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Evaluation of the Nutraceutical Potentials of *Sida acuta* (Burm .f) Malvaceae Leaves in Rats

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Abstract
This study aims at investigating the aphrodisiac potentials of the aqueous and ethanol extract of *Sida acuta* leaves on male albino rats. The extraction gave a yield of 68 % and further characterization of aqueous extract showed: appearance; solution, colour; dark amber, odour; slight odour, taste; bitter leaf water, and texture; slightly slippery. The chemical properties of the extract showed proximate composition : dry matter; 92.28%, crude proteins; 16.04%, ash; 8.53%, crude fibre; 4.18 % , ethanol extract; 1.57% and energy; 2760 kcal / kg. Nutrients provide nourishment. Proteins, carbohydrates, fat, vitamins, minerals, fibre and water are all nutrients. If people do not have the right balance of nutrients in their diet, their risk of developing certain health conditions increases. The phytochemical analysis showed that alkaloids gave 6.67 ± 0.006; flavonoids; 2.94 ± 0.06; saponins; 0.00 ± 0.00 ; tannins; 4.14 ± 0.06; cardiac glycosides; 5.93 ± 0.05; phlobatanins; 3.92 ± 0.06; terpenoids; 5.59 ± 0.05 and anthraquinones; 0.00 ± 0.00. Also, the protein contents of the *Sida acuta* leaves showed the presence of essential and some non-essential amino acids.. Recent scientific findings have established a relationship between the consumption of phytochemicals like carotenoids, polyphenols, isoprenoids,phytosterols, saponins, dietary fibres, polysaccharides for the possess health benefits like prevention of diabetes mellitus, obesity, cardiovascular diseases and cancer. *Sida acuta* being a mucilaginous plant is used in making sauce at homes. Beside the above high profile and abundant bioactive compounds, *S.acuta* leaves have abundant medicinal uses that made it an inter-continental nutraceutical plant.
Keywords: nutrients, protein, phytochemicals, nutraceutical, bioactive compounds, characterization

Introduction

Hippocrates-the father of modern medicine (460—377BC) emphasized the association between nutrition and human health and conceptualized the relationship between the appropriate foods for health and therapeutic benefits."Let food be thy medicine , and medicine be thy food"[1] .Also in 1989,Stephen Defelice, M.D, founder and Chairman of the Foundation for innovation in Medicine (FIM) Crowford, New Jersey, USA defined nutraceutical as a food (or part of food) that provides medical and /or health benefits including prevention and /or treatment of diseases. Nutraceuticals are products derived from food sources that provide both nutrition and medicinal benefits [2]. Nutraceuticals are also known by the following terms: Functional foods, Medical foods, Designer foods, and Phytochemicals. [3] These products include dietary supplements, diets, herbal products, genetically engineered foods, and vitamins. They contain a high concentration of bioactive compounds, derived from natural sources and have physiological benefits and aid in the prevention and treatment of disease .Nutraceuticals even include everyday foods like pre- and probiotics, fortified cereals, processed foods, and beverages [4]. Essentially, a nutraceutical is a substance that has a physiological benefit or provides protection from chronic disease. Unfortunately, the definition of nutraceuticals varies from country to country depending on how they are categorized and regulated. Presently, there is no clear internationally accepted definition of a nutraceutical. Nutraceuticals can improve health, delay the aging process, prevent chronic diseases, increase life expectancy, or support the structure and functioning of the body [5] They are also used in the prevention and treatment of mental health issues and disorders [6]. The old maxim an apple a day will keep the Doctor away, can now be replaced by a nutraceutical a day may keep the Doctor away since daily servings of fruits, nuts, and vegetables and the phytochemicals they contain have proffered relief/cure to most cardiovascular diseases, metabolic diseases, and some forms of cancer [7]. The phytochemicals over the past decades have witnessed an increasing interest in the protective biochemical functions in preventing health damage to human beings [8]. Flavonoids and phenolic compounds are widely distributed in plants and are reported to show various biological effects, including- anti-carcinogenic, anti-inflammatory and anti-osteoporosis activities [9]. Also reported was the role of pumpkin seed extract as inhibitor of cell growth in hyperplastic cancer cells. It is of note that natural anti-oxidants are present in castor

