numerous differences and similarities in their cellular and structural structures (Table 2). The two plant materials both tested positive for lignin and cellulose, exhibiting the presence of supporting and structural polysaccharides in their tissues. *Elaeis guineensis* showed the presence of calcium oxalate crystals but not starch and mucilage. *Garcinia kola*, however, was starch and mucilage positive but not for calcium oxalate. This difference suggests that *Garcinia kola* might have more storage and protective mechanisms as starch granules and mucilage, while *Elaeis guineensis* may offer more structural defense in the presence of calcium oxalate. In addition, *Garcinia kola* demonstrated the existence of cutin and suberin, two substances associated with protective layers and water loss resistance, whereas these were marked as not applicable in *Elaeis guineensis*. The occurrence of such waxy and fatty compounds in *Garcinia kola* is a sign of acclimatization to stresses. Overall, the chemo-microscopic pattern of the two plants suggests distinct anatomical and biochemical features, which are responsible for their respective therapeutic and functional activities.

Table 2: Qualitative chemo-microscopic evaluation for *Elaeis guineensis and Garcinia kola*

TEST	RESULT	
	Elaeis guineensis	***Garcinia kola***
Lignin	+	+
Starch	-	+
Calcium oxalate	+	-
Mucilage	-	+
Cellulose	+	+
Cutin	**Not Applicable**	+
Suberin	**Not Applicable**	+

3.3. Proximate analysis of *Garcinia kola*

Proximate analysis of *Garcinia kola* was guided towards its ash content, which is an important indication of the mineral content and purity of the sample (Table 3). The total ash value was determined to be 40.00%, indicating that the sample contained a high amount of inorganic constituents. The high ash content shows the high mineral profile of *Garcinia kola*. The acid-insoluble ash, that is, the part of the ash that is insoluble in dilute hydrochloric acid and is usually siliceous or other earthy matter, was 20.00%. This indicates a moderate degree of contamination or natural earthy residue, maybe due to soil or siliceous material. In addition, the water-insoluble ash value was 23.75%, which is the proportion of the ash that is insoluble in water. It could account for non-polar mineral components or fibrous residue. Overall, the results indicate that *Garcinia kola* is rich in minerals, but also emphasize the importance of proper processing to reduce potential impurities, especially for pharmaceutical or dietary applications.

Table 3: Proximate analysis of *Garcinia kola*

	ANALYTICAL STANDARD	COMPOSITION (%)
ASH VALUES	Total ash value	40.00
	Acid insoluble ash	20.00
	Water insoluble ash	23.75

3.4. Acute Toxicity Test for Phase 1:

Acute toxicity test (LD_{50}) result of phase 1 using Lorke's method, (Lorke, 1983). In this phase, there were no deaths recorded after 24 hours of administration.

TABLE 5 : Acute Toxicity Test Phase 1 Result.

DOSE ADMINISTERED (mg/Kg)	NUMBER OF DEATHS
10	0/3
100	0/3
1000	0/3

3.5. Acute Toxicity Test for Phase 2:

Acute toxicity test result of phase 2 using Lorke's method, (Lorke, 1983). In this phase, there were no deaths recorded after 24 hours of administration.

TABLE 6: Acute Toxicity Test for Phase 2 Result.

DOSE ADMINISTERED (mg/Kg)	NUMBER OF DEATH
1500	0/3
2600	0/3
5000	0/3

3.6. Anticonvulsant activities

3.6.1. PTZ –induced convulsion: Table 7 illustrates the impact of concurrently administering *Garcinia kola* and palm kernel oil on PTZ-induced convulsion. Mice were significantly protected against PTZ-induced seizures by the injection of palm kernel oil and *Garcinia kola*. Comparing all treated groups to the control, the combination of *Garcinia kola* and palm kernel oil significantly ($p<0.05$) delayed the onset of myoclonic convulsions, with the group receiving palm kernel oil (10 mg/kg) and *Garcinia kola* (100 mg/kg) experiencing the greatest benefit. In contrast, the group treated with palm kernel oil (10 ml/kg) alone experienced a significantly ($p<0.01$) greater effect than the groups treated with the various combinations, and the group treated with *Garcinia kola* (200 mg/kg) alone was able to prevent the commencement of myoclonic convulsions.

Significant delay ($p<0.001$) in the onset of tonic convulsion was observed in all the groups treated with the combination of palm kernel oil and *Garcinia kola* and the group treated with palm kernel oil (10 mg/kg) and *Garcinia kola* (100 mg/kg) having the highest delay. Palm kernel oil (10 ml/kg) only treated group had total inhibition of tonic convulsion, while *Garcinia kola* (100 mg/kg) only treated had effect that was significantly ($p<0.05$) higher than those treated with the various combinations of palm kernel oil and *Garcinia kola* (Table 7).

