Antifungal potentials of indigenous black soap commonly used in Ibadan, Nigeria

[a]Jonathan SG[1], Efunshile AM[2],[b]Olawuyi OJ[1],[a]Babalola BJ[1], Efuntoye MO[3] and [a]Dixon DO[1]

[a]Mycology&Biotechnology Unit , [b],Genetics & Molecular Biology Unit, [1]Department of Botany & Microbiology, University of Ibadan, Ibadan. Nigeria.[2]Department of Medical Microbiology, Ebonyi State University.Abakaliki, Nigeria3Department of Microbiology, Olabisi Onabanjo University, Ago Iwoye.Nigeria
gbolagadejonathan@gmail.com

Abstract: Antifungal potentials of indigenous black soap from Ibadan,South western Nigeria were investigated. Seven fungal species (*Trichophyton rubrum, T. mentagrophytes, T. proliferans, Microsporium canis, Trichophyton* .sp., *Aspergillus sp.* and *Candida albicans*) which are responsible for different kind of infections were tested against black soap samples collected from different locations within Ibadan city . All the test mycoorganisms were found to be susceptible to the black soap samples with varying degree of zones of inhibition (ZOI). *Candida albicans* was the most susceptible fungus in all tested samples. It produced 25mm ZOI at 100% concentration closely followed by the same sample at 75% (23mm). *Trichophyton mentagrophytes* was the highly susceptible to sample B at 100% concentration having 22mm ZOI. *Trichophyton proliferans* was susceptible to sample B. *M.canis* was sensitive to sample E at100% concentration closely followed by sample C and D at the same concentration. At 75% concentration, sample D also produced moderate inhibitory effect on *M.canis* (15mm). Generally, *C. albicans* was the most susceptible fungi to all the indigenous black soap samples used in these studies while *Aspergillus* sp. was least susceptible. However, *Aspergillus* sp was susceptible to sample D and E at 100% concentration (15mm)
[Jonathan SG, Efunshile AM,Olawuyi OJ,Babalola BJ, Efuntoye MO and Dixon DO **Antifungal potentials of indigenous black soap commonly used in Ibadan south-western Nigeria.** *Academia Arena* 2013;5(7):50-55] (ISSN 1553-992X). http://www.sciencepub.net/academia. 7

Keywords:. Indigenous black soap, inhibition, Nigeria, pathogenic fungi, susceptibility,

1.INTRODUCTION

Indigenous black soap has been used by West African natives from the time immemorial. This dark brown,soft and cleansing substance is known as '*sabulun salo'* in *Hausa,'anago'* , '*alata samina*' in Ghana and '*eko zhiko'* in Nupe (Getradeghana, 2000; David,2005;Aliyu *et al.*2012) .It is also referred to as *ôsêdúdú or 'abuwe'* among the Yoruba speaking people of south western Nigeria (Bella,2011).

.In south west Nigeria,indegenous black soap may be made from either roasted plantain skins or dried waste cocoa and vegetable oil or palm oil pods and oil palm or palm nut oil.(Ikpoh *et al.*,2012).In the northern part of Nigeria, it is produced from a mixture of vegetable oil palm kernel oil and shea butter(Getradeghana, 2000; Aliyu *et al.*2012.)Black soap is preferred for bathing due to its natural source of vitamins A and E (Getradeghana, 2000) .Because of its phenolic contents, it is generally used to cures skin rashes among the traditionalists (Mike,2008; Ekwenye and Ijeomah 2005). African black soap is centuries old, has numerous benefits is naturally scented with attractive odour. It is used to improve the skin quality.

Bathing is one of the most important ways of practicing proper hygiene and this is done with the aid of soap. Hygienic conditions are therefore necessary for maintaining good health in homes, communities, business centers and in health care settings (kampf and Kramer 2004). Using quality soaps with antiseptic properties helps to reduce the effect of disease causing micro-organisms on the skin. For years,back soap has also been used to achieve beautiful and healthy skin. African women have also used this natural soap for bathing and washing their hair (Ikpo *et al*,2012). There is a general believe among the Yoruba people that black soap will always enhance soft and disease free skin .

