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Research Article

Comparative Antimicrobial Efficacy of Locally Made African Black Soaps Produced in Akure, Nigeria and Medicated Soaps Against Selected Clinical Skin Pathogens

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Abstract

Microbiological analyses were carried out on African Black Soaps locally produced in three different settlements of Akure, Ondo state, Nigeria and Industrial Medicated Soaps to ascertain the type of organisms associated with them. It was discovered that the Black Soaps and the Medicated Soaps were bacteriologically sterile while ubiquitous air-borne fungi such as *Aspergillus niger* (2), *Aspergillus fumigatus* (1), *Candida albicans* (3) and *Aspergillus flavus* (2) were present in the African Black Soap samples and as well as the medicated soaps. Comparative evaluation of the antibacterial and the antifungal efficacy of the African Black Soap and Medicated Soaps against selected clinical pathogens such as *Staphylococcus aureus, Streptococcus pyogenes and Pseudomonas aeruginosa* for bacteria; *Mucor racemosus, Articulosporum* spp. and *Saccharomyces exiguus* for fungi were done adopting the standard methods described by Clinical and Laboratory Standards Institute (CLSI, 2014). The Minimum Bactericidal Concentration (MBC) of the African Black Soaps (A.B.S.1, A.B.S.2, and A.B.S.3) and that of the Medicated Soaps (I.M.S.1 and I.M.S.2) was not significantly different (400 µg/ml) at $P \leq 0.05$ levels of significance while the standard Minimum Inhibitory Concentration (MIC) of the A.B.S. 1, 2, and 3 for the fungal pathogens was 400 µg/ml compared to 600 µg/ml for I.M.S. 1 and 2 respectively at the same level of significance ($P \leq 0.05$). Conversely, the results indicated that the potent antifungal properties of locally made African Black Soaps were averagely marginally acceptable at 400 µg/ml concentration making them potent antifungal agents at a relatively higher concentration compared to that of medicated soap at 600 µg/ml concentrations respectively. The findings also proved the potent antimicrobial efficacy of locally made African Black Soaps over Industrial Medicated Soaps.

Keywords: African Black Soap; Industrial Medicated Soap; Antimicrobial Efficacy; Minimum Inhibitory Concentration (MIC); Minimum Bactericidal Concentration (MBC); Akure

Introduction

African Black Soap, commonly referred to as the black soap is traditionally produced in areas across West Africa mainly Ghana where it is referred to as "alata samina" or "anago samina" soap and Nigeria where it is referred as "ose dudu", a name used by the Yoruba people of western Nigeria that literally means "black soap" [1]. In Nigeria, it is produced in the western states of Nigeria such as Osun, Oyo, Ondo states etc. by the local women. The absence of lye makes African black soap much softer and almost putty-like when wet, with a crumbly and uneven surface. It is beige to brown, dark brown, gray in color or deep black in colour depending on the method of production [2,3].

The soap is a natural source of vitamins A and E; this makes it a good skin cleanser by supporting collagen production and helping to keep skin firm and smooth and also aiding in acne treatments [2,3]. Similarly, the soap also supports the tissue structure and helps to moisturize and improve skin texture and tone [1]. Recent studies suggest that the antioxidants from the vitamins contained in African Black Soap help to prevent free radical damage which can lead to visible signs of aging; demonstrating potentials for remedy of dandruff and itchy scalp, evening out dark spots, eczema, razor bumps and eliminating blemishes [4,5]. Black soap contains a high amount of glycerin, which absorbs moisture from the air and literally deposits it into the skin, making the skin soft and supple [4]. Other studies also contain data that suggests that Black soap possess potent antimicrobial activities against many known antibiotic resistant skin pathogens in the tropics; however, the variations in the different compositions of many locally made black soap have led indicated different results and hence findings suggest that the peculiar components of many black soap variants ultimately determine its medicinal and antimicrobial properties [5].