oil, and they have been in use among Ebira people of Kogi state Nigeria as cure for skin diseases, purgative, heal irritated and/or inflamed nipples and to aid delivery in delayed expectant mothers [10]. Nutraceuticals are classified on the basis of various chemical constituents present in herbal plants such as dietary fibre, probiotics, prebiotics, polyunsaturated fatty acids, anti-oxidant vitamins, polyphenols and spices.[11].The unexploited potentials of this inter-continental plant *Sida acuta* and its recent attraction of research interest propelled the researchers to this study.

Materials and Methods

Plant material

Sida acuta Burm. f., Malvaceae, was collected from the botanical garden of the Department of plant Science, Joseph Sarwuan Tarka University, Makurdi, Nigeria. It was identified and authenticated by Prof. H.O.A .Oluma, a Botanist in the Department

Preparation of Sida acuta *Extracts*

The leaves of *S. acuta* were dried for 24 hours at room temperature. The leaves were washed with normal saline and air-dried for another 24 hours to make sure that there is no element of water in it. The dried leaves were divided into two parts of 500 g each. One part was boiled in distilled water at 100 ^{0}C for 15 mins. The concoction was allowed to cool and was filtered with Whatman number 1 filter paper and stored in the laboratory freezer (Thermocool 250) to avoid decomposition. In addition, the other 500 g was placed in the thimble of a medium-sized soxhlet extractor for 6 h using 100% ethanol as the extracting solvent. The solvent was then eliminated by vacuum distillation in a rotary vacuum evaporator (Büchi R – 124, Flawil, Switzerland), and it was lyophilized, representing an extraction yield of 3.1% of the dried leaves.

Proximate Composition

The proximate analysis of the samples for moisture, ash, fibre and fat were done by the method of [5]. The nitrogen was determined by micro-Kjeldahl method as described by the percentage Nitrogen was converted to crude protein by multiplying with a factor of 6.25. All determinations were performed in triplicates.

Determination of Carbohydrate

The total carbohydrate content was determined by difference as described by AOAC [15]. The procedure described by [5] was used in determining the carbohydrate content. The sum total of the moisture, fat, protein and ash content were subtracted from 100 %. Carbohydrate = 100 - (% protein+ moisture + % fat + % ash).

Determination of Crude Fibre

A quantity, 2 grammes of the sample was put in to a round bottom flask, 100 ml of 0.25 M H_2SO_4 was added and the mixture boiled for 30 minutes. The hot solution was quickly filtered. The insoluble residue was washed with hot water until it is base-free. It was dried to constant weight in an oven at 100 ^{0}C cooled in a desiccator and weighed as (C_2,) the weighed sample was incinerated in a furnace at 550C for 2 hours, cooled and re-weighed as (C_3). The crude fibre was calculated as the loss in weight on ashing. % $Crude\ fibre$ = C2-C3 x 100/C_1

Where, C_1= weight of the original sample (2 grammes)

Determination of Crude Protein

The Micro kjeldahl method described by [5] was used to determine crude protein. A quantity of sample, 2 grammes was placed into a 100 ml Kjeldahl flask and a few anti-bump granules were added. An amount, 1 gramme K_2SO_4 and 1 gramme of $CuSO_4$ catalyst were added to speed up the reaction. The flask was placed on a Kjeldahl rack and heated until a clear solution was obtained. At the end of digestion, the flask was cooled and the sample transferred to a 100 ml volumetric flask and made up to the mark with distilled water. After cooling, 20 ml of the digest was pipette-transferred in to Markham semi-micro nitrogen distiller and 10 ml of 40 % NaOH solution was added. The sample was steam-distilled liberating ammonia into a 100 ml conical flask containing 10 ml of 40% Boric acid and 2 drops of methyl red indicator. Distillation process continued until the pink colour of the indicator turns greenish. The control was titrated with 4% boric acid with end-point indicated by a change from greenish to pink colour. The percentage total nitrogen per sample was calculated as:

$$\%\ Nitrogen = titre\ value\ of\ sample - blank\ x 0.0014\ x\ dil \frac{NH3}{weight} of\ sample\ x\ 5\ ml\ aliquot..$$