The times of death of the mice treated with the various combinations of palm kernel oil and *Garcinia kola* were significantly ($p<0.001$) longer than that of control with the group treated with palm kernel oil (10 mg/kg) and *Garcinia kola* (100 mg/kg) having the longest time. The group treated with palm kernel oil (10 ml/kg) alone had a time of death that was longer than all the groups treated with the combinations, *Garcinia kola* (100 mg/kg) only, and standard drug, phenobarbitone (40 mg/kg). Moreover, mice treated with palm kernel oil alone did not die throughout the duration of the experiment (Table 7).

Table 7: Effect of combined administration palm kernel oil and *Garcinia kola* seed extract on Pentylene tetrazol-induced convulsion

TREATMENT	Dose mg/kg	Onset of myoclonic	Onset of Tonic	Time of death	No. of death
Control	-	0.32 ±0.08	1.32 ± 0.02	2.89±0.01	5/5
Phenobarb	40	1.23 ±0.09c	18.28±1.82c	30.09±0.01c	2/5
KO +GK	5ml+100	4.10±0.34c	5.55± 0.82c	22.38±2.76c	3/5
KO+GK	10ml+100	4.20±0.33c	9.24± 1.60c	24.71±5.28c	1/5
KO+GK	5ml+200	4.14±0.29c	7.23± 4.51c	22.71±2.78c	2/5
KO+GK	10ml+200	3.93±1.21c	6.55± 2.07c	9.24±2.51b	5/5
KO	10ml	13.4±0.98c	0.00± 0.00c	60.00±0.00c	0/5
GK	200	0.00±0.00c	15.09± 1.41c	17.98±1.18c	5/5

Data are expressed as MEAN ± SEM, Significant at ap < 0.05; bp < 0.01; cp<0.001, when compared to control. (n=5).

3.6.2. Isoniazid-induced convulsion

Mice given palm kernel oil and *Garcinia kola* simultaneously showed considerable ($p<0.001$) protection against isoniazid-induced convulsions. When compared to the control group, the group treated with palm kernel oil (10 mL/kg) and *Garcinia kola* (200 mg/kg) showed the greatest ($p<0.05$) delay in the beginning of myoclonic and tonic convulsions, and

this delay was greater than that of the group treated with the conventional medication, diazepam.
Although it was shorter than that of the conventional drug group, the group also had the longest time of death, which was significant ($p<0.01$) when compared to the control group. However, it was discovered that the group given only 10 mL/kg of palm kernel oil suppressed the beginning of tonic convulsions and kept the animals safe during the experiment, with no deaths noted. Compared to the conventional drug group, diazepam, this effect was greater (Table 8).

Table 8: Effect of combined administration palm kernel oil and *Garcinia kola* seed extract on Isoniazid-induced convulsion

TREATMENT mg/kg	Dose	Onset of myoclonic	Onset of Tonic	Time of death	No. of death
Control -		2.53±0.28	11.50 ± 0.95	25.82±2.92	5/5
Diazepam	5	4.17±0.10a	26.19 ± 0.53b	84.09±4.05c	5/5
KO +GK	5ml+100	3.44±0.27	29.13± 0.87c	36.01±2.75	5/5
KO+GK	10ml+100	3.75±0.45	23.63± 2.91	36.32±1.70	5/5
KO+GK	5ml+200	3.12±0.10	26.96± 2.33b	31.41±1.93	1/5
KO+GK	10ml+200	4.70±1.89a	32.22± 1.60c	76.21±1.51b	2/5
KO	10ml	3.40±0.73	0.00± 0.00c	120.00±0.00c	0/5
GK	200	2.55±0.69	19.03± 1.23	36.74±3.25	5/5

Data are expressed as MEAN ± SEM, Significant at a $p<0.005$; b $p<0.01$; c $p < 0.001$, when compared to control. (n=5).

4. Discussion

Palm kernel oil and *Garcinia kola* are two important ethno medicines employed in the treatment of various diseases such as fever and convulsion especially in children. The anticonvulsant activity of the concomitant administration of *Garcinia kola* and palm kernel oil was evaluated in this study against experimentally-induced convulsions. The combination of palm kernel oil and *Garcinia kola* seed extract was found to provide a significant degree of protection against seizures induced by pentelyene tetrazol and isoniazid. However, it was observed that the anticonvulsant activity of *Garcinia kola* alone was better than that of the various combinations. Moreover, the anticonvulsant activity of palm kernel oil alone against the two experimentally-induced seizures was better than that of the various combinations, *Garcinia kola* alone and that of the standard drug in some cases. The lower activity of the combinations than *Garcinia kola* alone or palm kernel oil alone suggest some levels of antagonism. It therefore implies that combining the two natural products in the treatment of convulsion reduces the efficacy of the medicines. But according to De Sarro et al. (1999) [23], pentylene tetrazol (PTZ) may have an anticonvulsant effect by blocking gamma aminobutyric acid (GABA) from acting on GABA receptors. The primary inhibitory neurotransmitter linked to epilepsy is gamma aminobutyric acid. Convulsions are attenuated and enhanced, respectively, by the increase and inhibition of GABA neurotransmission [25,26,27].

