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# Essential vitamins and mineral salts in some extracts used in alternative medicine in Nigeria

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**ABSTRACT**

*Minerals are essentially required for tissue functioning in human beings and their presence in medicinal plants can have a substantial influence on the therapeutic value of herbal remedies. Excessive intake of some minerals can upset homeostatic balance and cause toxic side effects. Also, severe shortages or self-prescribed minerals can alter the delicate balance in body functions that promotes health. Vitamins are organic compounds present in minute amounts in natural foodstuffs that are essential to normal metabolism and the lack of which in the diet causes deficiency diseases. Mineral and vitamin compositions analyses were carried out on four extracts-the extracts from earthworm, Aloe vera, Ganoderma lucidium, and snail (Archachatina) using standard methods. The aim of the study was the comparison analysis of the mineral and vitamin compositions of some extracts used in alternative medicine. The mineral and vitamin compositions of Ganoderma, Aloe vera, earthworm extracts and snail water showed that they have high medicinal values. However, results showed that the mineral and vitamin constituents vary significantly ($p < 0.05$) among the extracts. The mineral and vitamin composition of the extracts confirm their usefulness in alternative medicine.*

**Keywords:** Minerals; vitamins; extracts; antinutrients, alternative medicine.

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## INTRODUCTION

Nowadays more and more people choose to be treated by methods that are not based on Western systematic techniques that are the knowledge and practice of medicine which is usual in the West. These methods are known as “Alternative medicine. Alternative Medicine is defined as medicine that encompasses any healing practice "that does not fall within the realm of conventional medicine." Commonly cited examples include naturopathy, chiropractic, herbalism, traditional Chinese medicine, Ayurveda, meditation, yoga, biofeedback, hypnosis, homeopathy, acupuncture, and diet-based therapies, in addition to a range of other practices.

Extracts from plants and animals have been used over the years to treat various diseases and sicknesses found among men. According to the World Health Organization (WHO), nearly 80 percent of the world’s population depends for its primary health care needs on medicines derived from plants and animals [1]. Of the 252 essential chemicals that have been selected by the World Health Organization, 11.1% come from plants, and 8.7% from animals [2]. Although considered by many as superstition, the pertinence of traditional medicine based on animals cannot be denied since they have been methodically tested by pharmaceutical companies as sources of drugs to the

modern medical science [3]. The annual global trade in animal-based medicinal products accounts for billions of dollars per year [4]. In like manner, the use of medicinal plants as traditional medicines is well known in rural areas of many developing countries [5]. The medicinal plants traditionally occupied an important position in the sociocultural, spiritual, and ethnopharmacology of rural and tribal lives in different parts of the world. Modern pharmacopeia contains at least 25% drugs derived from plants and approximately 70% of "synthetic" medicines are derived from plants [6]. [7] in its resolution AFR/RC50/R3 (2000) recommended and encouraged research and the use of medicinal plants especially in countries where access to modern medicine and conventional treatment is difficult. However, the medicinal value of these plants depends upon chemical compound that produce a specific physiological action on human body [8, 9]. Quality of herbs depends on the presence of active principles. [10] reported that *Aloe* gel obtained from the inner portion of the leaves contains glucomannan, a hydro-soluble fibre which has a glucose-lowering effect.

Minerals are inorganic elements that originate in the earth and cannot be made in the body. They play important roles in various bodily functions and are necessary to sustain life and maintain optimal health, and thus are essential nutrients. Most of the minerals in the human diet come directly from plants and water, or indirectly from animal foods. However, the mineral content of water and plant foods varies geographically because of variations in the mineral content of soil from region to region [11, 12]. Minerals are essentially required for tissue functioning in human beings and their presence in medicinal plants can have a substantial influence on the therapeutic value of herbal remedies: a positive contribution as a source of essential nutrients or even as active principles, or a negative effect because of the accumulation of high concentrations of potentially toxic elements [13]. The elemental composition of plants is important to the health and productivity of animals which graze them. Green tea catechins were demonstrated to prevent inflammation, cancer, hypercholesterol, angiogenesis, arthritis, oxidative stress, and neurodegeneration [14, 15] and according to University of Maryland Medical Center [16], certain plant extracts such as green tea extract may be able to burn fat and boost metabolism because of the polyphenol catechin. Living organisms need minerals for osmotic adjustment, to activate enzymes and other organic molecules that enhance the growth and maintain life processes [17, 18]. Enhanced intake of minerals like Ca, K, Na and P can be useful in patients with chronic renal failure [18].