In Akure, south-western Nigeria, the locally made African black soap produced in the town is composed of plantain peels, cocoa beans pods, palm kernel oil, paraffin oil, lime and Shea butter [6]. The locally made African black soap therefore contains vitamins A and E, Polyphenols, Antioxidants and Major fatty acids (Lauric, Myristic, Cinnamic, Oleic, Palmitic, Stearic, Linoleic and Arachidic acids respectively) [4]. However, there exists no significant information on the antimicrobial potential and comparative bactericidal or fungicidal effects of African black soap locally made in Akure

against known skin pathogens in contrast with many commercially available medicated soaps licensed for sales in the markets. Hence this study was aimed at characterizing microorganisms associated with black soap, determine the antimicrobial properties of the locally made black soap on selected skin pathogens and compare the antimicrobial potency of the black soap locally made in Akure on selected skin pathogens with some industrial made medicated soaps in Akure, Nigeria.

Materials and Methods

Study Area Description

The study area Akure is found in Ondo State, Nigeria with coordinates 7°16' N 7°20' N/ 5°11' E 5°118' E [7]. It encompasses both the Akure South Local Government Area and Akure North Local Government Area of Ondo state, with an estimated population of about 400,000 persons (inhabitants inclusive) [7].

Sampling Points in the Study Area

The locally made African black soaps used were obtained from three different locations in the study area namely: Ijoka, Isinkan and Ita-ogbolu all in Akure, Nigeria. These areas are renowned for production of black soap in Akure and many of their products are patronized by local respondents in Akure metropolis.

Sample Collection (Local Black Soaps and Medicated Soaps)

A total of 3 different locally made African black soap samples were collected into sterile polyethene packs using the guidelines described [6]; while Industrially produced medicated soaps such as Dettol and Septol which are certified by the Nigerian National Agency for Food and Drug Administration and Control (NAFDAC) were obtained from commercial vendors at the Akure Central Market. The samples were collected between April and June, 2016; stored in ice packs before laboratory analyses were carried out and all the samples collected were analyzed in the laboratory within 6hr of sample collection [2,3].

Sample preparation, Standardization of Inoculum and Isolation of Microorganisms

The methods described in Aliyu., *et al.* [8], Obi [9] and Adebomi., *et al.* [1] were adopted for sample preparation and Inoculum standardization in which sterile distilled water was used as diluents and a 1g of each sample stock of locally made African black soap was weighed into 10 ml of sterile distilled water for a serial dilution procedure in sterile test tubes under aseptic conditions until four different dilutions were obtained for a pour plate culture technique [9]. Thereafter, a 1 ml each of the dilution factors 3 and 4 were used for inoculating already prepared Nutrient Agar and Potato Dextrose Agar seeded with 250 mg Chloramphenicol (for total filamentous fungi counts). The Bacterial isolates were incubated at 37°C for 24hrs while Fungal isolates at 26 ± 2°C for 3 - 5 days [10]. Following incubation, the culture plates were observed for colony forming units of bacteria and spore forming mycelia units of fungi; thereafter, the fourth dilution factor was established as the standard for the isolation of the fungi due to easy numerical estimation of different colony and mycelia units [4].

Identification and Characterization of fungal isolates

The methods described by Jonathan., *et al.* [11] and Onifade., *et al.* [12] were adopted for identification of the fungi isolates. The cultural characteristics (macro-morphology) and the microscopic morphological characteristics (micro-morphology) of the various distinct mycelia units obtained were compared with the available literature (Compendiums for Air, Soil, Food and Indoor fungi) [13]. The macro-morphological properties of the different mycelium clones were obtained by visual appearance of the mycelium units while micro-morphological properties of fungi mycelium clones were obtained via microscopic observations of stained mycelia with cotton blue in lactophenol dye [13]. Photomicrographs of the different mycelium clones obtained were compared and juxtaposed for matching information contained in the available literature for air and soil fungi as described in Samson., *et al* [13].

Collection of Test Organisms

Selected clinical pathogenic bacteria isolates of *Staphylococcus aureus, Streptococcus pyogenes* and *Pseudomonas aeruginosa* were confirmed and obtained at the Ondo State Specialist Hospital, Akure, Ondo State while fungal pathogenic isolates such as *Mucor racemosus, Articulosporum* spp. and *Saccharomyces exiguus* were also confirmed and obtained from the same specialist hospital in June, 2016.

