

Phytochemical and vitamin content *Newbouldia* leaf

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Abstract

This study analyzed and identified the concentrations of secondary metabolites present in *Newbouldia laevis*. The results showed the *Newbouldia laevis* contains various secondary metabolites in the following concentrations: saponin (1.0410 ± 0.13294 mg/g), tannin (1.4665 ± 0.06152 mg/g), glycosides (0.8240 ± 0.1838 mg/g), alkaloid (1.8995 ± 0.2333 mg/g), phenol (0.3980 ± 0.03253 mg/g) and flavonoid (1.6170 ± 0.06505 mg/g). The concentration of vitamins were vitamin A (0.0040 ± 0.00436 mg/g), vitamin B1 (0.3700 ± 0.05369 mg/g), vitamin B2 (0.3067 ± 0.00252 mg/g), vitamin B6 (0.0257 ± 0.00503 mg/g), vitamin B9 (0.0677 ± 0.00351 mg/g), vitamin C (0.1170 ± 0.02272 mg/g), vitamin D (0.2420 ± 0.01082 mg/g), vitamin E (0.7767 ± 0.02043 mg/g) and vitamin K (0.1147 ± 0.00115 mg/g) and β -carotene (0.0587 ± 0.00252 mg/g). Thus, the leave extracts of *Newbouldia laevis* could be used for medicinal purposes.

Keywords: Phytochemicals; saponin glycosides; alkaloid; phenol; flavonoids; tannins; vitamins

1. Introduction

[1] reported how old the use of traditional drugs has been in use. The traditional drugs which involve the use of gravies (herbalism) is distinct from orthodox western medicine. It's projected that 70 % of the world's population (mainly in the developing countries) rely on the traditional drug as their introductory form of health care [2]. The use of traditional drugs can't be scrapped out in the treatment and operation of disease conditions in the African landmass and this could be due to socio-cultural and socio-profitable lifestyles; lack of introductory health care and good help [3]. Plants contain active components analogous to anthraquinones, flavonoids, glycosides, saponins, as well as tannins which contain medical parcels that are exercised for the treatment of different conditions [4]. The active ingredients for a vast number of pharmaceutically derived specifics contain components derived from phytochemicals plants. These substances that contain the mending property are known as the active components and differ from plant to plant. Among these plants are the vegetables whose part(s) are eaten as supporting food or main dishes and which could be sweet, bitter, or tasteless [5]. In the former times, disquisition has been concentrated on scientific evaluation of traditional drugs of plant origin, and netting of farther effective and safe hypoglycemic agents has continued to be a quarrying sphere [6]. A truly large area of Nigeria's ecological zones is populated with multitudinous plant species which have their mileage either directly or indirectly for humans [7]. The medicinal values of multitudinous of these plants can't be over-emphasized in the light of oral traditions and myths from the distant history that have continued to glorify the healing graces of these plants and their extracts. Generally, the active factors contained in *Newbouldia laevis* can be pulled and used in different forms which include infusions, syrup, creations, decoctions, invested oils, essential oils, ointments, and creams [8] in