Vitamins are defined as a group of complex organic compounds present in minute amounts in natural foodstuffs that are essential to normal metabolism and the lack of which in the diet causes deficiency diseases [19]. Liver extract contains vitamin B12, folic acid, and iron. In animals, it seems to increase the number of liver cells. Liver extract is used for improving liver function, treating chronic liver diseases, preventing liver damage, and regenerating liver tissue. It is also used for allergies; chronic fatigue syndrome; enhancing muscle development in bodybuilders; improving stamina, strength, and physical endurance; removing chemicals from the body (detoxification); and as an aid to recovery from chemical addiction or poisoning [20]. Vitamin C is an antioxidant, along with vitamin E, beta-carotene, and many other plant-based nutrients. B vitamins are all involved in the metabolism of carbohydrates, fats and proteins into usable energy, but some are also important for digestion, immunity and red blood cell production within bone marrow. Some B vitamins are also needed to maintain the health of your skin, nails and hair, and B-12 and folic acid are required for healthy brain chemistry and higher brain functions, such as cognition and short-term memory. However, vitamins and herbal extracts are associated with various side effects, potential serious drug interactions and mostly unproven efficacy [21]. The aim of this study is the comparison analysis of the mineral and vitamin compositions of some extracts used in alternative medicine.

## MATERIALS AND METHODS

Samples of earthworm were procured from riverside of Okitipupa, Ondo State. They were washed with water and transported in a clean plastic bucket with moist sand to the laboratory for processing. The extraction of the samples was carried out according to the method described by Ang Lopez and Realm [22]. Samples of succulent leaves of *Aloe vera* plant were procured from the neighbourhood, washed with distilled water and taken to the laboratory for processing. Extraction of *Aloe vera* juice was done according to the method described by [23]. Samples of *Ganoderma lucidium* were obtained from a farmland in Owo Local Government Area, Ondo State, Nigeria. Aqueous extraction was carried out on the samples according to the method of [24]. Samples of matured giant land snails were obtained from Oje market, Ibadan, Oyo State and were transported to the laboratory for processing. The samples were thoroughly cleansed with distilled water. The bluish supernaut got after the shell is carefully removed and the resultant fluid from the snails was centrifuged at 500 rpm for 15 minutes.

Mineral and vitamin compositions analyses were carried out on each of the four extracts-the extracts from earthworm, *Aloe vera*, *Ganoderma lucidium*, and snail (*Archachatina*) and the results are shown in tables below.

**Statistical analysis**

All assays were carried out in triplicate, and the means and standard error of means (SEM) were determined using SPSS version 20. Analysis of variance was performed to determine significant differences between the paired samples. Differences in paired samples performance for the nutritional and chemical compositions were tested by the Student's t-test. <0.05 implies significance.