The Crude protein was calculated as $\%\ Crude\ protein\ (P) = 6.25\%$ x N

Determination of Moisture Content

The method described by [5] was used in the determination and was based on the difference between the net weight and the weight after drying to a constant weight at (1000C) for 24 hours. Crucibles were washed and dried to a constant weight in an oven at 1000C .They were later removed and cooled in a desiccator and weighed (W_1), ground sample of 2 grammes was placed in the weighed moisture dish (W_2). The crucible containing the sample was kept in an oven at 1000C for 5 hours and weighed. It was kept back in an oven and re-weighed after 3 hours to ensure a constant weight (W_3). Moisture content was calculated as;

$$\%\ Moisture = W2 - \frac{W3}{W2} - W1$$

Determination of Fat Content

The procedure outlined in [5] was used to determine the fat content of the samples. A quantity, 10 grammes of the sample (*Sida acuta* leaf powder) was weighed and poured into a clean thimble of known weight, and placed in the extractor or extraction flask and 50 ml of solvent (n-hexane) was introduced into the flask. Heating was done at 700C for 4 hours. The solvent was recovered and the flask was transferred which includes the oil and solvent mixture into a hot air oven. This was heated until the solvent evaporates. It was later transferred into a desiccator to cool for 15 minutes before weighing the oil. Percentage fat content was calculated as:

$$\% \, Fat = weight\ loss/weight\ of\ sample\ x\ 100$$

Determination of Ash Content

The method described by [5] was used. The weight of a clean crucible was taken, 5 grammes of sample were added at the crucible. The crucible and content were placed on the muffle furnace rack until the sample was completely ashed. The ashes in the crucible were re-weighed and the percentage ash content was calculated as:

$$\% \, Ash = W3 - W1\frac{x100}{W2} - W1$$

Qualitative Phytochemical Analysis of Aqueous Leaf Extract of S. acuta

Phytochemical components of the aqueous leaf extracts of *S. acuta* were screened using methods outlined by [5], Evans [12] ;Pearson [13] and Sofowora [14] The components analyzed were Alkaloids, Flavonoids, Saponins, Phenol, Tannins, Steroids, Anthroquinone, Terpinoids, Phlobatanin and Cardiac glycoside .

Test for Alkaloids (Mayer's test): Alkaloid solution produces white yellowish precipitate when few drops of Mayer's reagents are added. 2.3.2. Test for Flavonoids (Shinoda's test): An amount, 2 ml of aqueous solution of the extract was treated with 1 ml of 10% ammonium hydroxide solution. Yellow fluorescence indicated the presence of flavonoids.

Test for Saponins (Frothing test): A quantity, 10ml of the aqueous extract was mixed with 5 ml of distilled water and shaken vigorously for a stable persistent froth.

Test for Phenols (Ferric chloride test): A measured volume, 5 ml extract was added to few drops of neutral 5% ferric chloride solution. A dark green colour indicated the presence of phenolic compounds.

Test for Tannins (Ferric Chloride test): One ml of water and 1-2 drops of 0.1% ferric chloride solution was added with 1 ml of aqueous extract of *S. acuta* and the blue colour observed indicated the presence of gallic tannins and the green black colour indicated the presence of catecholic tannins.

Test for Steroids (sulphuric acid test): Two ml of acetic anhydride was added to 5 ml aqueous extract with 2 ml H_2SO_4. The colour change from violet to green or blue confirmed the presence of steroids in sample.