Indigenous African black soap is scented with distinct aroma which could be employed by local people to remove body odour . Black soap is a multi-purpose cleanser which can be used by children as well as adults. Charcoal or ash from dried cocoa pods in the soap may help to inhibit bacteria and microorganisms, providing more thorough cleansing and skin protective values(Ugbogu,2006).Black soap can help reduce acne outbreaks by reducing oiliness and killing bacteria which cause acne. Some proponents say using black soap reduces the appearance of acne scars.
used in black soap have been used as a traditional folk treatment for skin irritation (Getradeghana,2000). Some black soap formulas contain honey, also known for its healing properties. Black soap can be used by people with sensitive skin, normal, dry or oily skin. It can help with dandruff when used as a shampoo and has antiseptic and anti-fungal properties while

moisturizing and protecting the skin(Getradeghana,2000).

One of the constituent of the African black soap is ash and this provides gentle exfoliation. This gentle exfoliation may help reduce the appearance of fine lines and discolorations and reduce razor bumps (Getradeghana, 2000). Black soap is milder and gentle on the skin. It is richly endowed with glycerin which is a good moisturizer, most of the synthetic antiseptic soaps possesses detergents, isoprophylalcohol, BHT and some other chemicals which causes skin irritation on dry and sensitive skin types.(Omobuwajo *et al*.2007).This irritant strips the skin of its natural hydrating oils hence making the skin feel tight, itchy and flaky. Individuals that make use of these synthetic antimicrobial soaps run the risk of infertility due hormonal imbalance instilled by some of the chemicals present in these soaps Omobuwajo *et al.* 2007). Also the use of the locally produced black soap is cost effective, readily obtained and easy to use.
Microorganisms found on the human skin are of two distinct populations: resident and transient (*Steven et al*,.2003;Jawetz *et al.*,2010). Resident microorganisms such as *Candida albicans*, *Malassezia* sp. are considered as floral inhabitant of the skin. (Garner and Favero, 1985).Transient microorganisms are found on and within the epidermal layer of the skin, as well as other areas of the body where they do not normally reside. Almost all disease producing microorganisms belong to this category. (Oluranti *et al.*,2012).Pathogen that may be present on the skin as transient types includes *Esherichia coli*, Dermatophytes such as *Microsporium ,Trichophyton,Salmonella* sp.,hepatitis A virus

Fungal infections of the skin are also known as 'mycoses'. They are common and generally mild. However, in immuno suppressed individual, fungi can sometimes cause serious disease(*Jonathan et al.*,2012a).A variety of environmental and physiological conditions have also been reported to contribute to the development of fungal diseases(Jonathan *et al*.,2011). However, the main objective of this research study was to carry out in-vitro investigations in verifying the claim of some Yoruba traditionalists in using black soap for curing skin infections caused by fungi

2.Materials and methods

2.1 Collection of samples

Black soap samples were collected from retailers in five different markets (Ojoo, Agbowo, Alesinloye, Bodija and Sango) within Ibadan city and wrapped in sterile aluminium foil and were brought to the laboratory for investigation.

2.2.Test mycoorganisms

The pathogenic fungi used in this study were *Trichophyton rubrum, Trichophyton mentagrophytes, Trichophyton proliferans, Trichophyton* sp.,*microsporium canis, and Candida albicans* which were collected from the Mycology unit of Medical Microbiology Department Lagos University Teaching Hospital (LUTH) Idi-Araba Lagos state and *Aspergillus* sp. was obtained from the Mycology Laboratory, Department of Botany and Microbiology, University of Ibadan.

2.3Sterilization and aseptic conditions

The glass wares such as Petri-dishes, pipettes, Erlenmeyer's flasks, beakers were sterilized in a dry air oven at 160 °C for 3 hr. Other materials such as cork borer were sterilized by flaming using spirit lamb. The work benches were surface sterilized by wiping with 70% ethanol. A spirit lamp was also during all bench work periods.

