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Research Paper

Sphenostylis stenocarpa: An Under-utilized Legume with Nutraceutical Potentials- A Review.

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ABSTRACT:
Since the time of early man, the search for food substances that can provide nutrients, welfare as well as have therapeutic potentials has been part of what man needs most in foods. However, minerals, vitamins, dietary fibre, hydrolyzed nutrients, phytonutrients, enzymes, carotenoids, prebiotics, probiotic and even functional foods are among the needed nutraceuticals. Sphenostylis stenocarpa is an underutilized legume which its seed milkS was reported to have abundant bioactive compounds with hypoglycaemic activity. This study investigated the anti-diabetic activity of seed milk extract in streptozocin-induced diabetic rats. The seed milk extract at a concentration of 100,200, 300 and 400 mg/kg body weight were orally administered to - streptozocin-induced diabetic rats for a period of fifteen (15) days. The oral glucose tolerance test was also carried out using animal experimental method. The phytochemical analysis of the milk extract revealed the presence of flavonoids, isoflavones, saponin, tannin, phytosterol, lignin and anthocyanidine at moderate concentrations. The acute toxicity test showed no lethality using Sphenostylis stenocarpa seed milk up to a concentration of 5000 kg/body weight. In oral glucose tolerant test, the Sphenostylis stenocarpa seed milk extract exerted the highest response, similar to glibenclamide after 15 minutes and 30 minutes of administration compared with the control. The Stenostylis stenocarpa seed milk extract recorded the highest blood glucose- lowering effect after day 15 of treatment ($p < 0.05$) compared with the diabetic rats that were administered normal saline and 0.3 mg/kg body weight of glibenclamide. The seed milk extract of Sphynostylis stenocarpa possessed anti-diabetic activity like the reference drug glibenclamide, and the results of this study revealed that the graded doses of the seed milk extract have blood glucose-lowering effect in a time and concentration-dependent manner. Besides being anti-diabetic, Sphenostylis stenocarpa seed milk is also used in management of chronic diseases like hypertension and other cardiovascular diseases because of it's dietary fibre content. Research work showed also that it is anti-inflammatory, anti-cancer, anti-malnutrition, anti-alcohol abuse (antabuse) , anti-cholesterolemic and anti- osteoporosis.

***KEY WORDS**: therapeutic, Hippocrates, Spices, vitamins, flavonoids, maxim, probiotics.*

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I. INTRODUCTION

As far back as (460-377BC),the father of modern medicine (Hippocrates (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" .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. 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{ Nwankwo M.O.and Ekeanyanwu C.R. (2011)}. The phytochemicals over the past decades have witnessed an increasing interest in the protective biochemical functions in preventing health damage to human beings { Rathinavelu *et al.* 2013}. 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 (Medjakovic *et al.*2006) also reported 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 (Momoh, *et al*. 2001). 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 (Kokate et al.2002; Kalia,2005) . The unexploited potentials of this under-utilized legume crop-African yam bean and its recent attraction of research interest propelled the researchers to this study.

II. MATERIALS AND METHODS

Plant Materials

The harvested seeds of *Sphenostylis stenocarpa* (African yam bean) were purchased from Saturday Market, Kwande LGA, of Benue State, Nigeria. The seeds were identified and authenticated by Mr. Alfred Ozioko and Prof.M.I. Uguru,both of Centre for Ethnomedicine Drug Development (BDCP) and Crop Agronomy Department of the University of Nigeria Nsukka respectively. The seeds were washed with normal saline and oven-dried. They were de-shelled and some quantity fried at 30 -50^{0}C for milk-making, while others were macerated for oil extraction

Extraction of African Yam Bean Seed Oil

The extraction of oil from the AYB was carried out using soxhlet extraction technique with n-hexane at 60-70^{0}C as the extracting solvent. In this, 500g of the ground seeds was put in the extractor and allowed to run for 6 hours. Finally, the oil-solvent mixture collected in the flask was regenerated and/or dried at 100^{0}C in an oven. The difference in weight of the empty flask and the oil gives the oil yield of the sample.

3.2.1Characterization of the Oil;

3.2.2 Physical Properties.

These ease the extraction of some information that are strictly unobtainable through chemical approaches. The physical properties of plant lipids generally are determined to a great extent by the constituent fatty acids that made up the triacylglycerol framework. For instance, fats made up of highly saturated fatty acids are liquids at room temperature. Other factors such as climate, soil, crop cultivar and the variety of vegetable fat affect the physical properties of lipids, (Njoku *et al.*, 2001).