## RESULTS

The mineral compositions of the extracts were shown in Table 1 while Table 2 shows the paired samples test of the mineral compositions of the extracts. Iron content ranged from 8.67 to 13.27mg/100g with earthworm extract having the highest value and *Ganoderma* extract having the lowest value. Zinc content ranged from 0.40 to 13.2mg/100g with earthworm extract having the highest value and *Ganoderma* extract having the lowest value. Similar trends were observed for zinc and iron amongst the four extracts. Calcium and potassium had similar trends amongst the four extracts. Calcium content ranged from 281.67 to 753.33mg/100g with the highest value found in *Aloe vera* and the lowest value found in earthworm. Potassium content in the extracts ranged from 15.00 to 125mg/100g with *Aloe vera* extract having the highest value and earthworm extract having the lowest value. Similar trends were observed for magnesium and phosphorus amongst the four extracts. The range for magnesium content was 46.67 to 99.33mg/100g with the highest value in *Aloe vera* and the lowest in earthworm extract while Phosphorus content ranged from 323.33 to 585.33mg/100g with the highest value in *Aloe vera* extract and the lowest value in earthworm. Figure 1 shows the trends in the mineral composition of the extracts.

**Table 1. Mineral compositions of some extracts used in alternative medicine**

| PARAMETERS (mg/100g) | SNAIL WATER | *GANODERMA* | *ALOE VERA* | EARTHWORM |
|---|---|---|---|---|
| IRON | 9.33±0.18 | 8.67±0.12 | 11.47±0.09 | 13.27±0.09 |
| ZINC | 0.50±0.00 | 0.40±0.00 | 0.63±0.03 | 13.2±0.09 |
| MAGNESIUM | 76.67±1.67 | 65.00±0.00 | 93.33±3.33 | 46.67±1.67 |
| CALCIUM | 351.67±1.67 | 385.00±2.89 | 753.33±3.33 | 281.67±3.03 |
| POTASSIUM | 31.67±1.67 | 81.67±4.41 | 125.00±0.00 | 15.00±0.00 |
| PHOSPHORUS | 393.33±1.67 | 328.33±6..01 | 585.33±3.33 | 323.33±1.67 |
| Ca/Mg | 4.59±0.11 | 5.92±0.04 | 8.07±0.18 | 6.05±0.28 |
| Ca/P | 0.89±0.01 | 1.17±0.03 | 1.28±0.01 | 0.87±0.01 |
| Ca/K | 10.77±0.91 | 12.65±2.36 | 13.00±1.00 | 16.57±1.17 |

*Values are means ±SEM (Standard error of means) of triplicate samples*

The mineral ratios amongst the extracts showed no similar trends. Ca/K ratio ranged from 10.77 to 16.57 with the highest ratio found in earthworm extract and the lowest in snail water. Ca/P ratio ranged from 0.87 to 1.28 with *Aloe vera* extract having the highest ratio and earthworm extract having the lowest ratio. Ca/Mg ratio ranged from 4.59 to 8.07 with the highest ratio found in *Aloe vera* and the lowest ratio in snail water.