2.4Media preparation and Culture techniques

The media used for this study was saboroud dextrose agar (SDA) for the dermatophyte species, Potato Dextrose Agar (PDA) for *Aspergillus* sp. and yeast extract agar (YEA) for *Candida albicans*. These were prepared according to manufacturer's prescriptions. They were all transferred from slants bottles and sub-cultured unto appropriate fresh media plates . The plates were incubated at 30 °C for a period of five days.

2.5Inoculum preparation

The surface of the Petri-plates containing the filamentous fungus and the dermatophtyes were flooded with ten (10) ml of sterile distilled water. 0.5 ml containing approximately 2.4 X 10^6 cells/ml were then used as the inoculum.

For the *Candida albicans*, loop full of each fungus was transferred into sterile 20 ml of yeast extract medium in a 50 ml Erlenmeyer's flask. Incubation was at 35 ^{0}C for 48 hours. A loop full was then streak onto the YEA.

2.6Antifungal activity of black soap

The agar well diffusion technique was used in the investigation of the antifungal potentials of the various black soaps against the test organisms. 0.5 ml of the inoculum was transferred aseptically using a sterile pipette into the Petri-plates and the suitable molten agar for each fungus was poured into the plates and swirled gently for even distribution. This was then allowed to solidify. Six holes were made into the already solidified agar medium using a sterile cork borer of 5 mm diameter. Each well was then filled with the black soap dilution and allowed to stand for

30 minutes on the bench to allow for proper diffusion of the soap suspension into the medium. Plates were then incubated at 30 °C for 72 hours (For the filamentous fungi) and at 35 °C for 24-48 hours (for the yeast). The relative antifungal activity of the black soap was taken as the susceptibility of the test organisms to the black soap as indicated by the clear zone of growth of inhibition around the wells. The zone of inhibition was recorded in millimetres (mm).

2.7Data Analysis

Data collected was analyzed using ANOVA. Means were separated using Duncan Multiple Range Test (Duncan, 1955).

3. Results and Discussion

3.1Antifungal potential of black soap samples at various concentration: From this study, the black soap samples were able to inhibit the growth of the test fungi used in this study. The mycelia growth of the test fungi except (*Trichophyton sp*.) were significantly ($p<0.05$) inhibited as indicated by clear zones of inhibition . At 100% concentration, the soap samples obtained from Sango (sample A) showed no significant ($p<0.05$) mycelia growth inhibition of *Trichophyton sp*.(0.00mm) while *T. rubrum, T. mentagrophytes, T. proliferans and M. canis* were partially inhibited. Sample A was however observed to have the most significant effects on *Candida albicans* (6.00mm) and *Aspergillus sp.* (4.0). Sample B however exerted higher significant ($p<0.05$) effect on all the pathogenic fungi than the sample A with *T. mentagrophytes* (28.0mm) as the most significant ($p<0.05$) black soap ;while *Trichophyton sp.* (9.0mm) was least inhibited. There were no significant ($p<0.05$) difference in the treatments of the pathogenic fungi by the black soap sample C and E, although both recorded a more significant ($p<0.05$) control when compared to sample A. However, sample D exhibited the highest inhibitory effect on *Candida albicans* (25.0mm) and least effect on *T. prolierans* (14.5mm). Generally, at 100% soap concentration, sample B appeared to be the most significant soap ($p<0.05$) in against *T. mentagrophytes*.However, sample D was best effective against *Trichophyton sp*. and *Candida albicans*, while *T. rubrum*, *T. proliferans* and *M. canis* were significantly ($p<0.05$) inhibited by sample E.Both sample D and E had higher significant ($p<0.05$) activities against *Aspergillus sp*. than other soap samples

Table 3.1: Antifungal potential of different black soap samples obtained from different markets at 100% concentration (1 gram of soap in 100mls of pure distilled water)