Chemical Properties;

Acid Value Determination;

Reagent preparation; Alcoholic Potassium hydroxide solution (0.1M)

The solution was prepared by dissolving 1.4 gramme of potassium hydroxide in 250cm^3 of methanol. It was the standardized 0.1M Hydrochloric acid to a phenolphthalein end-point.

Neutral Solvent; the neutral solvent used was prepared by mixing equal volumes (70cm^3+ 70cm^3) of 2-propanol and toluene in a conical flask.

Phenolphthalein indicator; this was prepared by dissolving 1 gramme of phenolphthalein in 100ml of methanol.

Procedure;

A quantity 2.0 gramme of the oil of African yam bean was dissolved in 40 milliliter of neutral solvent in a conical flask. 2 to 3 drops of phenolphthalein indicator was added and the solution was the titrated with 0.1M of alcohol hydroxide until a pink colour which persisted for about 50 seconds was obtained.

Calculation of acid value.

Acid value = M x V x 56.1/W

Where M= molarity of alcoholic potassium hydroxide

V= volume of alcoholic potassium hydroxide

W=weight of the oil used in grammes.

56.1 = molecular weight of KOH.

Iodine value;

The Wij's method of iodine determination was used.

Reagents;

Carbon tetrachloride

10% potassium iodide solution

1% starch indicator

0.1M Sodium thiosulphate solution

Wij's solution.

Procedure; A quantity 5 gramme of the oil of African yam bean was weighed in to a 250cm^3 conical flask, 20milliliter of carbon tetrachloride was added in to the flask. 25 cm^3 of Wij's solution was added in to the flask, the flask was stirred and the resulting mixture was stored in the dark for 30 minutes. At the expiration of 30 minutes, 20 cm^3 of 10% Potassium iodide solution was added, followed by the addition of 100millilitres of cold water. The solution was titrated with 0.1M $Na_2S_2O_3$ (Sodium thiosulphate solution). The $Na_2S_2O_3$ solution was added slowly from a burette in to the flask while stirring until the yellow colour of the resulting solution was almost discharged. 3 drops of starch indicator solution was added and the sodium thiosulphate solution was added drop-wise until blue-black colouration of the starch-iodine was discharged. A blank determination was also carried out. The iodine value was also then calculated using the equation below;
Iodine value =(b--t) x M x 12.69/W
Where b=titre value of the of the 0.1M $Na_2S_2O_3$ solution of the blank.
t= titre value of the0.1M $Na_2S_2O_3$ solution of the sample.
M=molarity of $Na_2S_2O_3$ solution.
W= weight of the sample
12.69= Equivalent of iodine (I_2).

Peroxide Value;
Reagents;
Glacial acetic acid – chloroform solution mixed in the ratio 3;2 by volume.
Saturated solution of potassium iodide (KI).
0.1M $Na_2S_2O_3$ .5$H_2$0 solution
Procedure;
A mixture of 10ml chloroform and acetic acid was boiled in a 250ml round bottom flask until the mixture reflects. A solution of 1 gramme of potassium iodide in 1.2 litre of water was poured down from the column slowly so that refluxing continued without interruption. This ensured that absence of oxygen in the flask was maintained. Any precipitated potassium iodide was re-dissolved by adding 5 drops of boiled cold water. Then 2 grammes of the oil of African yam bean was accurately weighed and poured down the column without interrupting the steady state At this stage, the cooling water was turned off to raise the condensation level and to ensure that all the samples was washed in to the flask. The solution was further boiled for 5 minutes and rapidly cooled with cold water. It was diluted with 50ml of distilled water and titrated with the sodium thiosulphate solution using starch as indicator.

Calculation of peroxide value;
Peroxide value= ML of 0.002 thiosulphate used/Grammes of oil taken
Saponification value;
Reagents;
0.5M alcoholic KOH
0.5M HCl solution
Procedure;
A volume 2.5 gramme of oil sample was weighed in to a round bottom flask with a glass joint and 25 ml of the alcoholic KOH was added to the round bottom flask. The round bottom flask was connected to a condenser and the content refluxed using water bath for one hour. While still hot, the content was titrated against 0.5HCl, using phenolphthalein indicator. A blank was also conducted, the saponification value therefore is;
(Mg KOH/ g of oil) =(b--a) x 28.05/g
Where b = titre value of the 0.5M HCl solution used for blank determination
a = titre value of 0.5M HCl solution required for the sample determination
g = weight of oil sample in grammes.
NB;Percentage free fatty acid (%FFA);This was determined by multiplying the acid value with the factor 0.503. Thus, the FFA=0.503 x 2.91 =1.46%