Preservation of Isolates

The identified collected bacterial isolates of were preserved on Nutrient Agar Slants and stored at 4°C as described by Cheesebrough [14], while identified fungal isolates were preserved on Potato Dextrose Agar Slants and stored at 4°C as described by Cheesebrough [14].

Comparative Antimicrobial Potency of African Black soaps and Medicated Soaps

Different concentrations of the African black soap from the three sampling points and medicated soaps obtained were made at 0.2 mg/ml, 0.4 mg/ml and 0.6 mg/ml respectively; modifying the methods described [1-3,6,9]. A standard bactericidal agent (Ofloxacin with Minimum Bactericidal Concentration (MBC) at 450 µg/ml) was used as control for Comparison of antibacterial efficacy of samples [15] while extended broad spectrum antibiotic (CM254XJ500 with Minimum Inhibitory Concentration (MIC) at 500 µg/ml) was used as control for Comparison of the efficacy of samples against fungal isolates; adopting the modifications of Bashua and Oladunmoye [5]. The methods of Clinical and Laboratory Standards Institute (CLSI, 2014) were adopted to compare the efficacy of the commercial antibiotics with the crude plant extracts on clinical and typed bacterial and fungal isolates on already prepared Mueller Hinton agar respectively as described in Obi [9]. Thereafter, a ruler was used to measure the diameter of the clear zones of inhibition noticed on the plates and this was noted as degree of antibiotic resistance [14].

Data Analysis

Analyzed sample treatments were replicated thrice; data means obtained were subjected to a 2-way analysis of variance and treatment means were separated using Duncan's New Multiple Range test at $P \leq 0.05$ levels of significance [1-3,6,9].

Results

The African black soap samples were discovered to be bacteriologically sterile after isolation techniques were carried out; however, characterization of the fungal isolates obtained from the samples across the different farm settlements are represented in table 1. A total of 8 fungal isolates of *Aspergillus niger* (2), *Aspergillus fumigatus* (1), *Candida albicans* (3) and *Aspergillus flavus* (2) were also obtained from the samples analyzed. The means of the zones of inhibition of the different concentrations of the black soap and medicated soap against the selected clinical bacterial pathogens which were subjected to statistical analysis using Duncan's New Multiple Range test at $P \leq 0.05$ level of significance and as well as their sensitivity patterns are represented in table 2. More so, the already analyzed mean zones of inhibition of the different concentrations of the black soap and medicated soap against the selected clinical fungal pathogens which were subjected to statistical analysis using Duncan's New Multiple Range test at $P \leq 0.05$ level of significance and as well as their sensitivity patterns are represented in table 3.

RIC	Identification Characteristics		CFI	Number of Isolates
	Cultural Characteristics	Morphological Characteristics		
1	Fastidious stained white mycelium with brownish black centers that spreads rapidly	Long thin walled hyaline conidiophores with globose radiate heads appear smooth with black bars; conidiophores are branched and lumped with cylindrical phalides	*Aspergillus niger*	2
2	Fastidious white fluffy mycelium with dark green velvety centers	A globose rough edged, non-septate conidia observed with monoserate radiate head; phalides appear short necked attached to pigmented conidiophores vesicles	*Aspergillus fumigatus*	1
3	whitish cream lobate colonies that spreads in a non-systematic matter with no true mycelium	Colonies of loose budding cells that stains hyaline and appear globose with round edges	*Candida albicans*	3
4	fastidious grayish white mycelium with yellowish green centers and pinkish velutinous drabs that have floccose tufts	Long coarse conidiophores with radiate conidial heads that appears apically swollen with cylindrical phalides. Conidial heads are biserate with branched hyaline conidiophores	*Aspergillus flavus*	2

Table 1: Morphological and Cultural Characterization of fungi isolated from the African Black Soap samples.
Keys: RIC: Representative Isolate Clones from different sampling points; CFI: Confirmed Fungal Isolate.