**Table 2. Paired samples test mineral compositions of some extracts used in alternative medicine**

| Parameters (mg/100g) | Paired samples | Diff. Mean | Sig. (2-Tailed) |
|---|---|---|---|
| Iron | snail_water- Ganoderma | 0.67±.22 | 0.093 |
| | snail_water- Aloe_vera | -2.13±0.19 | 0.007 |
| | snail_water- Earthworm | -3.93±0.23 | 0.004 |
| | Ganoderma- Aloe_vera | -2.80±0.21 | 0.005 |
| | Ganoderma- Earthworm | -4.60±0.20 | 0.002 |
| | Aloe_vera- Earthworm | -1.80±0.06 | 0.001 |
| Zinc | snail_water- Ganoderma | ---------- | ------ |
| | snail_water- Aloe_vera | -0.13±0.03 | 0.057 |
| | snail_water- Earthworm | -0.33±0.03 | 0.010 |
| | Ganoderma- Aloe_vera | -0.33±0.03 | 0.020 |
| | Ganoderma- Earthworm | -0.43±0.03 | 0.006 |
| | Aloe_vera- Earthworm | -0.20±0.06 | 0.074 |
| Magnesium (Mg) | snail_water- Ganoderma | 11.67±1.67 | 0.020 |
| | snail_water- Aloe_vera | 16.67±1.67 | 0.010 |
| | snail_water- Earthworm | 30.00±2.89 | 0.009 |
| | Ganoderma- Aloe_vera | 28.33±1.67 | 0.003 |
| | Ganoderma- Earthworm | 18.33±1.67 | 0.008 |
| | Aloe_vera- Earthworm | 46.67±1.67 | 0.001 |
| Calcium (Ca) | snail_water- Ganoderma | -33.33±1.67 | 0.002 |
| | snail_water- Aloe_vera | -401.67±1.67 | 0.000 |
| | snail_water- Earthworm | 70.00±2.89 | 0.002 |
| | Ganoderma- Aloe_vera | -368.33±1.67 | 0.000 |
| | Ganoderma- Earthworm | 103.33±1.67 | 0.000 |
| | Aloe_vera- Earthworm | 471.67±3.33 | 0.000 |
| Potassium (K) | snail_water- Ganoderma | -50.00±5.00 | 0.010 |
| | snail_water- Aloe_vera | -93.33±1.67 | 0.000 |
| | snail_water- Earthworm | 16.67±1.67 | 0.010 |
| | Ganoderma- Aloe_vera | -43.33±4.41 | 0.010 |
| | Ganoderma- Earthworm | 66.67±4.41 | 0.004 |
| | Aloe_vera- Earthworm | ---------- | ------ |
| Phosphorus (P) | snail_water- Ganoderma | 65.00±7.64 | 0.014 |
| | snail_water- Aloe_vera | -190.00±2.89 | 0.000 |
| | snail_water- Earthworm | ---------- | 0.001 |
| | Ganoderma- Aloe_vera | -255.00±7.64 | ------ |
| | Ganoderma- Earthworm | -255.00±7.64 | 0.580 |
| | Aloe_vera- Earthworm | 260.00±2.89 | 0.000 |
| Ca/Mg | snail_water- Ganoderma | -1.32±0.10 | 0.006 |
| | snail_water- Aloe_vera | -3.48±0.14 | 0.002 |
| | snail_water- Earthworm | -1.46±0.33 | 0.048 |
| | Ganoderma- Aloe_vera | -2.16±0.14 | 0.000 |
| | Ganoderma- Earthworm | -0.14±0.25 | 0.633 |
| | Aloe_vera- Earthworm | 2.02±0.24 | 0.014 |
| Ca/P | snail_water- Ganoderma | -0.28±0.03 | 0.012 |
| | snail_water- Aloe_vera | -0.39±0.01 | 0.001 |
| | snail_water- Earthworm | 0.02±0.01 | 0.370 |
| | Ganoderma- Aloe_vera | -0.11±0.02 | 0.032 |
| | Ganoderma- Earthworm | 0.30±0.02 | 0.006 |
| | Aloe_vera- Earthworm | 0.41±0.01 | 0.001 |
| Ca/K | snail_water- Ganoderma | -1.88±1.45 | 0.418 |
| | snail_water- Aloe_vera | -2.24±1.91 | 0.449 |
| | snail_water- Earthworm | -5.80±0.26 | 0.029 |
| | Ganoderma- Aloe_vera | -1.96±2.52 | 0.517 |
| | Ganoderma- Earthworm | -4.84±1.15 | 0.052 |
| | Aloe_vera- Earthworm | -2.88±1.43 | 0.181 |

*Significant difference ($P < 0.05$)*

Table 2 shows the paired samples test of mineral composition of the extracts. There were significant differences in calcium, Magnesium and potassium compositions between the extracts: snail water and *Ganoderma*; snail water and *Aloe vera*; snail water and Earthworm; *Ganoderma* and *Aloe vera*; *Ganoderma* and Earthworm; *Aloe vera* and Earthworm. For iron and phosphorus, there were significant differences between extracts except between snail water and *Ganoderma* and *Ganoderma* and earthworm respectively. For zinc, there were significant differences between the extracts except between snail water and *Aloe vera*; *Aloe vera* and earthworm.