Extraction of AYB Seed milk
Five hundred grammes (500 g) seeds of AYB was roasted using frying pan for 50 minutes at 30-50^{0}C and were de-shelled when hot. The seed cotyledons were ground and sieved with fine-pored silk, and made in to milk by mixing and homogenizing in the ratio of 1:5 v/v of the flour/ de-ionized water .The prepared milk was used immediately for its storage always result to contamination and auto-oxidation of the labile substances.
The physicochemical properties of the milk were determined using both the sensory method and the use of instruments (AOAC, 2006).The colour and aroma of the oil were sensorily determined as described by Ihekoronye and Ngoddy, 1985. Chemical Properties was conducted by titration for acid value, and pH with pH

metre (Jenway, 3507) and the presence of minerals was carried out using Atomic absorption spectrometer (AAS)(NARICT, Zaria) Nigeria.

Physicochemical analysis of the Milk

The extracted milk was subjected to sensory analysis by 20 Panelists invited from the Department of Food Science and Technology, University of Nigeria, Nsukka. The chemical properties

Proximate Analysis of the Milk

The crude lipids were extracted using petroleum ether as solvent in a soxhlet apparatus and ash content (gravimetric by AOAC. The total carbohydrate was calculated by the difference method (sum of crude protein, ash, moisture and crude fat petroleum ether extract) minus the sum from 100). The moisture contents of the milk were determined after drying at 105 ^{0}C.The microkjeldahl method was also used to determined the total nitrogen and crude protein (m x 5.95). Nitrogen free extract (NEF) was calculated by difference as NFE total (CHO)n – crude fibre.

Animal Protocol

Purchase of Animals

Twenty five (25) male albino rats weighing 100-180g were used for the study, the rats were obtained from the College of Veterinary Medicine, University of Nigeria, Nsukka, Enugu state, Nigeria. They were acclimatized for Fourteen days in the animal house of Department of Biochemistry, and were given regular feed (grower'mash) Vital Feeds Nigeria Ltd, Jos, Nigeria and water *ad libitium.* This occurred under standard environmental conditions with a 12- hour light/dark cycle maintained.

Experimental Design

A total of twenty five (25) male albino rats weighing180-220 grammes were used for the study, the rats were obtained from the faculty of Veterinary Medicine, University of Nigeria, Nsukka, Nigeria. The rats were divided into five groups with five animals per group, and different treatments administered to each group;

Group 1: Non- diabetic control (not induced).

Group 2: Streptozocin - induced diabetic rats administered 0.3 ml of normal saline.

Group 3: Streptozocin -induced diabetic rats administered with 0.3 mg/kg body weight of glibenclamide.

Group 4: Streptozocin -induced diabetic rats administered 100 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract.

Group 5: Streptozocin -induced diabetic rats administered 200 mg/kg body weight of *Sphenostylis stenocarpa* seed milk

Drug Preparation

Glibenclamide (Hovid, Ipoh Malayasia, Batch No. VUDIA 11 – 0, 5mg) was purchased from a pharmaceutical shop in Nsukka, Enugu State, Nigeria. The tablets were finely powdered, suspended in a normal saline and was filtered using a Buchner funnel and whatman no 1 filter paper at a concentration of 5mg/ml and was administered at 50mg/kg body weight.

Induction of Diabetes

Streptozocin diabetic rat were prepared by adopting the method of Saidu *et al.*,(2011). All rats, except the Normal control group were intraperitoneally injected with 120 mg/kg body weight of the prepared streptozocin. After 6 hours of streptozocin administration, rats in their cages were then allowed 10% glucose solution for the next 24 hours in orde to prevent streptozocin -induced hypoglycaemia. The animals were observed for polydipsia, polyuria, polyphagia as well as general reduction of body weight. Seventy two hours after the streptozocin administration, the animals were fasted overnight and diabetes was confirmed by measuring fasting blood glucose level with the aid of a Glucometer (ACCU – Chek, Active Roche Diagnostics). Only rats that have fasting blood glucose level > 7.0 mmol/l (126 mg/dl) were considered and included in the study (Saidu et al., 2011).

Animal Treatment

The experimental animals were treated in four different groups for 15 days. Group 3 was treated with the standard drug (Glibenclamide) while groups 4 and 5 were treated with African yam bean milk of 100 mg/kg b.w and 200 mg/kg b.w dosage respectively, twice daily. The mean blood glucose levels in the animals were measured 72 hours after the drug administration by tail tapping using Glucometer (ACCU – Chek, Active Roche Diagnostics).the experimental animals were treated with the standard drugs and the AYB milk by oral administration for 15 days and their mean blood sugar were recorded group- wise.