Consequently, sensitivity patterns were denoted by Comparison of analyzed data with accepted standards for Gram positive and Gram negative bacteria respectively as described in Cheesebrough [14]. The Sensitivity patterns of the clinical pathogens to varying concentrations of the African black soaps as well as the medicated soaps in tables 2 and 3 were all denoted as either Susceptible (S) at ≤ 16.00 mm and above, Intermediate (I) at ≤ 11.00 - 15.00 mm or Resistant (R) at ≤ 10.00mm as described by Cheesebrough [14], Bashua and Oladunmoye [5]. The values in table 2 showed that the African Black Soap from Ita-ogbolu has generally more antibacterial efficacy than the two test medicated soaps (I.M.S 1 and I.M.S. 2) at the specified level of significance at concentrations 400 µg/ml and 600 µg/ml respectively. More so, the pathogen *Pseudomonas aeruginosa* was more resistant to the medicated soap and the black soaps respectively at 200µg/ml and 400 µg/ml concentration. Comparatively, we can deduce from table 2 that the locally made black soaps A.B.S. 2 and A.B.S. 3 were marginally more potent bactericidals than Industrial Medicated Soaps (I.M.S. 1 and I.M.S. 2) at 200 µg/ml and 400 µg/ml concentrations at the specified level of significance while the bactericidal potency of locally made black soap A.B.S. 1 was significantly not different to I.M.S. 1 and I.M.S. 2 at 600 µg/ml concentration with respect to the specified level of significance. Hence, the Minimum Bactericidal Concentration (M.B.C) of A.B.S. 2 and A.B.S. 3 are 400 µg/ml while that of A.B.S. 1 is 600 µg/ml; this is significantly not different from the M.B.C of the I.M.S 1 and I.M.S. 2 at the same specified level of significance ($P \leq 0.05$).

Samples Used	Concentrations (µg/ml)	Analyzed Zones of Inhibition for selected bacteria pathogens (mm)			Deduced Sensitivity patterns of pathogens to treatment concentrations		
		S.A	S.P	P.A	S.A	S.P	P.A
A.B.S. 1	200	8.25 ± 1.28^{a}	7.54 ± 1.91^{a}	9.81 ± 1.21^{a}	R	R	R
	400	10.59 ± 1.84^{b}	11.21 ± 1.32^{b}	8.94 ± 1.32^{a}	I	I	R
	600	15.21 ± 1.11^{d}	16.11 ± 1.61^{d}	16.24 ± 1.21^{c}	S	S	S
A.B.S.2	200	9.21 ± 1.51^{a}	10.21 ± 1.33^{b}	6.24 ± 0.94^{a}	R	I	R
	400	12.22 ± 1.81^{b}	13.23 ± 1.52^{c}	11.89 ± 1.91^{b}	I	I	I
	600	16.71 ± 1.14^{d}	17.11 ± 1.56^{d}	16.91 ± 1.11^{c}	S	S	S
A.B.S.3	200	10.22 ± 1.34^{b}	8.91 ± 1.09^{a}	7.46 ± 1.71^{a}	I	R	R
	400	10.99 ± 1.11^{b}	11.84 ± 1.56^{b}	12.56 ± 1.71^{b}	I	I	I
	600	16.79 ± 1.21^{d}	17.24 ± 1.56^{d}	18.21 ± 1.91^{c}	S	S	S
I.M.S. 1	200	8.72 ± 1.24^{a}	9.34 ± 1.28^{a}	6.41 ± 1.21^{a}	R	R	R
	400	12.25 ± 1.11^{c}	13.33 ± 1.33^{b}	11.11 ± 1.21^{b}	I	I	I
	600	17.29 ± 1.15^{d}	17.24 ± 0.98^{d}	17.11 ± 1.66^{c}	S	S	S
I.M.S.2	200	8.22 ± 1.23^{a}	7.46 ± 1.33^{a}	9.24 ± 1.26^{a}	R	R	R
	400	13.44 ± 1.61^{c}	12.23 ± 1.36^{b}	12.05 ± 1.91^{b}	I	I	I
	600	17.03 ± 1.49^{d}	17.21 ± 1.81^{d}	17.21 ± 1.62^{c}	S	S	S
$C.T_B$	450	17.77 ± 1.28^{d}	17.84 ± 1.29^{d}	17.13 ± 1.21^{c}	S	S	S
The black soaps were less potent at 200 µg/ml, marginally potent at 400 µg/ml and quite potent at 600 µg/ml as compared with the medicated soaps at same levels of concentration.							