Organisms	Soap Samples and location/Zone of Inhibition (mm)				
	A (Sango)	B(Aleshinloye)	C(Agbowo)	D(Ojoo)	E(Bodija)
Trichophyton sp.	0.00^{c}	9.0^{c}	13.5^{a}	18.0^{ab}	14.0^{a}
T. rubrum	0.10^{c}	15.0^{bc}	18.5^{a}	16.5^{ab}	20.0^{a}
T. mentagrophytes	0.20^{c}	28.0^{a}	17.5^{a}	22.0^{ab}	16.0^{a}
T. proliferans	0.28^{c}	17.0^{b}	11.5^{a}	14.5^{b}	20.0^{a}
Microsporium canis	1.5^{c}	12.0^{bc}	16.0^{a}	15.0^{b}	17.5^{a}
Candida albicans	6.00^{a}	16.0^{bc}	17.0^{a}	25.0^{a}	20.5^{a}
Aspergillus sp.	4.0^{b}	10.0^{bc}	13.0^{a}	15.0^{b}	15.0^{a}
SEM	1.09	3.87	3.64	5.08	7.11

Data are means of three replicates. Values followed by the same letters are not significantly different by Duncan's multiple range test ($P \leq 0.01$).

In-vitro antifungal tests performed using 75% concentration of the soap samples showed less significant ($p<0.05$) inhibitory effect when compared to the activities of the black soap at 100% concentration. This is evident in sample A where the mycelia reductions of *Trichophyton sp.* (0.00), *T. rubrum* (0.08), *T. mentagrophytes* (0.10), *T. proliferans* (0.18), *M. canis* (0.92) and *Aspergillus sp.* (1.0mm) showed no significant ($p<0.05$) difference in the soap treatment. Both sample B and C treatment showed ($p<0.05$) significant control of *Trichophyton sp*., *T. rubrum*, *M. canis* and *C. albicans* while sample D exerted the highest significant ($p<0.05$) inhibition on *C. albicans* (23.0mm), whereas, no significant ($p<0.05$) difference was observed among the pathogenic fungi treated by sample E (Table 3.2).

The results of the antifungal potentials of black soap obtained from different sources conducted at 50% concentration against pathogenic fungi showed the reducing inhibitory effects. The soap samples demonstrated varying level of inhibitory effects on the fungi tested .Sample B showed the most significant ($p<0.05$) inhibition of *T. mentagrophytes* (12.0mm).Sample C inhibited *T. rubrum* (10.5mm) moderately while sample D had some notable effect on *Trichophyton sp.* (10.2mm) and *Candida albicans*

(17.0mm). Sample E was however found to be most effective in the inhibition of *T. proliferatum*, *Microsporium canis* and *Aspergillus sp*. (Table 3.3)

Table 3.2: Antifungal potential of different black soap samples obtained from different markets at 75% concentration (75mls of the above concentration in 25mls pure distilled water)

Organisms	Soap Samples and location/Zone of Inhibition (mm)				
	A (Sango)	B(Aleshinloye)	C(Agbowo)	D(Ojoo)	E(Bodija)
Trichophyton sp.	0.00^{b}	6.0^{bc}	7.5^{bc}	16.0^{bc}	10.0^{a}
T. rubrum	0.08^{b}	10.0^{bc}	14.5^{a}	13.5^{bcd}	15.0^{a}
T. mentagrophytes	0.10^{b}	22.0^{a}	10.2^{bc}	18.0^{b}	14.0^{a}
T. proliferans	0.18^{b}	13.0^{bc}	8.5^{bc}	11.5^{cd}	17.0^{a}
Microsporium canis	0.92^{b}	7.0^{bc}	11.0^{b}	12.0^{cd}	15.5^{a}
Candida albicans	4.00^{a}	14.0^{b}	15.0^{a}	23.0^{a}	16.5^{a}
Aspergillus sp.	1.0^{b}	5.0^{c}	7.0^{d}	10.0^{c}	13.0^{a}
SEM	0.83	4.53	1.99	2.69	4.15

Data are means of three replicates. Values followed by the same letters are not significantly different by Duncan's multiple range test ($P \leq 0.01$).