Test for Terpenoids (Salowski S test): An amount, 5 ml of leaf extract was mixed in 2 ml of chloroform, and 3 ml of concentrated H_2SO_4 was carefully added to form a layer. A reddish brown coloration at the interface showed positive results for the presence of terpenoids.

Test for Cardiac glycosides (Keller-Killani test): A quantity, 5 ml of aqueous extract was treated with 2ml of glacial acetic acid containing one drop of ferric chloride solution. This mixture was under-layed with 1 ml of concentrated sulphuric acid. A brown ring at the interface indicates a de-oxysugar characteristic of cardenolides. A violet ring may appear below the brown ring, while in the acetic acid layer, a greenish ring may form just gradually throughout the thin layer.

Test for Anthroquinone (Bontruger's test): A measured volume, 3 ml of aqueous extract was shaken with 3 ml of benzene, filtered and 5 ml of 10% ammonia solution was added to the filtrate. The mixture was shaken and the presence of a pink, red or violet colour in the ammonical (lower) phase indicated the presence of free anthraquinones.

Test for Phlobatannins: (hydrochloric acid test): Deposition of a red precipitate when 2 ml of extract was boiled with 1 ml of 1% aqueous hydrochloric acid was used as evidence for the presence of phlobatannins.

Oral Acute Toxicity Study

The oral acute toxicity study was done according to the method of Lorke, 1983 [4]. Eighteen albino rats were used. The test involved two stages. In stage one, the animals were divided in to (3) groups of three rats each and were administered 10, 100 and 1000 mg/kg body weight of the *Sida acuta* leaf extracts respectively. In the second stage, 1600, 2900 and 5000 mg/kg body weight of the *Sida acuta* leaf extracts were administered orally to another set of animals.

Drug preparation

Viagra, 5 mg tablet (Pfizer, USA) was bought from Nanka Pharmacy Makurdi. It was dissolve in a10 ml distilled water. The crude extracts of *Sida acuta* were prepared before use and orally administered (per os) in a total volume of 10 ml and 20 ml /kg body weight for ethanolic extract ; 30 ml and 40 ml / kg body weight of aqueous extract respectively.

Animal Protocol

Purchase of Animals

Thirty-five (35) clinically-healthy male Albino rats weighing 180 to 220 grammes were purchased from the animal house of the College of Animal production, Joseph Sarwuan Tarka University Makurdi, Nigeria. They were housed in clean and dried cages with wire mesh floor and standard growers mash (feed) and clean water fed them *ad libitum.* Their weight gain was measured every week by 12.00 h to get the accurate weight gain at the end of acclimatization period. At the end of three (3) weeks of acclimatization, the animals were started on normal feed and water and were administered respectively the extracts for fourteen (14) days. After, the above treatment, sexually mature female rats were introduced to the treated males and were observed for sexual activities.

Experimental Design

Thirty-five (35) male albino rats weighing 180-220 grammes were used for the study; the rats were obtained from the College of Animal production, Joseph Sarwuan Tarka University Makurdi. The rats were divided into seven groups with five animals per group, and different treatments administered to each group:
Group I: Normal rats (feed + water) Normal control

Group II: Rats (feed + water) and administered

0.3 ml Normal saline (Negative control)

Group III: Rats (feed + water) and administered 2 ml (5:10 m/v ;viagra / distilled water) (Positive control)

Group IV: Rats (feed + water) and administered 10 ml /kg/ body weight ethanolic extract.

Group V: Rats (feed + water) and administered 20 ml /kg / body weight ethanolic extract.

Group VI: Rats (feed + water) and administered 30 ml /kg/ body weight aqueous extract..

Group VII: Rats (feed + water) and administered 40 ml /kg/ body weight aqueous extract.