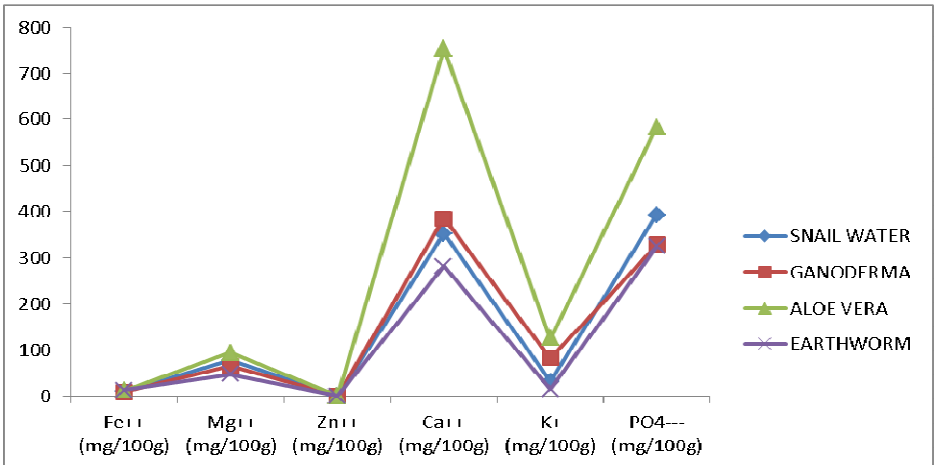



**Figure 1: The Trends of Mineral Compositions of some Extracts used in Alternative…**

The vitamin compositions of the extracts were shown in Table 3 while Table 4 shows the paired samples test of the vitamin compositions of the extracts. There was no similar trend found between any of the vitamin compositions amongst the four extracts. The range for ascorbic acid was 0.83 to 22.43mg/100g with the highest value found in *Ganoderma* extract and the lowest in earthworm extract. Thiamine content ranged from 0.13 to 0.24mg/100g with the highest value found in earthworm extract and lowest value in snail water. The range for riboflavin content was 0.09 to 0.19mg/100g with the highest value in earthworm extract and the lowest in snail water. Niacin content ranged from 0.14 to 0.28mg/100g with the highest value in earthworm extract and the lowest value in *Aloe vera*. Figure 2 shows the trends in the vitamin composition of the extracts.

There were significant differences in Ascorbic acid and Riboflavin compositions between extracts: snail water and *Ganoderma*; snail water and *Aloe vera*; snail water and earthworm; *Ganoderma* and *Aloe vera*; *Ganoderma* and earthworm; *Aloe vera* and earthworm. For Thiamine, there were significant differences between the extracts except between snail water and *Ganoderma* ; *Aloe vera* and earthworm. For Niacin, there were significant differences between the extracts except between snail water and *Ganoderma*.

