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PHYSICOCHEMICAL AND UV-VISIBLE SCREENING OF AQUEOUS WOOD-ASH EXTRACTS OF LOCUST BEAN, SHEA BUTTER, MANGO AND CASHEW TREES

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ABSTRACT

Aqueous extract of wood ash is used by some ethnic groups in Nigeria especially Nupes and Gbagyis to prepare food for preservation and other purposes. In the recent past the use of chemical additives has gained ground. The recent call for green revolution and natural products intervention necessitates reverse actions. This study, therefore, aimed at determining the physico-chemical properties of the ashes obtained from four different plants and at investigating the beneficial and/or detrimental effects on the consumers. The extracts were screened for the presence of bioactive constituents, mineral elements and for UV-visible absorption. The alkalinity of the extracts was found at pH 13.00, 12.66, 11.07 and 10.51 in the order of *Parkia biglobosa*, *Vitalleria paradoxa*, *Mangifera indica* and *Anacardium occidentale*. Saponin was the only phytochemical found in all ashes. A strong UV absorption was observed at 225-325 nm which is attributable to the only phytochemical found. *A. occidentale* which produced highest aqueous extract to ash recovery (i.e. y/x ratio 76.32 %) ratio was also found to have highest composition of sodium, potassium, magnesium and phosphorous (Na=21250, Mg=618, Mn=620 and P=620 mg/L), highest UV absorbing components and mildest pH 10.51. We hereby recommend that attention should be directed towards ash obtained from *A. occidentale* (Cashew tree) for both medicinal and industrial uses. Conclusively, the physicochemical properties of the extract are beneficial to the health of the consumers in question and this study supports the use of wood ash extract as practiced by Nupes and Gbagyis.

Keywords: Ash extract, Chemical additives, Green revolutions, Minerals, Nupe-Gbagyi traditions, Saponins, UV-visible absorption

INTRODUCTION

Globalization of food trade poses main challenges for food safety and quality. Food products are subjected to contamination by microbial activities causing adverse changes including food borne illness. Food borne pathogens are the leading causes of illness and death in undeveloped countries, killing approximately 1.8 million people per annum (Ifeadike*et al.*, 2012). Fungi are the main cause of food deterioration and spoilage worldwide, ranking second to insects. To avoid spoilage of food several physical and chemical preservation techniques are commonly employed. Food preparation "cooking and additives" modifies physical and chemical properties of food, and thus may influence the release and uptake of nutrients from the food matrix. Some processes reduce food particle size, and significantly improve gastric emptying rates and nutrient absorption (Bjorck *et al.*, 1994; Pera *et al.*, 2002). Thermal processing can significantly affect digestion of protein (Ruales and Nair 1994), starch (Lee *et al.*, 2005), fat (Benini *et al.*, 1994), and vitamins (Yeum and Russell, 2002). Theories surrounding the "survival of the fittest" state that those who are fit health-wise for their environment will survive. The entire body system of our ancestors worked perfectly well for decades because they were gatherers of natural diet (Singh *et al.*, 2011). This diet promoted slightly an alkaline state in the human body (Alpern and Sakhaee, 1997). The human digestive system cannot totally adapt to chemically modified, artificial and often toxic products, which are staples of the current western diet (Vormann and Remer, 2008). People cannot properly digest the foods that they are usually eating. Net acid-producing animal foods, sugars, and cereal grains have replaced alkali-rich fruits and vegetables. One of the most prevalent and preventable results is low-grade chronic metabolic acidosis, which when left untreated poses a substantial threat to human health.

