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COMPARATIVE PHYTOCHEMICAL ANALYSIS OF LOCAL AND FOREIGN INDUSTRIAL BLACK SOAPS

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Abstract
Phytochemical analysis of three local industrial soap (Zee, Dudu Osun and Dudu Yoyo) and one foreign industrial black soap (Cottage Fresh Alata Samina (CFAS) pure herbal soap) were investigated. These soaps were choosing for investigation because their label indicated use of herbal components. Phytoconstituents such as alkaloids, saponins glycosides, phytosterols, flavonoids, carbohydrates, protein, phenols and diterpenes were analysed using more than method of analysis for most of the phytoconstituents. The result reveals that saponins phytosterols and diterpenes were present in the local black soaps whereas the foreign black soap was found to contain alkaloids, saponins, phytosterols and diterpenes. The presence of these secondary metabolites validates the use of herbal components in the soap samples. Perhaps, the presence of alkaloids which act as antiparasitic and gout treatment makes CFAS a better herbal black soap.
Keywords*:* phytochemicals, black soap, comparative analysis

Introduction

Soap is a compound formed by the reaction of an essentially water insoluble fatty acid with an alkali (sodium or potassium hydroxide) or organic base to produce a carboxylic acid salt with enhanced water solubility, sufficient to produce useful surface. [1]

Black soap is usually made from an aqueous extracts (lye) of wood ash, cocoa pod, palm kernel ash, plantain peel ash e.t.c. and palm kernel oil which produces the fatty acid. The palm kernel oil is usually heated to smoke point after which the lye is gradually added until there is complete saponification of the oil. Black soap from various vegetable ash lye has been produced for a very long time by man. It is still been produced locally in Nigeria. [2]

These soaps are used in formulation of various traditional herbal medicaments intended for topical use. The soaps perform the function of an ointment base and other components or the active ingredients are added in powder form. The soaps are used principally for their alleged antiseptic properties and such are used to bath the affected areas before application of herbal preparations.[3] The incorporation of plant materials and extracts with activity against various skin conditions from eczema to purities and other more serious dermatological ailments, into soap is one of the major ways medicinal plants are utilized.[4]

Phytochemicals

Phytochemicals are non-nutrient plant chemical compounds or bioactive components found in plant parts such as leave, roots, rhizomes, stem, back, flower, grains or seeds employed in the control or treatment of a disease condition and therefore contain chemical component that are medically active.[5-6] Phytochemicals are a large group of plant derived compounds hypothesized to be responsible for much of the disease protection conferred from diets high in fruits, vegetables, beans, cereals, and plant based beverages such as tea and wine.[7] Indeed, once consumed and absorbed, flavonoids act favorably in the body, through actions such as inhibiting xanthine oxidase and arachidonic acid metabolism.[8]

Classes of Phytochemicals

Glycosides

Glycosides are colourless crystalline carbon, hydrogen and oxygen-containing (some contain nitrogen and sulfur) water-soluble phyto-constituents, found in the cell sap. Chemically, glycosides contain a carbohydrate (glucose) and a non-carbohydrate part (aglycone or genin).[9-10]

Glycosides are classified on the basis of type of sugar component, chemical nature of aglycone or pharmacological action. So, different group perform different functions. For example, cardiac glycoside (act on the heart), anthracene glycoside (purgative and for treatment and skin diseases) and chalcon glycoside (anticancer)

Flavonoids

Flavonoids are important group of polyphenols widely distributed among the plant flora. Structurally, they are made of more than one benzene ring in their structure (a range of C15 aromatic compounds) and numerous reports support their use as antioxidants or free radical scavengers.[9]

Phenolics

Phenolics are chemical compounds that occur ubiquitously as natural colour pigments esponsible for the colour, of fruits of plants. They are classified into (i) phenolic acids and (ii) flavonoid polyphenolics (flavonones, flavones, xanthones and catechins) and (iii) non-flavonoid polyphenolics. Caffeic acid is regarded as the most common of phenolic compounds distributed in the plant flora followed by chlorogenic acid known to cause allergic dermatitis among humans.[9]

Saponins

Saponins are regarded as high molecular weight compounds in which, a sugar molecule is combined with triterpene or steroid aglycone. There are two major groups of saponins and these include: steroid saponins and Triterpene saponins. Saponins are soluble in water and insoluble in ether, and like glycosides on hydrolysis, they give aglycones. Saponins are extremely poisonous, as they cause heamolysis of blood and are known to cause cattle poisoning.[9]

Tannins

Tannins are soluble in water and alcohol and are found in the root, bark, stem and outer layers of plant tissue. Tannins have a characteristic feature to tan, i.e. to convert things into leather. They are acidic in reaction and the acidic reaction is attributed to the presence of phenolics or carboxylic group.[9] Tannin are used as antiseptics and this activity is due to the presence of phenolic group.