Table 2: Comparison of antibacterial efficacy of Akure made African Black Soaps with Industrial made medicated soaps and sensitivity patterns.
Keys: A.B.S. 1: African Black Soap Produced at Ijoka; A.B.S. 2: African Black Soap Produced at Isinkan; A.B.S. 3: African Black Soap Produced at Ita Ogbolu; I.M.S. 1: Dettol Soap (Industrial Medicated Soap); I.M.S. 2: Septol (Industrial Medicated Soap 2); C.TB: Control Bactericidal Agent (Ofloxacin 450 µg/ml); S.A: Staphylococcus aureus; S.P: Streptococcus pyogenes; P.A: Pseudomonas aeruginosa; S: Susceptible (≤ 16.00 mm and above), I: Intermediate (at ≤ 11.00 - 15.00 mm), R- Resistant (at ≤ 10.00 mm), values with the same letter as superscript have no significant difference at p≤0.05 level of significance.

Similarly in table 3, the A.B.S. 1, A.B.S. 2 and A.B.S. 3 were all potent marginally at 400 µg/ml concentration on the clinical fungal pathogens used and they are comparatively more efficient fungicidals at 200 µg/ml than I.M.S. 1and I.M.S. 2. All the soaps tested (A.B.S. and I.M.S.) were all marginally potent against *Articulosporum* spp at 400 µg/ml and marginally potent against *Saccharomyces exiguous* at 200 µg/ml. However, A.B.S. 1, A.B.S. 2 and A.B.S. 3 were more significantly more potent than I.M.S. 1 and I.M.S. 2 at 600µg/ml against *Mucor racemosus* at the specified level of significance. Hence, the standard Minimum Inhibitory Concentration (MIC) of the A.B.S. 1, 2, and 3 for the fungal pathogens are 400 µg/ml compared to 600 µg/ml for I.M.S. 1 and 2 respectively at the same level of significance ($P \leq 0.05$).

Samples Used	Concentrations (µg/ml)	Analyzed Zones of Inhibition for selected fungal pathogens (mm)			Deduced Sensitivity patterns of pathogens to treatment concentrations		
		M.R	A.S	S.E	M.R	A.S	S.E
A.B.S. 1	200	6.77 ± 1.24^{a}	7.87 ± 1.52^{a}	10.67 ± 1.21^{a}	R	R	I
	400	11.46 ± 1.72^{b}	12.44 ± 1.56^{b}	14.36 ± 1.24^{a}	I	I	I
	600	16.24 ± 1.55^{c}	17.14 ± 1.28^{c}	16.78 ± 1.68^{b}	S	S	S
A.B.S.2	200	7.24 ± 1.55^{a}	9.54 ± 1.23^{a}	11.34 ± 1.94^{a}	R	R	I
	400	13.33 ± 1.66^{b}	11.90 ± 0.56^{b}	14.85 ± 1.22^{a}	I	I	I
	600	17.22 ± 1.21^{c}	18.64 ± 1.92^{c}	17.89 ± 1.92^{b}	S	S	S
A.B.S.3	200	8.09 ± 1.21^{a}	11.22 ± 1.09^{b}	12.88 ± 1.43^{a}	R	I	I
	400	14.21 ± 1.11^{b}	14.15 ± 0.92^{b}	15.55 ± 1.65^{b}	I	I	S
	600	18.28 ± 1.81^{c}	18.90 ± 1.10^{c}	18.24 ± 1.36^{c}	S	S	S
I.M.S. 1	200	9.71 ± 2.11^{a}	8.99 ± 1.21^{a}	11.24 ± 2.11^{a}	R	R	I
	400	12.29 ± 1.11^{b}	13.12 ± 1.67^{b}	14.44 ± 1.26^{a}	I	I	I
	600	15.57 ± 1.31^{c}	16.76 ± 1.36^{c}	19.04 ± 1.29^{c}	S	S	S
I.M.S.1	200	4.24 ± 1.22^{a}	9.44 ± 1.48^{a}	12.66 ± 1.38^{a}	R	R	I
	400	8.88 ± 1.16^{a}	12.14 ± 1.38^{b}	14.89 ± 1.11^{a}	R	I	I
	600	15.73 ± 1.84^{c}	17.77 ± 1.32^{c}	17.82 ± 1.38^{b}	S	S	S
$C.T_F$	500	18.94 ± 1.05^{d}	19.09 ± 1.81^{d}	19.14 ± 1.44^{c}	S	S	S
The black soaps were marginally potent at 200 µg/ml concentration, they were however more potent at 400 µg/ml and 600 µg/ml as compared with the medicated soaps at same levels of concentration.							