Experimental

The Seven (7) groups of grower albino rats each of five (5) rats were weighed on arrival and recorded as arrival weight (A_w) and recorded. The animals were fed with standard feed and water *ad libitum* for twenty one (21) days and were re-weighed, after which their masses-initial and final were recorded. At the end of three (3) weeks of acclimatization, the animals were started on normal feed and water and were administered respectively the *Sida acuta* leaf extracts for Fourteen (14) days. As, the above treatments were ongoing, sexually mature female rats were introduced to the males that are being treated and were observed for enhanced sexual activities that should result from the administration of the *Sida acuta* leaf extracts as aphrodisiac.

Statistical analysis

The data obtained in this study were expressed ae mean ± S.D. Test for significance between mean parameter in respect of group differences were performed using student t-test.

Results and Discussion

Physical properties of aqueous and ethanolic leaf extract of Sida acuta

Table 1: Organoleptic properties of *Sida acuta* aqueous leaf extract

S/ no:	Appearance	Colour	Odour	Taste	Texture
1.	Solution	Dark amber	Slight odour	Bitter leaf water	Slightly slippery

Tablee 2: Results of the proximate composition of *Sida acuta* leaf extract

S/no;	Parameters	Values (%)
1.	Moisture	13.46
2.	Crude ash	8.5
3.	Crude fat	9.82
4.	Crude fibre	4.18
5.	Crude protein	16.04
6.	Carbohydrate	47.97
7.	Energy	2760 Kcal/kg

N.B. Carbohydrate = 100 **–** (% protein+ moisture + % fat + % ash) = 47.97%.

Table 3: Quantitative and qualitative phytochemical screening of aqueous and ethanol extracts of Sida acuta leaves.

	Quantitative			Qualitative		
S/No.	**Phytochemical**	**Ethanol**	**Aqueous**	**Phytochemical**	**Ethanol**	**Aqueous**
1.	Alkaloids	6.6 ± 0.05	6.61 ±0.05	Alkaloids	+	+
2.	Saponins	00.0 ±0.06	0.00 ±0.06	Saponins	+	-
3.	Tannins	4.14 ±0.05	4.07 ± 0.05	Tannins	+	+
4.	Steroids	0.00 ±0.06	0.00 ±0.06	Steroids	-	-
5.	Flavonoids	2.94 ±0.06	2.57 ± 0.06	Flavonoids	+	+
6.	Cardiac glycosides	5.93 ±0.06	5.74 ±0.06	Cardiac glycosides	+	+
7.	Anthraquinone	0.00 ±0.05	0.00 ±0.05	Anthraquinone	+	-
8.	Phlobatanin	3.92 ±0.05	3.80 ±0.05	Phlobatanin	+	+
9.	Terpenoids	5.59 ±0.05	5.55 ±0.05	Terpnoids	+	+

Results are expressed as mean ± SD (n= 3).

Table 4: Animal groupings weight variations from arrival to acclimatization

Groups	Arrival weight (g)	Acclimatization/ (final) weight(g)	Growth rate and development (g)
1.	180. 00 ± 0.05	191.00 ± 0.05	11.00 ± 0.05
2.	191.00 ± 0.05	198.00 ± 0.06	7.00 ± 0.06
3.	195. 00 ± 0.04	210.00 ± 0.03	15.00 ± 0.03
4.	198. 00 ± 0.45	212.00 ± 0.05	14.00 ± 0.05
5.	200. 00 ± 0.07	214.00 ± 0.06	14.00 ± 0.06
6.	212. 00 ± 06	219.00 ± 0.05	7.00 ± 0.05
7.	220.00 ± 0.05	228.00 ± 0.06	8.00 ± 0.05