Terpenes

They are flammable unsaturated hydrocarbons, existing in liquid form commonly found in essential oils, resins or oleoresins.[10] Commonly important monoterpenes include terpinen-4-ol, thujone, camphor, eugenol and menthol. *Diterpenes (C20)* are classically considered to be resins and taxol, the anticancer agent, is the common example. The t*riterpenes (C30)* include steroids, sterols, and cardiac glycosides with anti-inflammatory, sedative, insecticidal or cytotoxic activity. Common triterpenes: *amyrins, ursolic* acid and *oleanic acid* s*esquiterpene (C15*) like monoterpenes, are major components of many essential oils.[11] The sesquiterpene acts as irritants when applied externally and when consumed internally their action resembles that of gastrointestinal tract irritant.

Anthraquinones

These are derivatives of phenolic and glycosidic compounds. They are solely derived from anthracene giving variable oxidized derivatives such as anthrones and anthranols.[12] Other derivatives such as chrysophanol, aloe-emodin, rhein, salinosporamide, luteolin and emodin have in common a double hydroxylation at positions C-1 and C-8.

Essential oils

They mostly contribute to the odoriferous constituents or *'essences'* of the aromatic plants that are used abundantly in enhancing the aroma of some spices.[11] Essential oils have been associated with different plant parts including leaves, stems, flowers, roots or rhizomes. Chemically, a single volatile oil comprises more than 200 different chemical components, and mostly the trace constituents are solely responsible for attributing its characteristic flavour and odour.

Steroids

Plant steroids (or steroid glycosides) also referred to as 'cardiac glycosides' are one of the most naturally occurring plant phyto-constituents that have found therapeutic applications as arrow poisons or cardiac drugs.[10] Steroids (anabolic steroids) have been observed to promote nitrogen retention inosteoporosis and in animalswith wasting illness.[12-13]

Alkaloids

Alkaloids are a structurally diverse group of over 12,000 cyclic nitrogen-containing

compounds that are found in over 20% of plant species.[14] Although no single classification exists, alkaloids are often distinguished on the basis of a structural similarity (e.g. indole alkaloids) or a common precursor (e.g. benzylisoquinoline, tropane, pyrrolizidine, or purine alkaloids).These are the largest group of secondary chemical metabolites ade largely of ammonia compounds comprising basically of nitrogen bases synthesized from amino acid building blocks with various radicals replacing one or more of the hydrogen atoms in the peptide ring, most containing oxygen. The degree of basicity varies considerably, depending on the structure of the molecule, and presence and location of the functional groups.[15] They react with acids to form crystalline salts without the production of water.[9]

Mechanism of Action of Phytochemicals

Phytochemicals may either be used as chemotherapeutics or chemo preventive agents with chemoprevention referring to the use of agents to inhibit, reverse, or retard tumorigenesis. In this sense chemo preventive phytochemicals are applicable to cancer therapy, since molecular mechanisms may be common to both chemoprevention and cancer therapy.[16-17] Plant extracts and essential oils may exhibit different modes of action against bacterial strains, such as interference with the phospholipids bilayer of the cell membrane which has as a consequence a permeability increase and loss of cellular constituents, damage of the enzymes involved in the production of cellular energy and synthesis of structural components, and destruction or inactivation of genetic material. In general, the mechanism of action is considered to be the disturbance of the cytoplasmic membrane, disrupting the proton motive force, electron flow, active transport, and coagulation of cell contents.[18]

MATERIALS AND METHODS

Chemicals

Fehling's Solution A&B and H_2SO_4 (BDH Laboratory Supplies Poole BH15, ITD, England). Molisch's Reagent & Benedict's Reagent (Made in Italy Packed by: Hendoz Nig. Ltd), Millon's reagent (EGACHEMIE G-Britain). Benzene (Griffen & George Limited London). Ethanol from Sigma-Aldrich Chemical Co. (St. Louis, USA), Vitamin C, Methanol, Chloroform, Ethyl Acetate, Hydrochloric Acid, Sodium Hydroxide, Hexane and all others solvent (Analytical grade) from Merck Co. (Darmstadt; Germany), and Distilled Water.

Materials

The local black soaps (Zee, Dudu Osun and Dudu Yoyo) were obtained from Okene central market, Kogi State, Nigeria. The foreign black soap (CFAS) was a product of Gettad Ent. Kaneshie Accra, Ghana and was obtained from Lokoja central market, Kogi State, Nigeria.

Phytochemical Screening

Preliminary Phytochemical screening was done using standard procedures to identify constituents, as described by.[19-20] Qualitative chemical test methods were used for detection of various phytochemical to give idea regarding the nature of constituents present in the soap samples.

Tests for simple sugar

Benedict's test

Equal volumes of Benedict's reagent and test solution were mixed in a test tube. The mixture was heated in boiling water bath for 5 minutes. Solutions appeared green showing the presence of reducing sugar.

Molisch's test

Equal volumes of Molisch's reagent and test solution were mixed in a test tube. The mixture was heated in boiling water bath for 5 minutes. Appearance of violet or purple colour ring showing the presence of reducing sugar.

Test for Proteins

Biuret Test

To the small quantity of extract 1-2 drops of Biuret reagent was added. Formation of violet colourprecipitate showed presence of proteins.

Millon's Test

To the small quantity of extract 1-2 drops of Million's reagent was added. Formation of white colour precipitate showed presence of proteins.