Glucose Level Determination

Procedure

a. The coding chip of the corresponding test strips to be used was inserted into the Accu – chek glucometer.

b. The area of the tail to be pricked was cleaned with swab containing methylated spirit and then pricked with a lancet.

c. The next step is the insertion of the test stip in to the glucometer.
d. A time, 2-4 minutes should be used for the activation of the strip in the glucometer after which, the blood sample was then dropped on the test area of the strip and the result displayed on the glucometer screen was recorded.

Glucose Profile Study

Glucose profile studies were conducted with streptozocin-induced diabetic rats using the method of Atangwho *et al* ., (2013) with modification.

Oral Glucose Tolerance Test

The method, dosage of extract and the glibenclamide and animal groupings in this study were as described in the experimental design. Also, the rats had glucose administered orally at a concentration of (2 g/kg body weight) 30 minutes after dosing, and blood samples were obtained by tail puncture at time zero (0) before glucose dosing and at 15, 30, 45, 60, 90, and 120 minutes after glucose administration to measure the glucose level.

Acute Anti-hyperglycaemic Study

Glucose profile studies were conducted with diabetic rats, in the study, five groups of streptozocin-induced diabetic rats were treated as follows: group 2 received 0.3 ml normal saline, group 3 received 0.3 mg/kg body weight of glibenclamide, group 4 received100 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract and group 5 received 200 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract and group 1 served as the normal control group. The normal saline and glibenclamide were administered in doses per day during the period of the study. Fasting blood glucose was measured on day 0 (baseline), 3, 6, 9, 12, and 15th day. At the end of the study, the animals were sacrificed and buried. The ACCU – Chek, Active Roche Diagnostics glucometer was used to measure the glucose level with compatible strip.

III. Results

The Seed milk extract of *Sphenostylis stenocarpa* was homogenized with de-ionized water in an electric blender (Nakai-462) China and used. The extract yield was observed to be 1.0 kg (33.3%).

In the experiment, there was no lethality or behavioural changes in the three groups of the mice that received 10, 100, and 1000 mg/kg body weight of the extract at the end of the first experiment. Based on this result, further increased doses of 1900, 2600 and 5000 mg/kg body weight of the extract showed that no death case was observed within 72 hours of administration. This result showed that the extract was safe at dose above 5000 kg body weight.

The result of proximate analysis of AYB seed milk revealed the following: fibre (9.24 ± 0.18), carbohydrates (60.26 ± 1.02%), moisture (5.02 ± 2.04), ash (3.40 ± 0.04%), crude protein (19.24 ± 0.06%), and lipids (2.84 ± 0.14%).

The qualitative phytochemical analysis as observed in table 4 showed moderate presence of compounds such as isoflavones, flavonoids and saponin, while anthocyanidines, phytosterol, lignin and tannins were low in the sample.

The results of the effect of *Sphenostylis stenocarpa* seed milk extract and glibenclamide on oral glucose tolerance in non- diabetic rat was shown in figure 1. The measured fasting blood glucose level reached its peak at 15 minutes after oral administration of glucose. Animals administered 2 g/kg body weight of glucose and 0.3 mg/kg body weight of glibenclamide had the highest significant ($p < 0.05$) reduction of fasting blood glucose concentration and sustained throughout all the measured time compared to the glucose level of other treatment groups. The animals administered 2 g/kg body weight of glucose and 100 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract showed significant ($p < 0.05$) decrease in blood glucose level 30 minutes from treatment compared to glucose level after 15 minutes of treatment, and also showed significant ($p < 0.05$) reduction in glucose after 45, 60, 90 and 120 minutes respectively compared to glucose level after 30 minutes of treatment. The animals administered 2 g/kg body weight of glucose and 0.03 ml of normal saline showed significant ($p < 0.05$) decrease in glucose level after 30 minutes compared to glucose level after 15 minutes and showed significant ($p < 0.05$) increase in glucose level after 60 minutes from treatment. The effect of *Sphenostylis stenocarpa* seed milk extract on glucose level of streptozocin-induced diabetic rats is shown in Figure 2. All animals induced with 150 mg/kg body weight of streptozocin showed significant ($p < 0.05$) increase in blood glucose level on day 0. Animals induced and treated with normal saline showed significant ($p < 0.05$) reduction in blood glucose level on day 3, 6, 9, 12, and 15 respectively. The seed milk extract of *S. stenocarpa* possessed anti-diabetic activity like the reference drug glibenclamide, and the results of this study revealed that the graded doses of the seed milk extract have blood glucose-lowering effect in a time and concentration-dependent manner.