The role of nutrition in human acid-base homeostasis has received growing attention in recent years. Updates on the relationship between diet, acid-base homeostasis, physiology, and pathophysiological consequences shows that "homeostatic mechanisms in healthy humans and the kidneys' capacity to excrete acid equivalents can prevent strong diet-induced alterations in blood pH (Vormann and Remer, 2008). Many nutrition scientists estimate the net systemic acid

load supplied by the diet [*net endogenous acid production* (NEAP)]. The NEAP for 159 replicated pre-agricultural diets was minus 88 ± 82 mEq/d; these were *net base-producing*. The NEAP for the standard American diet (as recorded in the third National Health and Nutrition Examination Survey) was plus 48 mEq/d;these were *net acid-producing* (Sebastian *et al.*, 2002). It is clear that food is a primary cause of chronic acidity in the body and it has potential medical significance. According to Sebastian *et al.* (2002), "The historical shift from negative to positive NEAP was accounted for by the displacement of high-bicarbonate-yielding plant foods in the ancestral diet by cereal grains and energy-dense, nutrient-poor foods in the contemporary diet, neither of which is net base-producing".

Melamed and Melamed (2012) opined that the burden of the digestive diseases in the developed nations and the entire world has long-term, pathophysiological consequences from the epidemic of metabolic acidosis. If the predominance of the acid-forming, processed foods and acidosis-producing medications were to be considered, it can be presumed that the prevalence of low-grade, chronic metabolic acidosis can occur in epidemic proportions. Considering the above assumption one would see the need to normalize acid-base homeostasis by supplying humans with minerals such as sodium, potassium, calcium, magnesium, and bicarbonate. The three natural ways known for this to occur are: healing mineral water, mineral supplements and alkaline-formed plant based foods.

Minerals and bicarbonate have been used in clinical practice for a long time for the correction of metabolic acidosis and/or digestive disorders. For over five centuries, the use of sodium-potassium-magnesium-bicarbonate healing mineral water for the treatment of various digestive disorders of liver, gallbladder, and pancreatic diseases by European doctors has a long tradition supported with solid medical researches and positive clinical evidences (McCance and Huether, 1994; Burckhardt, 2008). In the same vein, ash aqueous extract has been employed by some African traditionalists for nutritional, medicinal and industrial purposes. In Nigeria, tribal groups like Nupes and Gbagyis use this extract in the preparations of variety of diets and prevention of microbial activities. This age-long African tradition is over-due for scientific validations. This

research was designed to determine the physicochemical and the UV absorption properties of the ash-mineral-water.

MATERIALS AND METHODS

Materials

The equipment used in this research include analytical weighing balance, autoclave machine (MDL NUMBER: MC-K23), UV Spectrophotometer, incubator (UNISCOPE SM9082), pH meter (HI2211 pH/ORP Meter) and flame photometer.

Sample Preparation

Samples used in this study were ashes prepared from the stalks of locust beans *(P. biglobosa,* PBS), shea butter (*V. paradoxa,* VPS), mango (*M. indica,* MIS) and cashew (*A. occidentale,* AOS) which were obtained from Lapai, Nigeria. Stalks of each plant were collected in March, 2019 and dried for one week until a constant weight was achieved. 15 kg of each dried plant stalk was then burnt into ash inside a container in open air. Ashes produced were allowed to cool and kept in plastic containers, labelled and stored in a well ventilated room for further processing.

Extraction of Ash

The water used for the extraction of ash was sterilized in autoclave (MDL NUMBER: MC-K23, SPECFICATION: 220 V 50 Hz 2000 W 15 L) for 15 minute. Extraction was carried out using the traditional method practiced by the Gbagyi people as described by Timothy *et al.* (2015) with slight modifications. 200 g of the ash was extracted with 500 ml of water. Each ash sample collected from the burnt wood was wetted with 50 ml sterilized water inside a stainless bowl to form its paste. The ash-paste was extracted with 450 ml of sterilized water in a perforated bowl (sieve) underlayed with a white handkerchief, and extract was allowed to percolate into a container. This process was repeated 3 times for the extraction to be exhaustive. The extract was filtered using Whatman No. 1 filter paper, stored in plastic bottle and kept in the refrigerator for further analyses.