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the treatment/operation and prevention of some disease conditions. Despite the effectiveness of chemically synthesized medicine, screening for plant drugs will continue for the development of a new medicinal plant to resolve both old and new health problems [9]. *Newbouldia laevis* is generally grown as an ornamental tree and planted by slices. It's a truly popular plant in the African landmass and is largely precious due to its numerous immense benefits to humans. Some corridors of Nigeria generally regard this tree as the tree of fertility or tree of life. *Newbouldia laevis* is considerably used in African folk medicine for the treatment of malaria and fever, stomach stitch coughs, sexually transmitted conditions, tooth stitch, bone cancer, and constipation [9]. In southeastern and part of Midwestern Nigeria, the plant is used for the treatment of septic injuries and eye problems [10]. In Nigeria, the bark is nibbled and swallowed for stomach pains, diarrhea, and toothache [9]. The plant has been factory to be effective in the treatment of elephantiasis, dysentery, rheumatic bumps, pile, tooth stitch, and as a vermifuge to roundworms [11]. It has been found useful for observance stitch, sore bases, casket pain, epilepsy, and children's bouleversement. The flake, stem, and fruits have been used for febrifuge; crack dressing, and stomach stitch [9]. The antimicrobial eventuality of methanol extract of the flake [12, 13] has been reported in literature while the anti-seditious [14] and anti-malarial exertion of the root extract has been proved. Comforting goods of the methanol flake extract of *Newbouldia laevis* in mice and rats have also been studied and reported [15]. The plant leaves are used to stop vaginal bleeding in floated cancellation [16]. The stem bark is used in the treatment of incapacity, gestation, and various skin infections. The plant is used traditionally for the treatment of diabetes [17], diarrhoea, dysentery, and gravidity [16]. A recent study has shown the ethanolic flower extract of the plant has antidiabetic exertion [18]. Scientific reports on the phytochemical constituents of the plant reveal the presence of alkaloids and phenylpropanoids amongst others in the roots; flavonoids and tannins in the flake. Vitamin is generally used in multiple responses, and therefore most have multiple functions. In fetal growth and nonage development vitamins are essential for the normal growth and development of a multicellular organism. Using the heritable design inherited from its parents, a fetus develops from the nutrients it absorbs. It requires certain vitamins and minerals to be present at certain level [19]. Vitamins grease the chemical responses that facilitate skin, bone, and muscle development. However, a child may develop an insufficiency complaint, If there is serious insufficiency in one or further of these nutrients. Indeed minor deficiencies may beget endless damage. For grown-ups' health conservation once growth and development are completed, vitamins remain essential nutrients for the healthy conservation of the cells, and organs that make up a multicellular organism. They also enable a multicellular life form to efficiently use chemical energy handed by the food it eats and to help exercise the proteins, carbohydrates, and fats demanded for cellular respiration [20].

2. Material and methods

2.1. Collection of Sample

The leaves of *Newbouldia* used for the study were collected in Nokpa Nike in Enugu East Local Government Area, EnuguState. It was identified at the Botany Department Nnamdi Azikiwe University Awka.

2.2. Extraction

A quantity, (73.08 g) of ground powder were percolated with 500 ml of solvent (400 ml ethanol and 100 ml of water) for extraction and kept at Soxhlet 150 °C temperature for 36 hours. After extraction, the extracts obtained were filtered and concentrated. The extracts were used for qualitatively and quantitative phytochemical as well as determination of the vitamin contents.

2.3. Qualitative Phytochemical Analysis

The qualitative phytochemical analysis was done following [21; 22] protocols. The preliminary analysis involved testing for the presence of flavonoids, terpenoids, steroids, saponins, alkaloids, tannins, glycosides and phenols.

2.4. Test for Tannins

Extract (0.1 g) was stirred with 10 ml of distilled water and then filtered. Few drops of 1 % ferric chloride solution were added to 2 ml of each filtrate. The presence of a blue-black or blue-green precipitate indicated the presence of tannins [22].

2.5. Test for the Alkaloids

A quantity of the extract (0.1 g) was dissolved individually in dilute hydrochloric acid and filtered. Hager's Test: Filtrates were treated with Hager's reagent (saturated picric acid solution). Presence of alkaloids was confirmed by the formation of yellow coloured precipitate [22].

2.6. Test for Saponins

A quantity of each extract (0.1 g) was boiled with 5 ml of distilled water and filtered. To each filtrate, about 3 ml of distilled water was further added and shaken vigorously for about 5 minutes. Frothing which persisted on warming was taken as an evidence for the presence of saponins [8].

2.7. Test for Glycosides

Each extract (0.1 g) was mixed with 30 ml of distilled water and heated on a water bath for 5 minutes. To 5ml of each of the filtrates, 0.2 ml of Fehling's solution A and B were added until it turned alkaline. The solutions were heated on a water bath for 2 minutes. A brick-red precipitate indicated the presence of glycoside [8].

2.8. Test for Terpenoids

Each extract (0.1 g) was dissolved in ethanol. Acetic anhydride (1 ml) was added, followed by the addition of concentrated H₂SO₄. A change in colour from pink to violet showed the presence of terpenoids [8].

2.9. Lead Ethanoate Test for Flavonoids

A quantity (0.1 g) of each extract was dissolved in water and filtered. To 5 ml of each of the filtrates, 3 ml of lead ethanoate solution was added. Appearance of a buff – coloured (pale yellow-brown) precipitate indicated the presence of flavonoids [22].

2.10. Liebermann-Buchard Test for Steroids

To 0.1 g of each extract, 2 ml of acetic acid was added. The solution was cooled well in ice followed by the careful addition of concentrated tetraoxosulphate (VI) acid (H₂SO₄). Colour development from violet to blue or bluish-green indicated the presence of a steroidal ring [8].