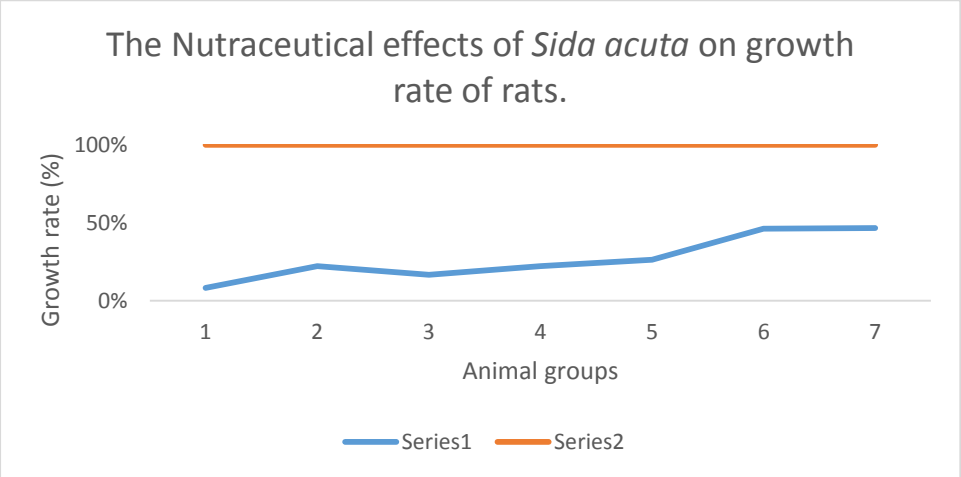

Figure 1: The Nutraceutical effect of sida acuta on growth rate of rats

Discussion

The study investigated the nutraceutical potentials of the leaves of *Sida acuta* harvested from Nsukka district of Enugu State, East Central Nigeria. Ten (10) kilogrammes mass of *Sida acuta* leaves was harvested from the hill top in Nsukka, washed and dried at room temperature for 48 hours. After this, they were ground into fine powder and stored in clean dried bottle for analysis. Another, 10 kilogrammes mass was also boiled in a measured volume of water and stored in a refrigerator for analysis. The