Test for Alkalinity

The pH of the aqueous extract was measured electrometrically with a glass electrode of the pH/ORP Meter (HI2211). The meter was calibrated with a standard (phosphate) buffer solution and then sterilized water after which the electrode was dipped into the solution and reading was taking. Litmus papers were also dipped into each extract. The extracts were then titrated with 0.5 M H_2SO_4 and ethanoic acid using methyl orange and/or phenolphthalein as indicators.

Phytochemical Screening

Phytochemical screening was carried out on each of the ash extract using the method described by Trease and Evans (1999). Each aqueous extract was tested for the presence of saponins, alkaloids, flavonoids, tannins, terpenoids, glycosides and phenolic compounds.

Mineral Content Analysis

Analysis of the mineral contents of the ashes extracts was carried out at the National Cereal Research Institute (NCRI), Badeggi, Niger State, Nigeria using methods described by (Vijay *et al.*, 2017). Estimation of mineral nutrients was done by using spectrophotometric methods, flame photometry and atomic absorption spectroscopy (AAS).

Ultraviolet-Visible (UV-Vis) Absorption Measurement

The UV-Vis absorption measurements were performed on a UV4000 spectrophotometer (Dinko Instruments, Barcelona, Spain) as described by Escobar *et al.* (2018). Aliquots of the different wood ashes extracted in water at a concentration of 200 g/L were subjected to UV-Vis absorption. Sterilized water was used as blank. Standard curves of the aliquots were built using aqueous solutions of known extracts (0.2 mg/mL) at different absorption bands ranging from 200 -700 nm.

RESULTS AND DISCUSSION

Percentage Yields

Table 1 presents the percentage yield of the aqueous extracts and yield of the ashes recovered from 15 kg of the dry wood of *Parkia biglobosa*, *Vitalleria paradoxa*, *Mangifera indica* and *Anacardium occidentale*.

Table 1: Percentage yield of the ash recovered and aqueous extracts

Plant	Dry wood (kg)	Ash recovered (g)	*Yield, x (%)*	Ash extracted (g)	Water (cm^3)	*Aqueous extract (cm^3)*	Yield, y (%)	Ratio y/x
V.paradoxa	15	609.92	4.07	200	1000	739	73.9	18.16
P. biglobosa	15	485.55	3.24	200	1000	690	69.0	21.30
M. indica	15	169.15	1.13	075	0350	188	53.7	47.52
A. occidentale	15	113.95	0.76	075	0350	203	58.0	76.32

Key: y/x = Ratio of soluble components to the inflammable ashes

Table 1 shows the percentage yield of four different wood ashes extracts;*V. paradoxa* extract yieldedthe highest percentage (73.9 %), followed by *P. biglobosa* extract yielded (69.0 %), then *A. occidentale* (58.0 %), while *M. indica* extract has the least percentage yield (53.7 %) amongst the four extracts. The amount of ash produced by a wood may be dependent on the fibre and fuel producing contents of the wood. A low ash recovery is expected from wood with high fuel producing component. The wood that produced much ash will therefore have more affinity for water retention and less fuel components. The relationship between the percentage ash recovered and that of the extract (ash: extract) followed a similar trend except in *A. occidentale* where low amount of ash recovered produced high aqueous extract (i.e. y/x ratio 76.32 %). This suggests that the plant may be richer in water soluble minerals like sodium, potassium, magnesium and

phosphorous (Füzesi *et al.*, 2015) than other plants, and that the *V. Paradoxa* extract with the least y/x ratio (18.16 %) may be richer than others in the insoluble mineral contents.

Level of Alkalinity

Table 2 presents the level of alkalinity of the aqueous extracts of the ashes recovered from dry wood of *P. biglobosa*, *V. paradoxa*, *M. indica* and *A. occidentale*.

Table 2: Alkalinity of the samples (10 mL)

Sample	Colour	Red litmus	pH	Titration with Ethanoic acid	
				Methyl orange	Phenoph-talein
P. biglobosa	Slightly yellowish	Blue	13.00	29.00	16.4
V. paradoxa	Colourless	Blue	12.66	21.10	4.80
M. indica	Brown	Blue	11.07	Nd	Nd
A. occidentale	Reddish Brown	Blue	10.51	Nd	Nd

Key: (Nd) Not determined.