**Table 3. Vitamin compositions of some extracts used in alternative medicine**

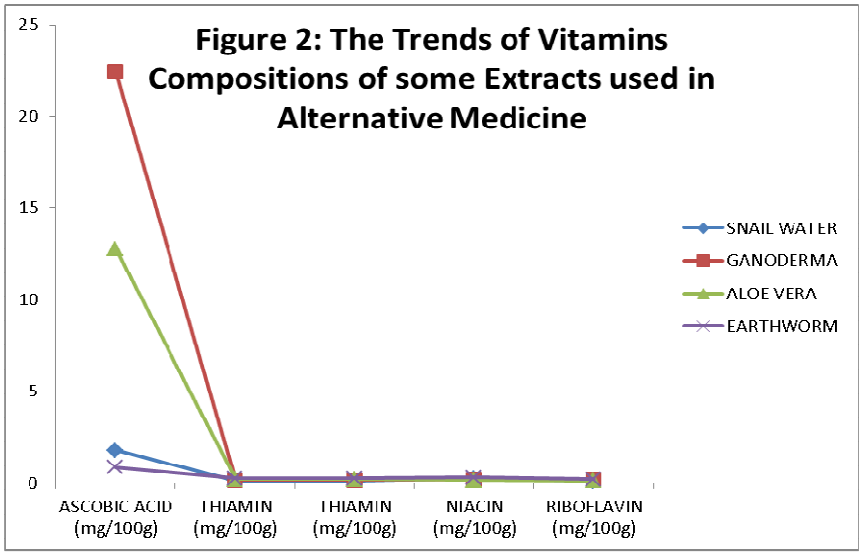
| PARAMETER (mg/100g) | SNAIL WATER | *GANODERMA* | *ALOE VERA* | EARTHWORM |
|---|---|---|---|---|
| ASCORBIC ACID | 1.77±0.04 | 22.43±0.03 | 12.77±0.15 | 0.83±0.17 |
| THIAMINE | 0.13±0.00 | 0.15±0.00 | 0.18±0.00 | 0.24±0.01 |
| NIACIN | 0.23±0.01 | 0.20±0.00 | 0.14±0.00 | 0.28±0.00 |
| RIBOFLAVIN | 0.09±0.00 | 0.16±0.00 | 0.12±0.00 | 0.19±0.10 |

*Values are means ±SEM (Standard error of means) of triplicate samples.*

**Table 4. Paired samples test vitamin compositions of some extracts used in alternative medicine**

| Parameter | Paired samples | Diff. Mean | Sig. (2-Tailed) |
|---|---|---|---|
| Ascorbic Acid | snail_water- Ganoderma | -20.67±0.09 | 0.000 |
| | snail_water- Aloe_vera | -11.00±0.06 | 0.000 |
| | snail_water- Earthworm | 0.93±0.09 | 0.009 |
| | Ganoderma- Aloe_vera | 9.67±0.12 | 0.000 |
| | Ganoderma- Earthworm | 21.60±0.17 | 0.000 |
| | Aloe_vera- Earthworm | 11.93±0.07 | 0.000 |
| Thiamine | snail_water- Ganoderma | -0.03±0.01 | 0.057 |
| | snail_water- Aloe_vera | -0.06±0.01 | 0.014 |
| | snail_water- Earthworm | -0.11±0.01 | 0.003 |
| | Ganoderma- Aloe_vera | ---------- | --------- |
| | Ganoderma- Earthworm | -.09±0.01 | 0.023 |
| | Aloe_vera- Earthworm | -.06±0.01 | 0.051 |
| Niacin | snail_water- Ganoderma | 0.04±0.01 | 0.053 |
| | snail_water- Aloe_vera | 0.09±0.01 | 0.012 |
| | snail_water- Earthworm | -0.05±0.01 | 0.049 |
| | Ganoderma- Aloe_vera | 0.05±0.01 | 0.015 |
| | Ganoderma- Earthworm | -0.09±0.00 | 0.001 |
| | Aloe_vera- Earthworm | -0.14±0.01 | 0.002 |
| Riboflavin | snail_water- Ganoderma | -0.07±0.01 | 0.007 |
| | snail_water- Aloe_vera | -0.03±0.00 | 0.010 |
| | snail_water- Earthworm | -0.10±0.01 | 0.007 |
| | Ganoderma- Aloe_vera | 0.04±0.00 | 0.008 |
| | Ganoderma- Earthworm | -0.03±0.01 | 0.038 |
| | Aloe_vera- Earthworm | -0.07±0.01 | 0.007 |