Test for Anthraquinone glycosides

Borntrager's Test

To the 3ml of extract, dil. H_2SO_4 was added. The solution was then boiled and filtered. The filtrate was cooled and to it equal volume of benzene was added. The solution was shaken well and the organic layer was separated. Equal volume of dilute ammonia solution was added to the organic layer. The ammonia layer turned pink

showing the presence of Anthraquinone glycosides.

Test for steroids

Salkowski Test

To 2ml of extract, 2ml of chloroform and 2ml of conc. H_2SO_4 was added. The solution was shaken well. As a result chloroform layer turned red and acid layer showed greenish yellow fluorescence.

Test for alkaloids

Hager's Test

To the 2-3ml of filtrate, 1ml of dil. HCl and Hager's reagent was added and shaken well. Yellow precipitate was formed showing the presence of alkaloids.

Mayer's Test

To the 2-3ml of filtrate, 1ml of dil. HCl and Mayer's reagent was added and shaken well. Formation of yellow precipitate, showed the presence of alkaloids.

Test for Flavonoids

With Lead Acetate

To the small quantity of extract lead acetate solution was added. Formation of yellow precipitate showed the presence of flavonoids.

Test for Tannins and Phenolic compounds

$FeCI_3$ Solution Test

On addition of 5% $FeCl_3$ solution to the extract, deep blue black colour appeared.

Lead Acetate Test

On addition of lead acetate solution to the extract white precipitate appeared.

Test for Saponins

Foam Test

To 1ml extract 20ml distilled water was added and shaken well in measuring cylinder for 15min. Then 1cm layer of foam was formed.

Test for Diterpene

Copper Acetate Test

5ml of each extract was mixed with 3ml concentrated H_2SO_4 and 3-4 drops of copper acetate solution. Formation of emerald green colour indicates the presence of diterpene.

Test for phytosterols

Salkowski Test

5ml of each extract was mixed in 2 ml of chloroform, and 3ml concentrated H_2SO_4, shaken and allow to stand. Appearance of golden yellow colour indicates the presence of phytosterols

RESULTS AND DISCUSSIONS

The Phytochemical analysis of three local industrial soap (Zee, Dudu Osun and Dudu Yoyo) and one foreign industrial black soap (Cottage Fresh Alata Samina(CFAS) pure herbal soap) was determined. The result reveals the presence of saponin, phytosterol and diterpens except CFAS that contained alkaloids as shown in Table 1.

Table 1 – showing the Phytochemical analysis of the soaps.

S/No	Constutuents	Chemicals	Zee	Dudu Osun	Dudu Yoyo	CFAS
1	Alkaloids	Hager's Reagent	-	-	-	+
		Mayer's Reagent	-	-	-	-
2	Reducing sugar	Benedict's Reagent	-	-	-	-
		Molisch's Reagent	-	-	-	-
3	Steroids	Salkowski Regent	-	-	-	-
4	Saponins	Foam	+	+	+	+
5	Phenolics& Tannin	FeCI3 Sol.	-	-	-	-
		Lead Acetate	-	-	-	-
6	Proteins	Biurret Reagent	-	-	-	-
		Million's Regent	-	-	-	-
7	Anthraquinone glycosides	Borntrager's Reagent	-	-	-	-
8	Flavonoids	Lead Acetate	-	-	-	-
9	Phytosterol	Salkowski Regent	+	+	+	+
10	Diterpene	Copper Acetat	+	+	+	+

The presence of these phyto-constituents such as alkaloids in CFAS makes the product a better herbal black soap as alkaloids are known to be anti-parasitic and used in treatment of gout.[21] Alkaloids which form the largest group of phytochemical in plants exhibit toxicity against cells of foreign organisms, and are used for the development of powerful pain killer drugs.[22]

Phytosterol which encompass plant sterols and stanols, are phytosteriods similar to cholesterols which are present in plants. Phytosterols can reduce blood cholesterol by significant amount. An average of 8.8% reduction in LDL-cholesterol was observed at a mean intake of 2 grams of phytosterol supplement per day.

Diterpenes have been used in traditional medicine for anti-cancer, anti-diabetic and various other Ailments.[23]

saponins are responsible for the haemostatic activity of plant and they also arrest bleeding from damage vessels by precipitating proteins to form vascular plugs.

The absence of other phyto-constituents tested may be as a result of the fact that the part of the plant where such constituents are produced are not used in the soap. Perhaps they might have been lost during the process of the soap production.

CONCLUSION

Phytochemical analysis of three local industrial soap (Zee, Dudu Osun and Dudu Yoyo) and one foreign industrial black soap (Cottage Fresh Alata Samina (CFAS) pure herbal soap) were successfully investigated. The presence of these secondary compounds, such as alkaloids, saponins, phytosterol and diterpenes validates the use of herbal components in the soap samples. Many rural community in Nigeria uses black soap with herbal component either as soap for bathing or for medical conditions. Presence of phytochemicals in these samples indicates possible preventive and curative properties. Perhaps, the presence of alkaloids which act as antiparasitic and gout treatment makes CFAS a better herbal black soap. There is need to carry out more pharmacological studies to support their use as medicinal soaps.

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