2.11. Ferric Chloride Test for Phenols

About 0.1 g of each extract was boiled with distilled water and then filtered. To 2 ml of each filtrate, few drops of 10 % ferric chloride solution were then added. A green-blue or violet colouration indicated the presence of a phenolic hydroxyl group [22].

3. Quantitative Phytochemicals Analysis/ Results

3.1. Determination of Alkaloids (Harborne, 1973)

The sample was weighed (1.0 g) using electric weighing balance into a 250 ml beaker; 100 ml of 10 % acetic acid in ethanol was added to the sample and covered. The mixture was allowed to stand for four hours for proper extraction to take place. The sample was filtered with filter paper and the extract was concentrated on a water bath to one quarter of the original volume. A volume, 20 ml of ammonium hydroxide was added drop wisely to form precipitate of the alkaloid in the filtrate. The filtrate was weighed with NH₄OH and filtered. The filter paper was weighed before using it to filter. After filtering, the filter paper and the precipitate were dried in an oven at 40 °C and weighed. The alkaloid content was determined using the following formula.

$$\text{Concentration of alkaloid} = \frac{W_2 - W_1}{W_3}$$

Where W₁ = weight of empty filter paper

W₂ = weight of the alkaloid and filter paper

W₃ = weight of sample used

3.2. Determinations of Saponins

A quantity of (1.0 g) of the sample was weighed using an electric weighing balance into 250 ml conical flask and soaked with 100 ml of 20 % ethanol for three (3) minutes and heated for three (3) hours at 55 °C for proper extraction then filtered. The residue was re-extracted with another 100 ml of 20 % ethanol. The two extracts were combined and heated to 40 ml at 90 °C on a water bath. The concentrate was transferred into a 500 ml separating funnel and 20 ml of

diethylether was added and shaken vigorously, the upper layer was discarded. The purification process was repeated and 60 ml of n-batanol was added, the lower layer was discarded while the upper layer was collected. The combined n-butanol extract was washed with 10 ml of 5 % aqueous NaCl and the lower layer was discarded while the upper layer was collected in a weighed beaker and heated to dryness. The beaker is allowed to cool in desiccators and re-weighed. The saponin content was determined using the following formula.

$$\text{Concentration of saponin} = \frac{W_2 - W_1}{W_3}$$

Where

W_1 = weight of empty beaker

W_2 = weight of beaker + sample after heating

W_3 = weight of sample used

3.3. Determination of Tannins

Extract of the sample was weighed (1.0 g) into a plastic bottle and 50 ml of distilled water was added and shaken for 3 hours in a vibrator. The sample was filtered into a 50 ml volumetric flask and made up to mark. A volume, 5 ml of the filtrate was dispensed into a test tube and mixed with 2 ml of 0.1M FeCl_2 in 0.1N HCl and 0.008 M potassium ferrocyanide, the absorbance was measured at 120 nm for 10 mins. The tannin concentration was determined using the following relation.

$$\text{Concentration of tannin} = \frac{\text{AbsxPathlength}}{100 \times \text{weight of sample used}}$$

Where

Abs = value of absorbance read

D.F = dilution factor

3.4. Determination of Flavonoids

Extract (1.0 g) was repeatedly extracted with 100 ml of 80 % aqueous methanol at room temperature; the solution was shaken for 30 mins and filtrate was transferred into a weighed beaker and evaporated to dryness over a water bath and weighed again. The time for the first extraction was 1 hour, 45 mins for the second extraction and 30 mins for the third extraction. Flavonoid was determined using the following formula.

$$\text{Concentration of Flavonoid} = \frac{W_2 - W_1}{W_3}$$

Where

W_1 = weight of empty beaker

W_2 = weight of beaker + sample after drying

W_3 = weight of sample used

3.5. Determination of Steroids

Extract (1.0 g) was dispersed in 100 ml of distilled water into a conical flask; the mixture was shaken for 3 hours and allowed to stand overnight. It was then filtered, the filtrate was eluted with 10 ml normal ammonium hydroxide solution, 2 ml of the elute was put into a test tube and mixed with 2ml of chloroform and also 3 ml of acetic hydride was added to the mixture, followed by 2ml of concentrated H_2SO_4 drop wisely. The absorbance was measured in a Spectrophotometer at 420 nm. The steroid concentration was determined using the following relationship

$$\text{Concentration of steroids} = \frac{\text{AbsxPathlength}}{100 \times \text{weight of sample used}}$$