*Significant difference (P < 0.05)*




## DISCUSSION

Minerals are chemical constituents used by the body in many ways and though they yield no energy but play important roles in many activities in the body [25, 26]. The human body needs different minerals in order to function properly [27]. These elements are divided into macro- and micro-minerals. Macro-minerals are needed in larger amounts than 100 mg/day and they include calcium (Ca), phosphorus (P), magnesium (Mg), sulfur (S), sodium (Na), chloride (Cl) and potassium (K) micro-minerals are needed in smaller amounts than 100 mg/day and they include elements such as iron (Fe), zinc (Zn), iodine (I), selenium (Se), manganese (Mn), chromium (Cr), copper (Cu), molybdenum (Mo), fluorine (F), boron (B), cobalt (Co), silicon (Si), aluminum (Al), arsenic (Ar), tin (Sn), lithium (Li) and nickel (Ni) [28]. The results indicate that the four extracts are good sources of macro and micro mineral elements. This is very important when the usefulness of such minerals is put into consideration. Minerals are needed in the body because they form the structure of the body and help the body systems to work effectively. Zinc is needed for the body's defensive (immune) system to properly work; plays a role in cell division, cell growth, wound

healing and the breakdown of carbohydrates and is also needed for the senses of smell and taste [29, 30, 31]. The main function of Fe is in the transport of oxygen to the tissue (hemoglobin) and is also involved in the processes of cellular respiration [32, 33]. Magnesium is an essential mineral for staying healthy and is required for more than 300 biochemical reactions in the body [34]. Multiple health benefits of magnesium include transmission of nerve impulses, body temperature regulation, detoxification, energy production, and the formation of healthy bones and teeth and it aids in the absorption of calcium by the body [27]. Magnesium is closely associated with calcium and phosphorus both in its distribution and its metabolism. The other crucial health benefits of magnesium include protein synthesis, relief from bronchospasm (constricted airways) in the lungs, and improvement of parathyroid function. It boosts the bio-availability of vitamin B6 and cholesterol, improves muscle functioning, and prevents osteoporosis, insomnia, constipation, heart attacks, hypertension, constipation, migraines, kidney stones, and gallstones. Calcium plays a critical role in maintaining structural integrity of the skeleton. Calcium is an absolutely critical nutrient in regulating acid/alkaline balance (called pH) in the blood and helps form and maintain healthy teeth and bones. It also helps the body with clotting blood, sending and receiving nerve signals squeezing and relaxing muscles, releasing hormones and other chemicals and keeping a normal heartbeat [35]. Potassium is an essential mineral and a major electrolyte found in the human body. It plays an important role in electrolyte regulation, nerve function, muscle control, blood pressure and regulates water and mineral balance throughout the body [36]. It works with sodium to maintain the body's normal blood pressure. Phosphorus-containing compounds in the body play a major role in genetic material - the DNA and RNA that makes each of us unique; cellular membranes; teeth and bones; human energy systems and cell signaling systems, which regulates diverse functions from the acid-base balance in the body to hormonal responses [34].

Furthermore, the ratios of the mineral compositions is very important as reported by [37] that determining nutritional interrelationships is much more important than knowing mineral level alone. The ratios are often more important in determining nutritional deficiencies and excess; it is predictive of future metabolic dysfunctions or hidden metabolic dysfunction. Calcium and phosphorus are usually discussed together because they occur in the body combined with each other for the most part and because an inadequate supply of either limits the nutritive value of both. The Ca/P ratio observed in all the four extracts is of nutritional benefit, particularly for children and the aged who need higher intakes of calcium and phosphorus for bone formation and maintenance. Food is considered ‘good’ if the ratio is above one and ‘poor’ if the ratio is less than 0.5 while Ca/P ratio above two helps to increase the absorption of calcium in the small intestine [38]. Ca/Mg ratio is the lifestyle ratio because it is associated with the diet, attitudes, and lifestyle factors such as one’s relationships, location, occupation, friends and perhaps other lifestyle factors. The Ca/Mg ratio observed in this study is within normal range in the four extracts. The ratio range of 10-12 and 3.0-3.3 is considered hypoglycemia while ranges of 3.3-6.7 and 6.67-10 are considered good. Ratio greater than 16.0 or very low ratio less than 2 is associated with mental or emotional disturbances [39]. Ca/K ratio is usually called thyroid ratio because calcium and potassium play a vital role in regulating thyroid activity. The Ca/K ratio in the four extracts is within the range considered good for thyroid activity. The Ca/K ratio ranges 1-2 and 8-16 indicate moderate thyroid activity with 10-25% energy loss while ratio ranges 2-4 and 4-8 indicate mild thyroid activity with 25-50% energy loss. Ratio below 1 or above 32 indicates abnormal thyroid activity with 75% or more energy loss [39].