Table 1: Physical Properties of African Yam Bean Seed Oil

Colour	Light yellow
Odour	Agreeable
Viscosity	(Centipoise) 830
Refractive index at200C	1.48
Boiling point	121.04 ^{0}C

Table 2 Chemical Properties of African Yam Bean Seed Oil

Acid value	2.9ml/Mol
Iodine value	132 ml/idodine
Peroxide value	8.02
Saponification value	194.01 ml/KOH
pH value	5.25
Percentage Free Fatty Acids (FAS)	1.46

Table 3: Physical Properties of African Yam Bean (AYB) Seed Milk

Parameter	Result
Colour	milk colour
Aroma	5.8
Taste	6.4
Mouthfeel	6.2
Overall acceptability	6.8

Table 4: Chemical properties African Yam Bean (AYB) Seed Milk

Parameter	Result
Titratable acidity	25.24
pH	4.76
Minerals by AAS	
Ca	0.12605ppm
Fe	0.05605ppm
Cu	0.0009ppm
Pb and Cd	Not Detected

KEY: ppm = Part per Million.

Table 5: Proximate Composition of African Yam Bean (AYB) Seed Milk

Nutrient	Relative abundance (%)
Carbohydrates	60.26 ±1.02
Crude Protein	19.94 ± 0.06
Lipids	2.84 ± 0.14
Crude Fibre	9.24 ± 0.18

Ash----------3.0 ± 0.04

Table 6: Qualitative Phytochemical Analysis of African Yam Bean (AYB) Seed Milk

Parameters------ Relative abundance (mg/100ml)
Isoflavones---------- ++
Anthocyanides-------+
Flavonoids----------++
Saponins----------++
Phytosterol----------
Lignin----------+
Tannins + +
KEY: +: Low present: ++: moderate present.

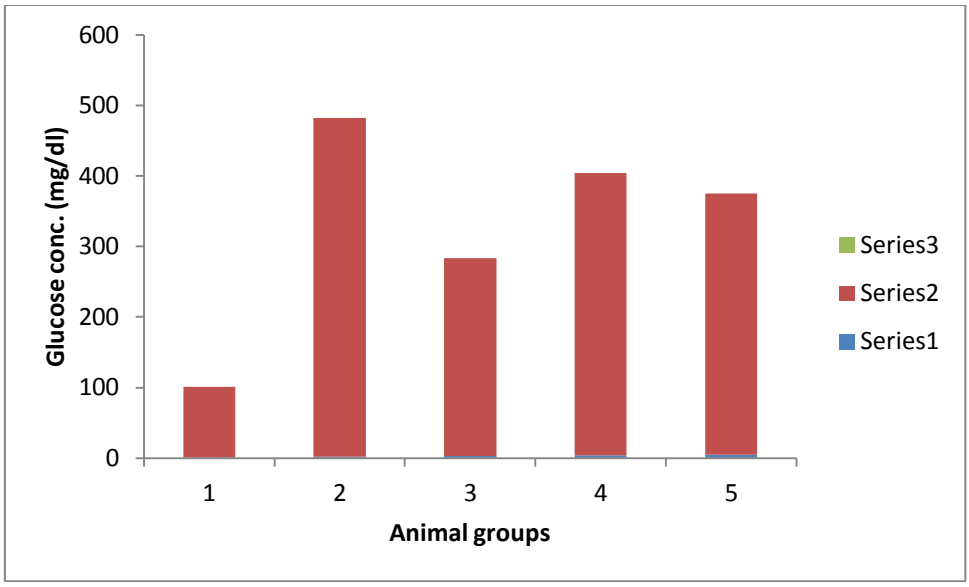

Fig.1 Effect of *Sphenostylis stenocarpa* seed milk on blood glucose concentration of Streptozocin-induced diabetic rats