The results of pH analyses displayed in Table 2 showed that all four ash extracts turned red litmus paper to blue indicating that all the ashes extracts were alkaline and the alkalinity increased in the order: *A. occidentale*<*M. indica*<*V. paradoxa*<*P. biglobosa*. These pH values were consistent with the findings of Deighton and Watmough (2020) who reported 12.1, 12.4 and 13.0 for Yellow Birch Ash, white pine ash and Sugar Maple Ash respectively; Pugliese *et al.* (2014) reported a pH of 10.91 – 12.62 for wood ash collected from biomass boilers at three Canadian mills producing centers.According to Reid and Watmough (2004) and Demeyer *et al.* (2001) wood ash has high pH values ranging from 8.9–13.5.

The pH of a medium is a measure of the acid–base equilibrium. pH is a factor in enzyme stability and a major factor that influences release of drug ingredients. A variety of factors controls the intestinal microbial homeostasis. Pancreatic juice plays an essential role in keeping the number of microorganisms in the small intestine low (Melamed and Melamed, 2014). Experiments on

people with pancreatic fistulas or during endoscopic cannulation of the main pancreatic duct showed that the pancreatic juice in healthy persons was virtually sterile (Minelli *et al.*, 1996). Pancreas becomes more susceptible to infection when pancreatic juice is acidified i.e. pH is low (Ramare *et al.*, 1993). Extremely low pH values result in the complete loss of activity for most pancreatic digestive enzymes and changes in pH in the small intestine can alter the activity of the pancreatic enzymes (Melamed and Melamed, 2014).

The antibacterial activity of pancreatic juice is extremely sensitive to pH, having an optimal activity at pH 8.5 and with a complete cessation of action at pH 7.0 (Pierzynowski and Zabielski, 1999). Metabolic acidosis, acidification of the pancreatic juice and the subsequent decreasing of the antibacterial activity of the pancreatic juice can be a causative factor for small intestine bacterial overgrowth (SIBO). This could be a reason for various symptoms of indigestion and abdominal pain (Melamed and Melamed, 2014).

Ramare *et al.* (1993) uncovered a similarity between antibacterial factors in the pancreatic juice with trypsin as various tests show that pancreatic juice destroys almost the entire spectrum of microorganisms. Brief interview made about the use of ash extracts (Tswaka) in the preparation of food by the Nupes and Gbagyis of Niger state revealed that it allows the food to remain for longer days than usual. It was observed that house hold with large family size especially farmers reckon much with the use of "tswaka" in the preparation of their meals. The results from this study revealed the alkaline nature of the extracts which among all usefulness will; (1) reduce the rate of digestion of the food, thereby enhance the working hours of the farmers, (2) neutralize the gastric acid and prevent emergence of ulcer among the consumers. "Tswaka" is also said to be used in the treatment of stomach pains, the pH found (13.00, 12.66, 11.07 and 10.51) is proof that it is an antacid.

One primary reason for the usual epidemic of digestive disorders in both local and urban settlements has been attributed to chronic metabolic acidosis (Melamed and Melamed, 2014).

Primarily, chronic metabolic acidosis affects two alkaline digestive glands, the liver, and the pancreas which produce alkaline bile and pancreatic juice with a large amount bicarbonate. Consumption of ashes extracts in food or as a remedy for stomach ache may balance any slight acidic alterations in the pancreatic juice pH which could result in serious biochemical changes. The pancreatic digestive enzymes require an alkaline environment for proper function and lowering the pH disables the pancreas activity (Melamed and Melamed, 2014). When the pH of the pancreatic juice is low, it can cause premature activation of the proteases inside the pancreas with the potential development of pancreatitis (Melamed and Melamed, 2014).