moisture content value of 7.723% obtained for *Sida acuta* leaves in this study (Table 1) is low and it suggests that the leaves can be kept for a relatively long time. The moisture content of any food can be used as an index to measure its keeping quality [18]. This value is lower than those of *Combretum zenkeri (*11.325%) [18], and *Hymenocardia ulmoides* (67.20%) and *Vitex ferruginea* (55.41%) [19], higher than those reported for *Piliostigma thonningii* (4.6%) , *Tylophora glauca* (7.11%) , and similar to those of *M. Oleifera* (9.533%) [20]. A protein content value of 16.04% obtained for *Sida acuta* is in multiples of values earlier reported for Cabbage (1.21g/100g), Lettuce (1.62g/100g), Celery leaves (3.46g/100g) and leaf parsley (2.97g/100g) [21], *Aloe barbadensis* (4.73%) [4] and *Aloe vera* leaves (6.86%) . The values reported for *C. zenkeri, Amaranthus asper, I. glauca* and *Moringa oleifera* were 20.5398% , 11.13% [, 20.0 and 30.29% . Thus, *S. acuta* can be termed protein rich and may serve a source of dietary protein supplementation, a nutraceutical point of view. The percentage of fat, 1.57% characterizes *S. acuta* as a low fat source. Earlier studies have reported 0.27%, 2.27%, 2.91%, 3.68%, 4.0% and 6.5% fat composition for leaves of *A. barbadensis* , *C. zenkeri* , *A. vera* , *Momordica charantia* [22], *A. asper* [23] and Moringa respectively. An ash content value of 8.53 % was obtained in this study. 0.1386%, 2.36%, 7.64% 15.42% and 18.5% ash content values were reported in earlier studies for leaves of *C. zenkeri* , *A. barbandensis*, *Moringa oleifera* (Moyo *et al.,* 2011), *M. charantia* [22] and *A. asper* [23] respectively. Its fibre content is 9.50%. Adequate intake of dietary fibre can lower the serum cholesterol level, risk of coronary heart disease, hypertension, constipation, diabetes, colon and breast cancer as well as diverticulosis . The fibre content values reported for leaves of *Saba florida* [24], *M. chanrantia* , and *Acalypha hispida, Acalypha racemosa* and *Acalypha marginata* [25] were 4.3%, 3.31% and 10.25%, 7.20% and 11.50% respectively. *S. acuta* is a very good source of carbohydrate given a percentage composition of 69.44% (Table 1). Carbohydrate provides energy to cells in the body particularly the brain, the only carbohydrate dependent on the organ of the body. It also supplies structural materials for our body's growth and development . The leaves of *Piper umbellatum* and *Peperomia pellucida, Commelina africana* and *Ageratum conyzoides, P. thonningii* and, *H. ulmoides* and *V. ferruginea* were reported to have carbohydrate content values of 38% and 42% [26], 34.35% and 33.37% , 65.28% and, 8.57% and 4.53%, respectively. The results of phytochemical (qualitative and quantitative) constitution of *S. acuta* leaves are as shown in Tables 2 and 3. Phytochemicals are secondary metabolites of plants that use their bioactive and pharmacological properties to exert biochemical effects on living organisms [27]. The phytochemicals, tannins, saponins, alkaloids, flavonoids, terpenes, steroids, cardiac glycosides, anthraquinones and phlobatanins were found to be present in *S. acuta* leaves and are in amounts to be of medicinal value [28]. Many plants containing alkaloids and flavonoids have diuretic, antispasmodic, anti-inflammatory and analgesic, demulcent, aphrodisiac, anti-helminthic, stomachic and wound healing properties . Alkaloids are capable of reducing headache associated with hypertension [29]. It has been reported that alkaloids can be used in the management of cold, fever and chronic catarrh. Flavonoids are known for their antioxidant activity and hence they help to protect the body against cancer and other debilitating diseases [30]. Flavonoids have been shown to have anti-bacterial, anti-inflammatory, anti-allergic, anti-mutagenic, anti-viral, anti-neoplastic, anti-thrombotic and vasodilatory activity [31]. Tannins are known to exhibit anti-viral, anti-bacterial and anti-tumor activities [32]. It was also reported that certain tannins are able to inhibit HIV replication selectively and is also used as diuretic [33]. Tannins are well known for their antioxidant and antimicrobial properties as well as for soothing relief, skin regeneration, as anti-inflammatory and diuresis. Saponins are expectants, cough depressants and administered for haemolytic activities [34]. In medicine, saponin is used as hypercholesterolemia, hyperglycaemia, anti-oxidant, anti-cancer, anti-inflammatory and weight loss. It has also been reported to have anti-fungal properties . Saponins exhibit cytotoxic effect and growth inhibition against a variety of cells making them have ant-inflammatory and anti-cancer properties [35]. Terpenes are very important group of organic compounds that have been reported as potent drugs used in treatment of wide range of ailments [36]. The most rapidly acting anti-malarial Artemisinin and its derivatives are terpenes [37;38;39;40]. The efficacy of the utilization of *S. acuta* leaves in herbal/ traditional/ folklore medicine may be attributed to its phytochemical profile. The leaves of *S. acuta* possess significant quantities of bioactive phytochemicals. The ethanolic extraction was carried out with soxhlet apparatus [41]. The two extracts were subjected to physicochemical analysis, and the organoleptic properties of the aqueous extract of *Sida acuta* showed: appearance; solution, colour; dark amber, odour; slight odour, taste; bitter leaf water and texture; very slightly slippery. These properties are comparable with the report of [42]. Also, the chemical properties of *Sida acuta* showed the proximate composition as dry matter; 92.29%, crude proteins; 16.04 %, ash; 8.53 %, crude fibre; 4.18 % ,ethanol extract; 1.57 % and energy; 2760 kcal/kg. This proximate composition is in agreement is in agreement `with the work of [43] on *Sida acuta,* which is of *Malvaceae* family and in variation with *Sphenostylis stenocarpa* of *Leguminceae* by [44]. Moreover, the proximate analysis of foods are used as an index for comparing the nutrients composition of a given plant material. Here, the proximate analysis showed that *Sida acuta* extracts are rich in various nutrients and other bioactive compounds that confer it the ability to perform multiple biological activities and a good natural alternative to synthetic growth promoter and also aphrodisiac-viagra (Sildenafil citrate) [45]. However, it has been reported that the active component of viagra is the amino acid L-arginine from coconut [46]. Hence, coconut potentiates viagra in a man without erectile dysfunction [47]. L-arginine is fortunately is among the amino acid composition of *Sida acuta* leaf extracts. This may likely be why the *Sida acuta* extracts mimic viagra [48]. Research also showed that the ethanol synergises with arginine in *Sida acuta* extracts to potentiate the aphrodisiac potentials of *Sida acuta*. This said synergism increases the aphrodisiac roles of *Sida acuta* very well, but unlike the synthetic viagra has never produced priapism either in experimental animals or in humans during validation trials [45]. The phytochemical studies