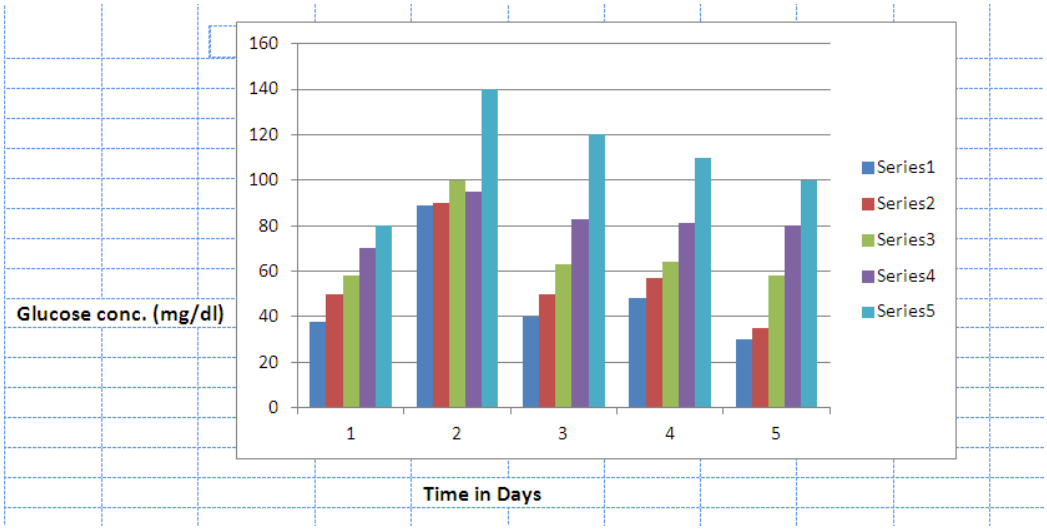

Fig. 1. Effect of *Sphenostylis stenocarpa* seed milk on blood glucose concentration against time (in days) in Streptozocin induced diabetic rats.

IV. Discussion

The study investigated the nutraceutical potentials the oil and milk extracts of African yam bean (*Sphenostylis stenocarpa*) from Nsukka district of Enugu State , East Central Nigeria. Thirty kilogrammes (30kg) mass of AYB was purchased from Ogige Market Nsukka, East Central Nigeria and oil was extracted

from 10kg mass of it , during which the percentage oil yield was got as 25. Milk was also extracted from 15kg of the AYB seeds. 300 millilitres of milk was produced from each 50 grammes of the flour and the percentage yield was 50. The light- yellow coloured oil obtained from *Sphenostylis stenocarpa* seeds had a viscosity of 830 centipoise and a refractive index of 1.48,which is in agreement with the value of 1.462 for *B. Sapida* oil (Akintayo and Bayer, 2002) . This showed that the oil is a drying oil (Duel ,1951). The saponification value of the oil was found to be 194.01 ml/KOH. This value is in agreement with the values obtained for some vegetable oils ranging from 188-196 mg KOH/gramme { Aremu *et al*. 2006). It has been reported by (Pearson, 1976) that oils with higher saponification values contain high proportion of lower fatty acids. The oil had a low acid value of 2.9 ml/mol compared with *Plutenia conophora* (11.5mgKOH/g) as reported by (Akintayo and Bayer 2002). The iodine value of AYB oil in this study is 132 ml/iodine which is comparable with Groundnut and Cotton seed as reported by (Pearson, 1976). In view of the fact that drying oils have an iodine value above 100, (Edem *et al*.1990), *Sphenostylis stenocarpa* seeds oil could be classed as drying oil and as such is unsaturated, thus it is suitable for utilization in the manufacture of soaps and vegetable oil-based ice cream. The results of the proximate composition of AYB milk showed that the mean moisture value of it was 5.02± 2.04% dry weight. This result is somehow lower when compared with the mean moisture value of legumes ranging between 7.0% and 11.0% as reported by (Aremu *et al.* 2006). However, this value is comparable to the moisture content of cashew nut flour (5.7%) (Aremu et al. 2006). Ige *et al.* (1984) had earlier reported content of 5.0% for fruited pumpkins. The mean ash content of AYB milk in this study was 3.0 ± 0.04. This value is comparable to the value reported by (Aremu *et al*. 2006) for other nuts. { Pomeranz and Clifton, 1981) had recommended that the ash content of nuts, seeds and tubers should fall in the range of 1.5-2.5% in order to be suitable for animal feed. In this study, the ash content of AYB milk was approximately within the range and may be recommended for animal feeds. The mean lipid value of 2.84 ± 0.14 reported in this study was relatively close to the values for other varieties of oil seeds ranging between 47.9-51.1% as reported by { Ige *et al*.1984; Asiegbu, 1987; Fagbemi and Oshodi, 1991) had earlier reported a mean lipid values of 49.2% and 47.01% respectively for pumpkin seed which is still closely related to the result obtained in this study. However, the value got in this study is comparably lower than the values of 36.7 as reported for cashew nut flour by (Aremu et al. 2006) and 23.5% for soy bean by (Paul and Southgate, 1980). Lipids are important in diets because they promote fat-soluble vitamins absorption (Bogert *et al.