pH value of food has an influence on the time required for food digestion and on the time required to restore the fasting pH levels (Kalantzi *et al.*, 2006). According to Kong and Singh (2008), intragastric pH in fasted healthy subjects is in the 1.3 to 2.5 range, eating could increase pH to a range of 4.5 to 5.8. Within 1 h after eating, the pH of the stomach decreases to less than 3.1 (Dressman, 1986). Food composition that has been fortified with high pH (ashes extract) components should be able to raise the pH above 3.1 even when the subjects fast for some hours. It is expected that the people who prepare their food with ash extract should be free of conditions like ulcer.Also patients withchronic pancreatitis who have a low bicarbonate concentration in their pancreatic juice and bile should be able to resist the development of duodenal acidity by consuming food enriched with high pH additives (Melamed and Melamed, 2014).

Pathophysiologically, substances with extremes of pH (less than 2 or greater than 12) are very corrosive and can create severe injury and burns in the upper gastrointestinal tract. Locations most seriously affected are in the oesophagus and stomach since the corrosive material often remains in these areas for a longer period of time. However, injuries can also occur in any area in contact with the caustic agents such as the oral mucosa, pharyngeal area, upper airways, and duodenum (Chibishev *et al.*, 2010). Acids and alkali agents have contrasting characteristics and differ in how they cause tissue damage.

Alkalis cause more injury to the oesophagus because it has higher surface tension that permit a longer contact time with oesophageal tissues, but when reacted with acidic contents in the stomach it neutralizes gastric injury. This explains the more severe damage to the oesophagus and less to the stomach. The severity of injury depends on several aspects: Concentration of the substance, length of time of tissue contact, and pH of the agent (Contini and Scarpignato, 2013; Park, 2014). In this research, *V. paradoxa* and *P. biglobosa* showed high pH values (12.66 and 13.00 respectively), suggesting that the extract made from these plants may cause more damages to the oesophagus, but less to the stomach.

Phytochemical Composition

Table 3: Phytochemical composition of the ash extracts

Phytochemical	*P. biglobosa*	*V. paradoxa*	*M. indica*	*A. occidentale*
Saponins	++	+++	++++	+
Alkaloids	-	-	-	-
Flavonoids	-	-	-	-
Terpenoids	-	-	-	-
Tannins	-	-	-	-
Glycoside	-	+	-	-
Phenolics	-	-	-	-

Keys: (-) completely absent, (+) trace amount, (++) moderate amount, (+++) appreciable amount. (++++) substantial amount.

The result of phytochemical screening of the ash extracts presented in Table 3 showed that saponins are the only phytochemical content of the ashes. This is in agreement with the alkaline nature reported for the extracts in Table 2, which in turns confirmed the usability of ashes for soap making. Meanwhile, the results showed that saponins content of *M. indica* ashes is highest followed by *V. paradoxa, then P. biglobosa* and *A. occidentale*. Although, the phytochemical result obtained in this study differs from the report of Timothy *et al.* (2015) which reported the presence of three phytochemicals in *Azadirachta indica* (neem) and six in *Parkia biglobosa* (locust bean) wood ash extracts. These include; alkaloids, cardiac glycosides, terpenoids,

saponins, tannins and sterols. According to Asma *et al.* (2016), ash values represent the inorganic residue present in herbal plants. Based on this, no phytochemical is expected to be determined from ash except water soluble saponin-glycosides as reported in Table 3 above.

Ashes are known for their use in local soap production. Saponins are a special class of glycosides which have soapy characteristics (Najafi, 2013). Saponins inhibit sodium ions efflux by blockage of the influx of concentration in the cells activating a sodium-calcium ions anti-porter in cardiac muscle and the increase in calcium ions influx through this anti-porter strengthens the contraction of heart muscles. Major properties of saponins include the formation of foam in aqueous solution, haemolytic activity (Khalil and Eladawy, 1994), reduction of the uptake of certain nutrients such as glucose and cholesterol at the gut through intralumenal physicochemical interaction. It can act as natural anti-inflammatory, anti-oxidant and anti-biotic (Aberoumand, 2012; Ray-Sahelian, 2012). According to Sodipo *et al.* (1991), saponins are active antifungal agents. This may justify the observation of the Nupes that food prepared with ash extract is preserved much longer than that prepared with water.