showed that the leaf extracts of *Sida acuta* contained the following in appreciable concentrations. Alkaloids, saponins, tannins, anthraquinones, cardiac glycosides, phlobatannins, flavonoids e.t.c. This study therefore showed that the significant ($p < 0.05$) increase and decrease ($p > 0.05$) observed in five sexual parameters investigated: mount frequency; intromission frequency; coitus frequency, ejaculation frequency and detumescence frequency had the roles of these phytochemicals played out very well [49]. In 2014, [50] reported that phytochemicals tune up the male hormone- androgen which potentiates aphrodisiac roles. Also, in 2011, [51], reported that androgenic activity of phytochemicals increases the testesterone levels. [50] also reported that phytochemicals confer toxicity and protective effects on rats administered with *Sida acuta* leaf extracts. Reports have shown that increase in testesterone level has been the major mechanism of aphrodisiac action shown by a number of medicinal plants. The ethanolic extract of *Sida acuta* mimics the ethanolic extract of *Blepharis edulis* root as reported by [52].Also, the aqueous extract of *Sida acuta* corroborated the aqueous extract of *Massularia acminate* roots [52], Ruta chalepensis [53], *Tribulus terrestris* fruits [50] exhibited aphrodisiac activity by increasing testesterone level. In rodents, an increase in feed and water consumption is an important index of good health, growth and development and generally result to increase in weight. Tables (12 and 13) show an increase in weight of the rabbits compared to their arrival weight. Weight gain in experimental animal models is an indicator of improved environment, feed intake which included *Sida acuta* leaf extracts and good acclimatization care. However, the increased body weight could be due to fortification of feed and increased feed and water intake observed all through the experimental period. The increase in weight of the experimental animals suggests that they increasingly accumulated calories from their improved ration and used that to store triglycerides in their bodies--adiposity. Although the animals used in this study were fed with normal grower's pelletized feed. *Sida acuta* leaf extracts might have allowed proper absorption and assimilation of the nutrients from their ration. The presence of dense nutrients may have stimulated appetite and increased feed assimilation resulting in increased weight gain (Ekpo, 2006). Organ weight is also an important index of sound physiological status in animals. The relative organ weight is important in determining the exposure of an organism to improved ration, better environmental conditions as well as good animal management skills. The organ weight and relative organ weight of the experimental animals as shown in (Table 3) are the reflection of the animal weight gain in the course of the experiment. Hence, it is of fundamental experimental significance that when a given set of animals are kept to acclimatize, with the environmental conditions, feeding and watering as well as other experimental factors put in place, the animals are bound to increase their weight due to growth and development that accompany acclimatization.

Conclusion

The results of this study showed that majority of plant materials that formed our foods contained the active ingredients of the pharmaceutical products we use on daily basis for our optimum health and wellbeing. *Sida acuta*, the raw material for this study has phytochemicals that have very good nutritional pharmacology of dietary phytochemicals. Hence, our daily consumption of *Sida acuta* and its products alongside other plant materials will help us immensely to procure sound healthy life, longevity and also, general fitness assured.

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