*1994). It is also a high energy nutrient and does not add to the bulk in the diet. The crude proteins of AYB milk was found to be 19.94 ± 0.06. This value is low compared to the protein content of soy bean , cowpeas, pigeon peas, melon, pumpkin and gourd seeds ranging between 23.1-33.0% (Olaofe *et al*.1994). The implication of the protein level was that AYB milk can supply the recommended daily intake of protein for children { Food and Agriculture Organisation) (2012).Apart from the nutritional significance of proteins as source of amino acids, they also play a part in the organoleptic properties of food (Okon,1983).The crude fibre of AYB milk was found to be comparable to other legumes with mean value ranging between 5-6% as reported by (Aremu *et al*. 2006). The maintenance of internal distension for a normal peristaltic movement of the intestinal tract is the physiological role which crude fibre plays. (Gallaher,2006) reported that a diet low in fibre is undesirable as it could cause constipation and that such diets are usually associated with diseases of the colon like piles, appendicitis and cancer (Aremu *et al*.2006). The value obtained for carbohydrates by difference is 72.45± 1.20 %. This value is a bit higher with an acceptable mean value for legumes, 20-60% of dry weight Arkroyed and Doughty ,(1964) . This result justifies the *Sphenostylis stenocarpa* as a possible rich source of energy and may be capable of supplying the daily energy requirement of the body (Aremu *et al*.2006). Dietary flavonoids protect against cardiovascular diseases/diabetes mellitus. The emerging consistent, provable and consistent evidence suggests that flavonoids can improve endothelial functions and may reduce blood pressure and glucose level (Hodgson,2006) through its vaso-relaxative effect on isolated arteries from rabbits as there is evidence that flavonoids metabolism is an important factor influencing the biological activity and effect of dietary flavonoids. Precisely the flavonoid (Hesperidin) raises blood levels of HDL (good cholesterol) and lowers the LDL (bad cholesterol). It also prevents inflammation as well as relief pain (Nwankwo and Ekeanyanwu, 2011). The reductive/ lowering effects in most of the cardiovascular parameters like systolic blood pressure, total cholesterol and blood glucose are the protective effects of saponin present in the milk of *Sphenostylis stenocarpa* .The presence of saponin resulted in the lowering of total cholesterol and reduction in inflammation (Kris-Etherton *et al.*2008). Saponin, if regularly included in the diet may help the body protect itself from cancer and other cardiovascular diseases as saponin and saponin-like compounds have shown evidence that they can buttress the body's ability to fight cancer, diabetes mellitus and cardiovascular diseases (Prio and Cao, 2000). The electrolytes analysis showed that potassium and magnesium reduces blood pressure. Hence, diet deficient in these minerals promote hypertension. An increase in potassium intake along with a decrease in sodium intake is the most important dietary change a person can make to reduce the risk of cardiovascular diseases (Lawrence *et al*.2006). The concentration of phytosterol obtained in the quantitative phytochemical screening could be a contributive factor to the reduction in the cardiovascular parameters because of its role in rennin-angiotensin aldosterone system, RAAS.It was