Table 3.3: Antifungal potential of different black soap samples obtained from different markets at 50% concentration (50mls of the above concentration in 50mls pure distilled water)

Organisms	Soap Samples and location/Zone of Inhibition (mm)				
	A (Sango)	B(Aleshinloye)	C(Agbowo)	D(Ojoo)	E(Bodija)
Trichophyton sp.	0.00^{d}	1.0^{e}	5.5^{d}	10.2^{b}	4.4^{c}
T. rubrum	0.03^{cd}	6.0^{c}	10.5^{a}	9.3^{b}	9.0^{b}
T. mentagrophytes	0.06^{cd}	12.0^{a}	8.2^{b}	10.0^{b}	10.0^{ab}
T. proliferans	0.10^{c}	10.0^{b}	3.0^{e}	5.8^{c}	12.0^{a}
Microsporium canis	0.62^{b}	4.0^{d}	6.5^{c}	5.0^{c}	10.5^{ab}
Candida albicans	1.00^{a}	9.0^{b}	10.5^{a}	17.0^{a}	8.5^{b}
Aspergillus sp.	0.00^{d}	1.0^{e}	3.5^{e}	5.4^{c}	6.0^{c}
SEM	0.04	1.07	0.57	1.98	1.17

Data are means of three replicates. Values followed by the same letters are not significantly different by Duncan's multiple range test ($P \leq 0.01$).

African black soaps has been reported to be rich in naturally occurring vitamin A, E and iron and has been found effective as cleansers, anti-aging, and also in skin and hair treatments (Kelly, 2011). The African black soap is thus a welcomed body treatment especially in the developing countries where herbal medicine are still relied on to meet their health needs, the use of which has also been encouraged and guided by the World Health Organization has been reported by Ukueze and Abariku (1998).

In is study, the antifungal properties claim of black soap were found to be genuine as the samples collected Ibadan were found to generally inhibited the growth of all the test fungi. This result was in agreement with the earlier observation of Ajose (2007) who reported the antiseptic properties of black soap against the fungal skin infections. The potentials of some commercially available black soap tested in-vitro reveals their efficacy against some common dermatophytes; *T. rubrum, T. mentagrophytes, T. proliferans, M. canis, C. albicans* and *Aspergillus sp.* at different concentration levels. This finding also agree with the report of Kilani *et al.* (2007) that antifungal activity of herbal decoction was effective against *Candida albicans*, *Trichophyton rubrum* and *Microsporium sp*.All the test organisms were susceptible to black soap samples used in this study. The control effect of this African soap could be attributed to the presence of some antimicrobial phytochemicals such as; alkaloids, tannins, flaronoids, cyanogenic glycoside and saponins , which may in turn account for the antifungal efficacy(Oluranti *et al*.,2012;Jonathan *et al*.,2012b). This results as obtained in this investigation was also in agreement with the report of Omobuwajo *et al.* (2007) on the efficacy of *Cassia senna* formulated black soap against some pathogenic microoranisms on human skin.The observation

obtained in this studies affairmed the report of Oladele *et al*., (2010) who incorporated into the black soaps the powdered leaves of *Senna alata* and *Ageratum conyzoides* which are known for the treatment of skin had significant control diseases.These workers had significant control of pathogenic fungi responsible for skin diseases .

4.0.Conclusion

The pathogenic fungi used in this study were significantly susceptible against various concentrations of the soap decoction while the varying degree in the anti-fungal potentials of the samples of the black soap obtained from various locations could be attributed to the variations in the preparation of the black soaps, since various samples were prepared differently using various materials. This study revealed that that black soap possessed in-vitro antifungal properties.