Ash extracts of *P. biglobosa*, *V. paradoxa*, *M. indica* and *A. occidentale* were found to contain exclusively saponins which is known to bind and lower the amount of cholesterol in the body, and in effect reduce the risk of atherosclerosis (Xu *et al.*, 1996; Asl and Hossein, 2008). This may ease the risk of hypertension arising from atherosclerosis among the people consuming ash extract in their food.

Mineral Contents of the Extracts

Table 4 presents the results of mineral analysis of ash extracts studied in this research.

Table 4: Mineral compositions of the extracts

Sample description	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Phosphorous (mg/L)	Iron (mg/L)
PBS	335^{d}	15050^{b}	85^{d}	471^{c}	117.137^{b}	606.535^{b}	36.978^{c}
VPS	1370^{b}	5860^{d}	162^{a}	564^{b}	227.796^{a}	426.864^{c}	33.444^{d}
MIS	440^{c}	10700^{c}	118^{b}	417^{d}	97.879^{d}	85.465^{d}	93.420^{a}
AOS	21250^{a}	21540^{a}	90^{c}	618^{a}	98.138^{c}	620.885^{a}	57.027^{b}

Key: a = highest value of the mineral, d = lowest value of the mineral
PBS = *P. biglobosa*, **VPS** = *V. paradoxa*, **MIS** = *M. indica* and **AOS** = *A. occidentale*

The analysis of mineral composition revealed the presence of potassium, phosphorous, sodium and magnesium in appreciable quantities different from iron, calcium and manganese. The principal cations in gastric juice are sodium (about 70 mM) and potassium (about 15 mM), whereas the principal anion is chloride (about 100 mM) (Dressman *et al.*, 1998; Vertzoni *et al.*, 2005; Kalantzi *et al.*, 2006).

The results in Table 4 showed that *A. occidentale* had the highest composition of sodium, potassium, magnesium and phosphorous. This is corroborated by the results of percentage yields presented in Table 1 which revealed that *A. occidentale* ash extract produced the highest y/x ratio (76.32 %) indicating the presence of water soluble minerals in higher abundance than other plants. The result of mineral content also showed that *V. paradoxa* had the highest composition of calcium and manganese. This was earlier predicted by the results of percentage yields (Table 1) which revealed that *V. paradoxa* ash extract produced the lowest y/x ratio (18.16) and may be richer than others in the insoluble mineral contents.

A deficiency of minerals such as potassium, magnesium, calcium, bicarbonates etc in food products shifts the body's internal environment from being slightly alkaline to being acidic causing chronic metabolic acidosis (Melamed and Melamed, 2014). *A. occidentale* had the

highest content of the four soluble minerals namely: sodium, potassium, magnesium and phosphorous (21250 and 21540, 618 and 620 mg/L respectively), *V. paradoxa* had the highest calcium and manganese content (162 and 227 mg/L), while *M. indica* was richest in the iron contents (93 mg/L).

Sodium and potassium are two important elements that constitute the body electrolyte. The high sodium and potassium content in *A. occidentale* ash extract is an indication of its tendency to regulate and control the osmotic balance of the body fluid as well as the body pH. Calcium is essential for bone formation. Magnesium could also help in lowering the blood pressure and reducing inflammation. It also plays a role in bone formation and blood clothing. Phosphorous is important for the wellbeing of the body. Iron help in preserving many vital functions in the body. Phosphorus is a macro-mineral that is necessary for proper growth and development. Phosphorus is present in every living cell. It is an essential nutrient for all animals needed in transferring and utilization of energy (Gene, 2014). Phosphorus must be balanced in the animal diet with adequate calcium and vitamin D for growth, reproduction, gestation, and lactation, because deficiency of phosphorus is the most widespread of all the mineral deficiencies affecting livestock. Judging by the composition of minerals (Table 4) found in these ashes, it is evident that ashes extract could serve as mineral supplements in food consumption.