The results showed that the extracts were rich in some vitamins that are needed for growth and proper development of the body. Riboflavin (Vitamin B2) is important for body growth and the production of red blood cells; niacin helps maintain healthy skin and nerves and ensures that the digestive and nervous systems function properly; thiamine (B1) helps the body cells to change carbohydrates into energy and ascorbic acid helps the body to make collagen, an important protein used to make skin, cartilage, tendons, ligaments, and blood vessels and is also needed for healing wounds, and for repairing and maintaining bones and teeth [40]. Ascorbic acid (vitamin C) is antioxidant; it helps immune system functioning and prevents some of the damage caused by free radicals that can engender disease conditions like cancer, heart disease, arthritis, cataracts [41]. It also helps in the absorption of inorganic iron and builds defence against scurvy. Furthermore, vitamin C facilitates transformation of cholesterol into the bile acid in the liver [42].

The mineral and vitamin compositions of *Ganoderma, Aloe vera,* earthworm extracts and snail water showed that they have high medicinal values. However, results showed that the mineral and vitamin constituents varied significantly ($p< 0.05$) among the extracts. The significant differences observed in the mineral and vitamin compositions between the plant extracts (*Aloe vera* and *Ganoderma*) could be due to several reasons. It has been reported that minerals in plant tissues vary considerably within a given crop and among crops and this wide

variation occurs because varieties differ in the amount of nutrients they take up as a result of the physical and chemical properties of soils. Location, the nature and chemical composition of the soil have been reported to influence the mineral and trace element compositions of plants [43, 44, 45]. Mineral nutrients concentrations fluctuate greatly in both space and time due to environmental factors such as weather, climate and physico-chemical properties, including soil type, soil pH and erosion [46, 47]. Thus, environmental factors such as location rather than genotype have been reported to have greater influence on the mineral and trace element composition of plants [45]. Similarly, the significant differences observed in mineral and vitamin compositions between the animal extracts (snail water and earthworm) could also be attributed to several reasons. Animals do not synthesis their minerals and vitamins; they depend on their food sources. The amounts of nutrients available to animals from time to time depend on quantity present in the food sources and the metabolism of the animal which is influenced by the interaction of dietary, environmental and genetic factors [48]. [49] reported that cobalt, copper, iodine and selenium deficiencies in the soil and flora in certain areas of the world have led to deficiencies of these minerals in domestic animals. In addition, the presence of inherent toxic factors or anti-nutritional components in plants could also affect the absorption and availability of some minerals and vitamins in plant food by humans and animals [50, 51, 52, 53]. In general, minerals from animal sources are absorbed better than those from plant sources as minerals are present in forms that are readily absorbed and binders that inhibit absorption, such as phytates, are absent. Thus, earthworm extract and snail water would be better sources of minerals and vitamins than *Aloe vera* and *Ganderma* extracts to treat patients who suffering from diseases caused by their deficiencies.

## CONCLUSION

The present study has verified the usefulness of the extracts for medicinal purposes based on their mineral and vitamin composition. However, earthworm extract and snail water are likely to be better sources of minerals and vitamins than *Aloe vera* and *Ganderma* extracts to treat human patients who are suffering from diseases due to their deficiencies because anti-nutrient factors which are generally present in plants.

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