3.6. Quantification of Terpenoid Content [21]

A quantity (0.1 g) of the extract was weighed out separately, macerated with 20 ml of ethanol and filtered through Whatman No. 1 filter paper. The filtrates (1 ml) were pipetted out and 1 ml of 5 % phosphomolybdic acid solution was

added and shaken. Gradually 1 ml of concentrated H₂SO₄ was added to each. The mixtures were left to stand for 30 minutes. Ethanol (2 ml) was added and absorbance was measured at 700 nm.

$$\text{Concentration of terpenoid} = \frac{\text{Abs} \times \text{Path length}}{100 \times \text{weight of sample used}}$$

3.7. Quantification of Glycoside Content [21]

The extract (0.1 g) was weighed out separately, macerated with 20 ml of distilled water and 2.5 ml of 15 % lead acetate was added and filtered. Chloroform (2.5 ml) was added to the filtrates, shaken vigorously and the lower layer collected and evaporated to dryness. Glacial acetic acid (3 ml) was also added together with 0.1 ml of 5 % ferric chloride and 0.25 ml of concentrated H₂SO₄. The mixture was shaken and put in the dark for 2 hours. Absorbance was measured at 530 nm.

$$\text{Concentration of glycoside} = \frac{\text{Abs} \times \text{Path length}}{100 \times \text{weight of sample used}}$$

3.8. Determination of the Vitamin Contents

The vitamin contents of the samples were determined using the modified method of AOAC (2005).

3.9. Determination of vitamin A (Retinol) Concentration

A quantity (1 g) of sample was macerated with 200 ml of petroleum ether for 10 min, and allowed to stand for 1 hour with intermittent shaking at every 1 min. The mixture was centrifuged for 5 min and 3 ml of the supernatant was transferred into triplicate test tubes. Each supernatant in the test tube was evaporated to dryness and the residue re-dissolved with 0.2 ml of acetic anhydride/chloroform (1:1) and 2 ml of 50 % trichloroacetic acid (TCA) in chloroform. The absorbance of the resulting solution was taken at wavelength of 620 nm at 15 seconds and 30 seconds against the corresponding blank.

$$\text{Concentration (mg/g)} = \frac{\text{absorbance} \times \text{dilution} \times \text{pathlength}}{\text{Extinction coefficient}}$$

Path-length = 1(constant)

3.10. Determination of Beta Carotene Concentration

A quantity (5 g) of the sample was weighed into the test tube and 20 ml of petroleum spirit was added and shaken for 5 min. The supernatant was decanted into another test-tube and the absorbance read at 450 nm.

$$\text{Concentration (mg/g)} = \frac{\text{absorbance} \times \text{dilution} \times \text{pathlength}}{\text{Extinction coefficient}}$$

Path-length = 1(constant)

3.11. Determination of vitamin C (Ascorbic Acid)

A quantity (1 g) of each sample was macerated with 20 ml of 0.4 % oxalic acid for 10 min and centrifuged for 5 min. The supernatant (1 ml) was transferred into test tubes to which 9 ml of 2,6-dichlorophenol indophenols (12 mg/l) had been mixed thoroughly by shaking. The absorbance of the resulting solution was taken at 520 nm at 15 sec and 30 sec against corresponding blank.

$$\text{Concentration (mg/g)} = \frac{\text{absorbance} \times \text{dilution} \times \text{pathlength}}{\text{Extinction coefficient}}$$

Pathlength = 1(constant)

3.12. Determination of vitamin E (α- Tocopherol)

A quantity (1 g) of each sample was macerated with 20 ml of petroleum ether for 10 min and allowed to stand for 1 hour with intermittent shaking at every 1 min, and centrifuged for 5 min. supernatant (3 ml) was transferred into triplicate test tubes, evaporated to dryness and the residue re-dissolved with 2 ml ethanol and shaken. A known volume, 1 ml of 0.2 % ferric chloride in ethanol and 1 ml of 0.5 % α-dipyridyl in ethanol were added to the resulting solution and then

made up to 5 ml with ethanol. The mixture was thoroughly shaken and the absorbance taken at a wavelength of 520 nm against corresponding blank.

$$\text{Concentration (mg/g)} = \frac{\text{absorbance} \times \text{dilution} \times \text{pathlength}}{\text{Extinction coefficient}}$$

Path-length = 1(constant)