UV-Visible Absorption of the Extract

The electromagnetic radiation absorption of ashes extracts in the UV-visible range is presented in Table 5 and also depicted in Figure 1.

Table 5: Electronic transitions that gave maximum absorbance at specified wavelengths

Sample	Colour	λ_{max} (nm)	Intensity	Electronic transition	Phytochemical responsible
P. biglobosa	Colourless	225	1.7060[c]	$\pi - \pi^*$	Saponnins
		517	0.4861	blue	
V. paradoxa	Colourless	225	0.8866[d]	$\pi - \pi^*$	Saponnins
		475	0.3210		
M. indica	Golden yellow	275	3.1340[b]	$\pi - \pi^*$	Saponnins
		375	0.7516		
A. occidentale	Brown	275	3.5366[a]	$\pi - \pi^*$	Saponnins
		517	0.5433		

Key: a, b, c & d = indication of the level of UV absorption intensity from highest to the lowest.

The UV-Visible spectrophotometric determinations of absorption maxima of the soluble contents of the plant ashes revealed the presence of UV sensitive components in all extracts and the colour transmitting components in some. The results presented in Table 5 and Figure 1 showed that *A. occidentale* has highest UV absorbing components. This strengthens the results of mineral analysis (Table 2) and that of percentage yields (Table 1) which revealed that *A. occidentale* ash extract produced the highest y/x ratio (76.32 %) indicating the presence of water soluble minerals in high abundance.

The strong absorption in the UV region of the electromagnetic spectrum is attributable to the only phytochemical (saponins) found in the extract. Saponins in addition to the soluble minerals constituted the abundant soluble contents of the extracts. The absorption of UV radiation strengthen the usability of the ashes in the production of local soap, such soap will strengthen the UV absorption of derma layer and protect the epiderma layer from radiation damage and probably from cancer (John *et al.*, 2013). It is noteworthy that *A. occidentale* has been reported for its anticancer activities (Dalia *et al.*, 2017)

Interestingly, the pH, 10.51 determined for *A. occidentale* ash is the mildest of all, suggesting that the ash extract may be body-friendly and even if ingested may pose little or no threat to the health. We hereby recommend that ash extract from these research plant materials be subjected

to cancer treatment assays, and specifically, attention should be directed towards ash obtained from *A. occidentale* (Cashew tree) for both medicinal and industrial uses.