Table 3: Comparison of antifungal efficacy of Akure made African Black Soaps with Industrial made medicated soaps and sensitivity patterns.

Keys: A.B.S. 1: African Black Soap Produced at Ijoka; A.B.S. 2: African Black Soap Produced at Isinkan; A.B.S. 3: African Black Soap Produced at Ita Ogbolu; I.M.S. 1: Dettol Soap (Industrial Medicated Soap); I.M.S. 2: Septol (Industrial Medicated Soap 2); C.TF: Control Standard Broad Spectrum Antibiotic (CM128PR100 at 500 µg/ml). M.R: Mucor racemosus; A.S: Articulosporum spp; S.E: Saccharomyces exiguus; S: Susceptible (≤ 16.00 mm and above), I: Intermediate (at ≤ 11.00 - 15.00 mm), R: Resistant (at ≤ 10.00 mm), values with the same letter as superscript have no significant difference at $p \leq 0.05$ level of significance.

Discussion

The microbes isolated from the various African black soaps are only fungi with no growth of bacteria as indicated in the results. This is because most fungi are terrestrial microbes and are found in plants, grains, animals etc. Since the materials used in the production of African black soaps were mostly dried dead materials from plants origin which encourages the growth of air-borne spore forming filamentous fungi, hence the risk of spore infestation of *Aspergillus flavus, Aspergillus niger* and *Aspergillus fumigatus* are very high. More so, these air-borne fungi may have contaminated the instruments used in production processes since air flow in the black soap production environment is not controlled; this was also implicated in the findings of Aliyu*., et al.* [2,3] and Adebomi., *et al* [1].

However, since the black soaps were potent antimicrobials with high bactericidal potentials, no intrinsic bacteriological contaminant were present; this have also been indicated in the findings of Bashua and Oladunmoye [5], Olajuyigbe [6]. The production process of the African black soap involves heating and the use of some additives such as lime, palm kernel oil and Shea butter which have all been reported to have potent bactericidal properties and hence inhibit the growth of bacteria [15]. The additive components of the Black soaps directly adjust the pH to an alkaline condition which invariably will not support the growth of bacteria [9]. Similarly, the active components of the medicated soaps (Dettol and Septol) are trichlorocarbamide, triclosan and chloroxylenol which have the ability to inhibit bacteria to a larger extent than fungi by denaturing or disrupting cell activity and interfering with microbial metabolism [4]. Hence, this substantiate why all the soaps used (African black soaps and medicated soaps) were bacteriologically sterile.

More so, the selected clinical pathogens (fungi and bacteria) used for the evaluation of the antimicrobial properties (antibacterial and antifungal) of the African black soaps as compared with the medicated soaps were pathogens which had been previously reported to be predominant in skin infections reported at the Ondo State Specialist hospital as at the time of this research. Hence, evaluation of their susceptibility to these test soaps will directly impact the recommended, readily available solution for these pathogens. The fungi *Mucor racemosus, Articulosporum* spp and *Saccharomyces exiguus* have been implicated in cutaneous and sub-cutanous mycotic infections in local respondents of Akure, Ondo State Nigeria in a recent study of Onifade., *et al.* [18], while the bacteria pathogens *Pseudomonas aeruginosa, Staph. aureus* and *Streptococcus pyogenes* have also been implicated in varying degrees of infection in the same metropolis.