3.13. Determination of vitamin B1 (Thiamine)

A quantity (1 g) of the sample was homogenized with 50 ml of ethanolic sodium hydroxide solution and filtered into a 100 ml flask. Filtrate (10 ml) was pipette into a beaker and 10 ml potassium dichromate added for color development. A blank sample was prepared and the absorbance was taken at 560 nm. The concentration of each sample was extrapolated from a standard curve.

$$\text{Concentration (mg/g)} = \frac{\text{absorbance} \times \text{dilution} \times \text{pathlength}}{\text{Extinction coefficient}}$$

Path-length = 1(constant)

3.14. Determination of vitamin B2 (Riboflavin)

Each sample (5 g) was extracted with 100 ml of 50 % hydrogen peroxide and allowed to stand for 30 min. Thereafter, 2 ml of 40 % sodium sulphate was added to makeup to 50 ml mark. The absorbance at a wavelength of 510 nm was read in a spectrophotometer.

$$\text{Concentration (mg/g)} = \frac{\text{absorbance} \times \text{dilution} \times \text{pathlength}}{\text{Extinction coefficient}}$$

Path-length = 1(constant)

3.15. Determination of vitamin B3 (Niacin)

Each sample (5 g) was added 50 ml sulphuric acid and shaken for 30 min. Thereafter, 3 drops of ammonia solution were added to the mixture and filtered. Potassium cyanide (5 ml) was added to 10 ml volumetric flask and the mixture acidified with 0.02 M H₂SO₄. The absorbance was read at a wavelength of 470 nm in a spectrophotometer.

$$\text{Concentration (mg/g)} = \frac{\text{absorbance} \times \text{dilution} \times \text{pathlength}}{\text{Extinction coefficient}}$$

Path-length = 1(constant)

3.16. Determination of vitamin B6 (Pyridoxine)

A quantity (1 g) of each sample was extracted with 500 ml of distilled water for 1 hour and filtered. Then, 2 ml of distilled water, 0.4 ml of 50% sodium acetate, 0.1 ml of diazotized reagent and 0.2 ml of 5.5 Sodium Carbonate was added to 1 ml of the filtrate and mixed thoroughly. The absorbance of the solution was read at a wavelength of 540 nm.

$$\text{Concentration (mg/g)} = \frac{\text{absorbance} \times \text{dilution} \times \text{pathlength}}{\text{Extinction coefficient}}$$

Path-length = 1(constant)

3.17. Determination of vitamin B9 (Folic Acid)

A quantity, 1 g of each sample was weighed into a beaker and extracted with 100 ml of distilled water with slight heat. The mixture was shaken thoroughly and filtered after cooling. The absorbance of the filtrate was read spectrophotometrically at a wavelength of 325 nm.

$$\text{Concentration (mg/g)} = \frac{\text{absorbance} \times \text{dilution} \times \text{pathlength}}{\text{Extinction coefficient}}$$

Path-length = 1(constant)

3.18. Determination of vitamin D

A quantity (1 g) of each sample was weighed into a beaker and macerated with 20 ml ethanol for 10 min and filtered. Thereafter, 0.5 ml of Conc. Sulphuric acid was added over a period of 1 min of the filtrate and diluted to 2.5 ml with ethanol. Then, 1 ml Concentrated Sulphuric acid was added over a period of 1 min and mixed thoroughly. The absorbance was read after 2 min at a wavelength of 525 nm.

$$\text{Concentration (mg/g)} = \frac{\text{absorbance} \times \text{dilution} \times \text{pathlength}}{\text{Extinction coefficient}}$$

Path-length = 1(constant)

3.19. Determination of vitamin K

A quantity (1 g) of each sample was dissolved in 10 ml of distilled water and filtered. To 1 ml of the filtrate, 2 ml of distilled water and 1 ml of 0.04% in 1:5 hydrochloric acids were added. The mixture was heated in boiling water for 45 min and cooled. The mixture was then diluted with 10 ml 1:3 ammonium hydroxide and the absorbance of the mixture read at a wavelength of 635 nm against a blank.

$$\text{Concentration (mg/g)} = \frac{\text{absorbance} \times \text{dilution} \times \text{pathlength}}{\text{Extinction coefficient}}$$

Path-length = 1(constant)

Table 1 Qualitative results of *Newbouldia laevis*

Phytochemicals	
Flavonoid	+++
Saponin	+++
Tanin	+++
Phenol	+
Glycosides	++
Alkaloid	++

KEY: + slightly present, ++ moderately present, +++ highly present

The result of chemical analysis indicated that flavonoid, saponin and tannin are highly present while glycosides and alkaloid are moderately present. Phenol is slightly present.