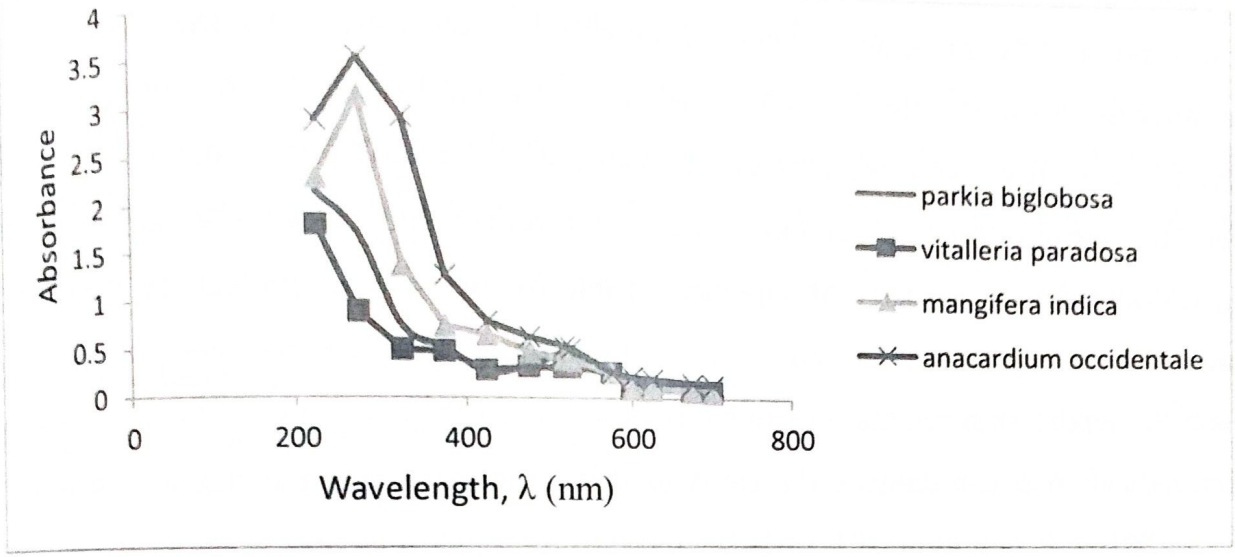


Figure 1: UV- Visible Spectra of the Ashes Extracts

The graphs obtained above (Figure 1) showed that the UV-Visible spectra of the four extracts could be related with the quantity of phytochemical composition of the extracts. The simple nature of the absorption peaks at 275 nm in *M. indica* and *A. occidentale* extracts makes it attributable to the only phytochemical (i.e. saponins) found in the extracts. Strong absorption at λ_{max} 275 UV region could enhance saponins' sunscreen-effect protecting the UV sensitive molecules in the body from being damaged by Ultra violet B radiations. A case of previtamin D2 which absorbed UVB at 260 nm and served as a sunscreen protecting the genetic material within the cell from the damaging UVB radiation is an example (Holick, 2016). These saponins could efficiently absorb the UVB radiation and reduce the number of photons reaching the photosensitive macromolecules within the cell.

Saponnin is an important bioactive material which has a wide array of pharmacological activities. The radiations at lower wavelengths have higher energies, this inverse relationship between wavelength and energy proves that when human skin is exposed to sunlight the highest energy radiation *i.e.* upper-UV radiation would penetrate more deeply into the skin than lower

energy photons such as near-UV and visible radiation. However, the skin contains a variety of macromolecules in the epidermis which include DNA, RNA and proteins that efficiently absorb upper-UV photons (Holick, 2016). Ashes are locally employed in the making of bathing soaps, the UV- absorption of the saponins contents of the extracts could strengthen the UV absorption of the macromolecules in the epidermis layer when soap made from ashes are used in bathing. Ordinarily, skin does respond to the exposure to sunlight by increasing the amount of the upper dead layer, the stratum corneum act like mirrors that reflect and refract UV radiations. The additional UV-absorbance property of saponins (Table 6) may further protect the upper layer from being dead, thereby softens the skin and maintains the freshness of the body for ages. This may explain the tender skin retention of our forefathers until their old ages. Near UV radiation creates free radicals that can damage the DNA in skin cells increasing the risk for malignancy (Wang *et al.*, 2010). Penetration of UV radiations into the epidermis and dermis can cause the formation of free radicals which can damage proteins, DNA and RNA in the cells (Halliday and Byrne, 2014). Saponins can also act as antioxidants and free radical scavengers, thereby reducing free radical damage to the cells.

CONCLUSION

Scientific studies and clinical evidences have proved that the pancreas and liver are more vulnerable to a reduction in their functions because of metabolic acidosis. It had been hypothesized that chronic metabolic acidosis destroys digestion. Therefore, basifying the pancreatic juice will increase the activity of the digestive pancreatic enzymes and could solve numerous digestive problems. The traditional alkaline-based food preparation is hereby identified as a natural way to prevent and cure the epidemic of gastrointestinal disorders. Prospective clinical studies are hereby called for to confirm the preventive and therapeutic ability of "tswaka" for normalizing the acid-base balance in digestive and pancreatic media. The ash extracts of the four plants studied in this research can be seen as a potential source of useful food additives (preservatives and fortifications) and promising drug candidates. Further studies on these extracts are on- going in order to ascertain their therapeutic properties and

formulate body creams with other natural oils. The anti-fungal activities of these extracts for the preservation of cooked food as claimed by Nigeria-Nupe traditions are also being investigated.

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Conflicts of Interest

The authors declare no conflict of interest.

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