It has been demonstrated that phenobarbitone and diazepam, two common medications used to treat epilepsy, work by strengthening GABA-mediated inhibition in the brain [26, 27]. According to reports, these medications increase GABA neurotransmission, which counteracts PTZ-induced convulsion [24]. Since phenytoin is believed to have an antiepileptic effect by preventing sodium ions from entering brain cells and so preventing the production of recurrent action potentials, it was unable to stop PTZ-induced seizures [28, 29]. Since both the individual products and the combination of palm kernel oil and *Garcinia kola* were able to protect the animals and postpone PTZ-induced convulsions, this further supports the products' CNS depressant effect and their capacity to improve GABA-mediated inhibition in the brain, with palm kernel oil exhibiting the highest activity.

The anti-tuberculosis medication isoniazid causes status epilepticus by inhibiting the pyridoxal-5-phosphate-dependent Glutamic Acid Decarboxylase (GAD), which lowers the amount of Gamma-Aminobutyric Acid (GABA), a key inhibitory transmitter chemical in the human brain [30,31,32]. The active form of pyridoxine, pyridoxal-5-phosphate, is an enzyme necessary for the production of GABA and a cofactor for GAD [31,32,33,34,35]. Status epilepticus is characterized by frequent seizures brought on by a drop in GABA levels [31, 32]. Intravenous diazepam is still utilized to control the

seizure episodes when pyridoxine is not available, despite the fact that isoniazid-induced seizures are known to react poorly to currently available anticonvulsant medications [31,32,36,37].

Although less effective than the effects of the individual products, the different combinations of palm kernel oil and *Garcinia kola* extract were found to considerably protect the treated mice against INH-induced convulsion. This further demonstrated that the two products' constituent parts had antagonistic properties. Their anticonvulsant actions consequently may have been owing to their ability to improved GABA production in the brain through the activities of their phytoconstituents. Because they have structural similarities with benzodiazepines, secondary metabolites from plants, like flavonoids, have been shown on multiple occasions to have antiepileptic properties by altering the GABA-Cl-channel complex [38]. It has been documented that some flavonoids and their glycosides have sedative, anticonvulsant, and anxiolytic effects on the central nervous system (CNS) [39].

In experimental epilepsy models, flavonoids such rutin, quercetin, and isoquercitrin have been demonstrated to exhibit anticonvulsant properties [40]. Because they have structural similarities with benzodiazepines, flavonoids are known to have antiepileptic effects by altering the GABA-Cl-channel complex [38]. Another flavonoid that has been described as a centrally acting benzodiazepine ligand and that proved effective against convulsions brought on by picrotoxin is apigenin [41]. Flavonoids, the polyunsaturated fatty acids 9-octadecenoic acid methyl ester, 9, 12-octadecadienoic acid (Z, Z), stearic acid methyl ester, and hexadecanoic acid methyl ester, as well as other phenolic compounds, including flavonoids, garcinoic acid, garcinol, and tocotrienol, are known to be abundant in *Garcinia kola* seed extract [39, 41]. These metabolites are likely to act by scavenging free radicals and modulating the GABA-Cl-channel complex in the CNS, thereby exerting its anticonvulsant activity.

Additionally, it has been claimed that omega-3-fatty acids and straight-chain or medium-chain fatty acids, including capric, lauric, myristic, palmitic, and stearic acid, have anticonvulsant properties [41]. Numerous fatty acids, including caproic, caprylic, capric, lauric, myristic, palmitic, linoleic, behenic, stearic, oleic, arachidonic, palmitoleic, and linolenic acids, have been found to be present in palm kernel oil [8,12]. According to this study, these fatty acids might be the cause of its anticonvulsant properties. These findings support previous reports by Alaribe et al. [8] and Amagon et al. [12] that the palm kernel oil has anticonvulsant properties.

The results of this study have confirmed the anticonvulsant potential of palm kernel oil and *Garcinia kola* seed extract combination which is used local in the treatment of convulsions in children but observed a high level of antagonism between the two natural products which leads to reduction of their combined efficacy in the treatment of convulsion [42]. Therefore, it is recommended that either of the products should be used alone, especially palm kernel oil, in the treatment of convulsions.

5. Conclusion

The finding of this study evaluates the use of Nigerian herbs as anticonvulsants; *Garcinia kola* and *Elaeis guineensis* kernel oil can be considered a promising complementary approach to managing convulsions individually. The combined products of palm kernel oil and *Garcinia kola* possess anticonvulsant activity, but mild. So, the combination is used mostly during healing crisis to produce a better therapeutic use, especially in neonates and children, and this supports its use in ethnomedicine for the treatment of central nervous system disorders, but it is better to use the individual product to achieve a better efficacy.

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