Table 2 Quantitative concentration of *Newbouldia laevis*

Phytochemical	Quantity
Saponin	1.0410± 0.13294
Tanin	1.4665± 0.06152
Glycosides	0.8240± 0.1838
Alkaloid	1.8995± 0.2333
Phenol	0.3980± 0.03253
Flavoniod	1.6170±0.06505

Table 3 Vitamin concentration of *Newbouldia laevis*

Vitamins	Quantity
A	0.0040± 0.00436
B	1 0.3700± 0.05369
B	2 0.3067± 0.00252
B	6 0.0257± 0.00503
B	9 0.0677± 0.00351
C	0.1170± 0.02272
D	0.2420± 0.01082
E	0.7767± 0.02043
K	0.1147± 0.00115
β - carotene	0.0587± 0.00252

4. Discussion

Phytochemical analysis is of great significance in the identification of new sources of nutritive and medicinal parcels. The results of the phytochemical analysis indicated the presence of saponin, tannin, glycosides, alkaloid, flavonoid, and phenol. The presence of flavonoids, glycosides, and tannin in the leave excerpt of *Newbouldia laevis* was in line with the report of [12]; although [12] didn't indicate the presence of alkaloid and saponin in their report. The studies of [23] and [24] didn't report the presence of saponin, alkaloid, and flavonoid. Saponin can inhibit the growth of cancer cells, boost vulnerable systems and energy, act as a natural and anti-inflammatory, antibiotic, and anti-oxidant, and can reduce the uptake of certain nutrients including glucose and cholesterol at the gut through intra-luminal physiochemical interactions. Tannin quickens the mending of wounds and inflamed mucous membrane while alkaloids have stimulating effects and act as a topical anesthetic in ophthalmology, important pain reliever antipyretic action and antibacterial exertion. The difference in quantitative analysis of this plant could be attributed to environmental factors during the growth of the plant or the time of collection.

Vitamins are nutrients our bodies need to maintain functions similar to impunity and metabolism. The results were expressed for the macronutrients as mg of element per kg on dry weight bases. The findings confirm and support the use of *Newbouldia laevis* as a good source in our diet to give vitamins and minerals. The result showed the aspects of vitamin B1, B2, B6, B9, C, D, E, K, β-carotene and vitamin A in veritably minute volumes. Vitamin A is important for normal vision, gene expression, growth, and function by its conservation of epithelial cell functions. Thiamine vitamin (vitamin B1) serves as a coenzyme to metabolize food for energy and to maintain proper heart and function. Thiamine is used to digest and prize energy from foods you eat by turning nutrients into useable energy in the form of "ATP". Riboflavins are necessary for coenzyme conformation [25]. Vitamin C is a veritably important antioxidant that protects the cell from oxidative stress or damage caused by free radicals. Vitamin C possesses antioxidant parcels that are needed for connective cells, wound mending, and facilitates the uptake of dietary iron from the intestine [26]. Scarcities of this vitamin dispose the red blood cell membrane to damage leading to haemolysis [25]. The body requires vitamin K for the complete conformation of certain proteins that are prerequisites for blood coagulation and which the body also needs for controlling the list of calcium in bones and other tissues. Without vitamin K, blood coagulation is seriously disabled and unbridled bleeding occurs. Primary clinical exploration indicates that insufficiency of vitamin K weakens bones, potentially leading to osteoporosis and may promote calcification of arteries and soft tissues [27]. Vitamin D plays a significant part in homeostasis and metabolism. β-carotene is a precursor of vitamin A which is essential for healthy skin, vision, and immune systems. Vitamin B6 serves as a coenzyme in some enzyme responses involving amino acid, glucose, and lipid metabolism [28]. Vitamin B9 (folate) is essential for the body to make DNA and RNA and metabolise amino acid, which is needed for cell division [29]. Vitamin E affects gene expression and is an enzyme exertion controller, as for protein kinase (PKC) which plays a part in smooth muscle growth with vitamin E sharing in the deactivation of protein kinase to inhibit smooth muscle growth [30].

5. Conclusion

This study confirmed the presence of some phytochemicals and vitamins with pharmacological properties that could be exploited for therapeutic purposes.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest.

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