Correspondence to:
Dr Segun Gbolagade Jonathan
Department of Botany & Microbiology,
University of Ibadan,Ibadan.Nigeria.
Email: gbolagadejonathan@gmail.com

REFERENCES

1. Ajose, F.O. (2007). Some Nigerian plants of dermatologic importance. *Int J Dermatol*, 46, Suppl 1:48-55.

2. Aliyu MS, Tijjani MB, Doko MHI, Garba I, Ibrahim MM, Abdulkadir SM,Abba D and Zango UU(2012). Antimicrobial Activity of Sabulun Salo a Local traditional medicated Soap. Nigerian Journal of Basic and Applied Science 20(1): 35-38

3. Bella, O. (2011): African Black Soap http//www.bellaonline.com/article/art26546.asp

4. David, O. (2005): Brief History of black soap and Ingredients (plantain skin),http//www.oakfordavid.com

5. Ekwenye, U.N. and Ijeomah, C.A. (2005).Antimicrobial effect of palm kernel oil. KMTL*Science Journal* **6:** 22-26.

6. Garner J.S and Favero M.S (1985).Guideline of Hand Washing and Hospital Environmental Control, NTIS United States, Department of Commerce, Springfield, pp 110-115

7. Getradeghana, B.T. (2000). Evaluation of African traditional soap. *Global Journal of Pure and Applied Science* **6**:174-179

8. Ikpoh IS, Lennox, JA., Agbo BE,Udoekong N S,Ekpo IA and Iyam, SO(2012). Comparative studies on the effect of locally made black soap and conventional medicated soaps on isolated human skin microflora. J. Microbiol. Biotech. Res.,, 2 (4):533-537

9. Jawetz AM, Melnicks KA, and Adelberg RJ, (2010). Normal human microbiota in: medical microbiology. (25thed.) McGraw- Hill companies inc. USA pp. 159-164.

10. Jonathan S.G,Ajayi I and Omitade Y(2011).Nutritional compositions, fungi and aflatoxins detection in stored 'gbodo' fermented (*Dioscorea rotundata*) and 'elubo ogede' fermented (*Musa parasidiaca*) from south western Nigeria. *African Journal of Food Science* 5(2):105-110

11. Jonathan SG,Olawuyi OJ and Oluranti OO (2012a). Studies on Immunomodulatory and prophylactic properties of some wild Nigerian mushrooms: *Academia Arena* :4(9):39-45

12. Jonathan SG, Olawuyi OJ , Aina DA , Dada HG and Oyelakin AO(2012b). A Influence of storage time on bio deterioration, aflatoxin contamination and food values of onion (*Allium cepa*) *Nature and Science* 10(11):26-33

13. Kelly k. (2011) Benefits of African black soap.LIVESTRONG.COM,copyright 2012 Demand Media,inc.last accessed:August 2011.

14. Kilani, A. M. Oyelade, O. and Adeleke, O. E. (2007). Antimicrobial Activity of a Decoction used by Southwestern Nigeria Traditional Healers on Selected Dermatophytes. African Journal of Biotechnology Vol. 6 (22), pp. 2529-2431

15. Mike, L. (2008). Phenolic constituents of Shea (*Vitellaria paradoxa*) Kernels. *Journal of Agriculture and Food Chemistry* **51**: 6268-6273

16. Oladele, A. T., Dairo, B. A., Elujoba, A. A., & Oyelami A. O. (2010). Management of superficial fungal infections with *Senna alata* ("alata") soap: A preliminary report. *African*

Journal of Pharmacy and Pharmacology, 4(3),098-103

17. Oluranti OO,Olawuyi O.J and Jonathan S.G(2012). Therapeutic properties of some Nigerian higher fungi. *Nature and Science* 10(10):135-143

18. Omobuwajo O.R. Abdu, A. Igbeneghu, O. A. Agboola, I.O. and G.O. Alade. (2011). Preliminary Investigation of an Herbal Soap Incorporating *Cassia senna* (L) Roxby Leaves and *Ageratum conyzoides* Linn. Whole Plant Powders. Continental J. Pharmaceutical Sciences 5: 1 – 10

19. Ugbogu, O.C. (2006). Lauric acid content and inhibitory effect of palm kernel oil on twobacterial isolates and *C. Albicans. African Journal of Biotechnology* 5(11):1045-1047.

20. Ukueze N. O and Abariku P. O (1998). Antimicrobial Activity of Certain Medicinal Plants used in Traditional Medicine in Nigeria-A preliminary study. J. Microbiology 6: 32-40

7/14/2013