The inhibition of the growth patterns of test bacteria against the African Black Soap indicates the varying the antimicrobial effect of the soaps on the test organisms. From the results, it was shown that the test bacteria have higher zones of inhibition in susceptibility to the African Black Soaps than the susceptibility ob-

served for medicated soap. The activities of the black soaps against bacteria have been linked to the metabolic components present in palm kernel oil and Shea butter which are major ingredients of the soap as described in Ugbogu., *et al.* [15], Jonathan., *et al.* [11] and Olajuyigbe., *et al* [6]. Moreover, since the medicated soaps do mostly contain synthetics rather than these natural available bioactive components, they showed mild potency to the test bacteria as compared to the degree of susceptibility exhibited by black soaps [9]. Shea butter contains high level of UV-B absorbing triterpenes esters including cinnamic acid, tocopherols (Vitamin A) and phytosterols; it also contains a high percentage of phytosterols compesterol, stigmasterol, beta and alpha-spino sterol [1]. Shea butter is composed of five principal fatty acids, palmitic, stearic, oleic, linoleic acid and arachidic acid while the major fatty acids in palm kernel oil are lauric acid, myristic acid and oleic acid respectively [5]. All these bioactive components generally contribute to the high susceptibility exhibited by the bacterial pathogens against the black soap [11].

Conversely, the results indicated that the potent antifungal properties of locally made African Black Soaps were averagely marginally acceptable at 400 µg/ml concentration making them potent antifungal agents at a relatively higher concentration compared to that of medicated soap at 600 µg/ml concentrations respectively. Contrastingly, the antibacterial efficacy of all the soaps (Black Soap and Medicated Soap) were marginally acceptable at 400 µg/ml, hence, the Minimum Inhibitory Concentration (MIC) of all the soaps to the bacterial pathogens was significantly different to that of the fungal pathogens at the specified level of significance. This indicated that more concentration of the Black Soap and the Medicated Soap are needed to be absorbed by the test fungi before they can exert their antifungal properties; this also agrees with the findings in Jonathan., *et al.* [11] and Obi [9]. This was partly explained by Ikpoh., *et al.* [4] that fungal pathogenic structure allows them to tolerate environmental stress better than bacteria with respect to their complex structure and functions [1,2,8].

Hence, this study has served as a progression to the foregoing information that more concentrations of the bioactive components of the African Black Soaps are needed to exert antifungal properties as compared to the concentrations needed for these soaps to exert antibacterial properties. Generally, the test bacteria pathogens were more susceptible to the African Black Soaps than the fungal pathogens while invariably the Minimum Bactericidal Concentration (MBC) of the African Black Soaps was averagely 400 µg/ml as compared to the MBC of medicated soaps which stood at 600 µg/ml respectively. Alternatively and interestingly, the MIC of the African Black Soaps and the Medicated Soaps against the bacteria pathogens was 600µg/ml, indicating that the soaps (African Black Soap and Medicated Soap) are potent antifungal agents at the same concentration this agrees with the findings of Adebomi., *et al.* [1] and Olajuyigbe., *et al.* [6] to a great deal. However, the African Black Soap from Ita-ogbolu was observed to have better antimicrobial efficacy than other African Black Soaps used, as it was an efficient antibacterial and antifungal at 200 µg/ml for some pathogens; however, this heightened potency can be attributed to differences in production processes and concentration of bioactive components it contains, as these variations in bioactive components were also reported to have effected similar heightened antimicrobial potential of black soaps produced in different locations as contained in the study of Ugbogu., *et al.* [15] and Bashua and Oladunmoye [5].

Conclusion

The antimicrobial activities exhibited by black soap could be attributed to the presence of its unique bioactive constituents such as fatty acids, high level of UV-B absorbing triterpenes esters, Vitamins, phytosterols, compesterol, stigmasterol, beta and alpha-spino sterol which signifies the potential of the soap as a topical therapeutic agent. The findings of this study has also proved that African Black soap has many health benefits such as anti-aging properties and can reduce fine lines and wrinkles for youthful, smooth skin. The findings also proved the potent antimicrobial efficacy of locally made African Black Soaps over Industrial Medicated Soaps and that it could also prevent the skin from rashes, ring worm, measles, and eczema and as well strengthen the skin and hair. These findings therefore, justify the traditional medicinal use of black soap as potent antiseptic over medicated soaps.

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