observed that phytosterol (β-sitosterol) reduced systemic blood pressure and blocked the circulating and tissue RAAS{ Vasudevan *et.a*l 2011).The physicochemical properties of AYB extracted milk was found to be in agreement with other plants milk like soybean milk ,Tigernut milk etc. The physical properties showed that the colour was milk colour, and other parameters that were sensorily tested by 20 panelists invited from the Department of Food Science and Technology which scored the following; aroma 5.80, taste 6.40, mouth feel 6.20 and overall acceptability 6.80. The results above was in agreement with work of (Akubor *et al.*2000), on physicochemical and sensory Characteristics of melon seed milk; (Belewu *et al.*2011) on Soy- Coconut milk preparation; (Ekpo, 2006) on physicochemical and sensory evaluation of Nigerian Tiger nuts. and (Awonorin and Udeozor, 2014) who worked on the physicochemical properties of Tigernut-soy milk. Chemically, the titratable acidity of the AYB milk is 25.244 and a pH of 4.76. These agree with the work of (Awonorin and Udeozor, 2014) who also worked on the physicochemical properties of Tigernut--Soy milk mixture. Also, the atomic absorption spectroscopy (AAS) gave us the results of Ca-0.1260 ppm, Fe-0.05605 ppm and Cu-0.0009 pm as the heavy metals Pb and Cd were not detected. Certainly, the above made the researchers convinced that the works of (Uguru and Madukaife, (2001); Azeke *et a*l 2011; Ekpo, 2006); Uche *et al*., 2014) on the nutritional qualities of this legume seeds gave the seeds the novel properties that made the legume a potential but latent nutraceutical. The cultivation and uses of seeds and tubers of the African yam bean (AYB) was worked on and reported by Klu,*et al.*2001; Uguru and Madukaife 2001; Azeke *et al*. 2011; Ekpo, 2006 reported on the nutritional evaluation of AYB and proved it as a novel food. Abbey and Berezi, 1988) showed that if well processed, AYB's digestibility will become increased. The chemical composition of AYB were worked on and reported by Edem *et al.*1990} and by Ekpo, 2006, they collectively the abundance of novel amino acids, phytochemicals and good quality bioactive compounds. Also,Okigbo, 1973; Nwokolo, 1996; Uguru and Madukaife, 2001. , corroborated the work of Abbey, and Berezi, (1988). Amoatey *et al*, 2000 reported on the processing of milk of AYB and Nnam, 2003}, reported that this legume is a good source of plant milk. The nutritional composition of AYB was also reported by Ene-Obong and Okoye (1993); andUche *et al.* 2014}, reported the nutritional evaluation of this legume and suggested the prospect of using the legume to reduce the scourge of malnutrition in the Northern and Southern Nigeria, in some war-torne countries of sub-Saharan Africa and beyond. The rationale behind this is that AYB is anti-malnutrition. In Togo, Ghana and Nigeria, the lectin content of AYB is used as insecticide. The paste made from the seeds are used as a cure for stomach ache/antacid. Also when this paste has water added to it, it becomes an anti-alcohol abuse (antabuse) which is natural unlike the drug disulfiram with its adverse drug reaction antecedents. Asuzu, and Undie 1986. Enwere and Ngoddy 1986 ; Lawrence *et al.*2006 reported the use of AYB in the management of chronic diseases like diabetes, hypertension and other cardiovascular diseases because of its dietary fibre content Nwankwo and Ekeanyanwu, 2011 reported that the phytochemicals contained also in the AYB such as flavonoids, isoflavones, anthocyanides, saponins, phytosterols, lignin and have the potential health benefits functioning as anti-cancer, and heart disease, lower blood cholesterol, reduce risk of heart disease, anti-hypertensive, anti-diabetic, anti-osteoporosis as well as anti-inflammatory agent. Since AYB is a Continental orphan legume which has the West Africans preferring the seeds to tubers, and the Easterners and Southerners relishing the tubers especially among the Bandudus, the Shabas and the tribe of Kinshasa in Democratic Republic of Congo. The FAO/WHO, (1991} have also reported the AYB amino acid profile to be higher than those in other legumes including soybean, and affirmed that this same amino acid profile compares favourably with whole hen's egg and met the organisations daily requirement of food. Nwankwo, Michael et al.2018} reported the anti-diabetic activity of *Sphenostylis stenocarpa* (African yam bean)(AYB) seed milk extract, Aremu *et al.*2016} reported the anti-dotal potentials of the *Sphenostylis stenocarpa* seed milk by mechanism of chelation. Also, .Sushil and Nishreen, 2017. showed that flavonoid components contained in the *Sphenostylis stenocarpa* seed milk-Hesperidin, Luteolin and Quercertin are known to possess anti-inflammatory property Asuzu and Undie, 1986 reported the pharmacological/medicinal use of *Sphenostylis stenocarpa* seed as Disulphiram/antabuse as well as other components of the *Sphenostylis stenocarpa* seeds and tubers which nutritionally provide abundant bioactive compounds. In 2018, the author published the anti-diabetic activities of the oil and milk of *Sphenostylis stenocarpa* seed Nwankwo, Michael.*et al*. 2018. Studies on the anti-dotal and anti-hypertensive potentials of both the seed oil and milk of *Sphenostylis stenocarpa* seed are on their finishing touches also by the author. I wish to suggest heret that in the light of the above, *Sphenostylis stenocarpa* scientifically belongs to the Hippocratic class of food, hence, it has abundant nutraceutical potentials.

V. CONCLUSION

This work suggests that *Sphenostylis stenocarpa* has nutraceutical potentials and also is in possession of a wide beneficial activities in man such as reducing the risk of heart diseases, anti-hypertensive, anti-diabetic, anti-osteoporosis as well as anti-osteoporosis as well as anti-inflammatory activities. It was obvious that *Sphenostylis stenocarpa* has a pronounced medicinally/pharmacological potentials.

VI. RECOMMENDATION

Sphenostylis stenocarpa seeds from all indications and inferences should be classed among the fonctional foods. This implies that this beans should be mass-produced and people should be enlightened on the beans so that they should include it in their staple for its abundant nutraceutical potentials.

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