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Comparative Antiseptic Effects of Some Locally Used Plant Products on Isolated Skin Microorganisms

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Abstract

This research was undertaken to test the efficacy of three locally used plant products (shear butter, palm kernel oil and black soap) and their synergistic combinations against selected skin microbes. One hundred and twenty (120) swab sticks were used to collect skin associated organisms from body parts (leg, knee, head, chest, face, back, armpit and areas affected by heat rashes) among volunteers with Makurdi metropolis, Nigeria. Microbial culture, identification and sensitivity tests followed standard microbiological practices. Identified genera were: Pseudomonas, Staphylococcus, Bacillus, Escherichia, Mucor, Aspergillus, Penicillium, Saccharomyces, Candida and Epidermophyton conidia. Inhibitory effect of the locally used products was compared with known orthodox medicated soaps (OMS) as control. As a result, most of the microbes resisted shear butter (SB only) except Candida and Saccharomyces. Palm kernel oil (PKO only) was effective against all microbes except Bacillus. All isolates were sensitive to Black soap (BS only). SB+PKO were 80% effective whereas SB+BS were 90% effective while BS+PKO were 100% effective against all microbes. Only one of the three OMS was 100% effective on skin isolates. Black soap has proven more effective than the two popularly used medicated soaps against skin microflora. Palm kernel oil was also highly effective but 100% efficacy was observed when it mixed with black soap. It was due to their synergistic effect. Shear butter was the least effective but its antiseptic action may be enhanced when mixed with black soap. The information provided is useful in the discovery of cheap and effective natural products in the prevention and treatment of dermatophytic infections in Nigeria.

Keywords: Plant products, Skin, Microorganisms, Antisepsis, Synergy

Introduction

From time past, human has continued to depend on plant products to treat ailments (Aguoru et al., 2015a, 2015b, 2015c; Getradeghana, 2000). As a result of civilization, these plant products previously used in crude forms had suffered neglect not because of ineffectiveness but also due to human's preference for social acceptance for western orthodox products (Aguoru et al., 2014, 2015d). Microbial resistance to these orthodox products in treating skin diseases, for example, has been a challenge. Apart from this, most orthodox soaps and ointments are expensive to come by as many are imported into Nigeria. Many users also suffer some degree of allergic reactions (Tarum et al., 2014) apart from known destructive effects of some products in the skin caused by chemical additives. Therefore, many people have recommended the use of locally made plant products as a better substitute for orthodox products in terms of efficiency, cost effectiveness, availability and skin protection (Balogun and Owoseeni, 2013). Dermatological benefits of crude shear butter (obtained from Vitellaria paradoxa), palm kernel oil (obtained from Elaeis guineensis) and black soap (made from cocoa pods (Theobroma cacao) have been reported (Balogun and Owoseeni, 2013; Getradeghana, 2000; Ikotun et al., 2017a).

Despite the above attributes, most people in the urban areas, especially students and corporate workers preferred orthodox types because of fragrance, attractiveness and antisepsis (Tarum et al., 2014). According to Getradeghana (2000), locally made skin products are produced and more acceptable by the rural dwellers. Though these products are available in the urban areas, they are seldom patronized. Skin related infections such as eczema, leprosy, scabies, and leishmaniasis are a major public health challenge in developing countries (World Health Organisation, 2018). They are mostly caused by bacteria and fungi exacerbated by lack of proper hygiene. This research was undertaken to test the efficacy of three locally used plant products (shear butter, palm kernel oil, black soap and their combinations) against skin isolates, and compare the results with those obtained using orthodox medicated soaps.

Materials and Methods

One hundred and twenty swab sticks were used to collect skin associated organisms from body parts (leg, knee, head, chest, face, back, armpit and areas affected by heat rashes) among volunteers with Makurdi metropolis, Nigeria. Inoculation was done first on general purpose media. Pure culturing took place on selective media types (Nutrient agar, Sabourad dextrose agar, Maltes extract agar and Potato dextrose agar) following standard practices. Microbial culture, identification and sensitivity tests followed standard microbiological practices. Identification of isolates was done by cultural and biochemical methods. Freshly prepared black soap, palm kernel oil and shear butter as well as three medicated soaps were purchased from North bank market, Makurdi. Inhibitory antiseptic effects of locally used products carried out. Results were compared with antiseptic effects of known orthodox medicated soaps (OMS) as control. Seven plant treatments were tested: Shear butter (SB), Palm kernel oil (PKO), Black soap (BS), Shear butter (SB) + Palm kernel oil (PKO, Shear butter (SB) + Black soap (BS) and Black soap (BS) + Palm kernel oil (PKO). Three orthodox soaps tested were: OMS1, OMS2 and OMS3.

Results and Discussion

Identified skin microorganisms were*: Pseudomonas, Staphylococcus, Bacillus, Escherichia, Mucor, Aspergillus, Penicillium, Saccharomyces, Candida* and *Epidermophyton conidia* (**Table 1**). Effect of single treatment application is given in (**Table 2**). Most of the microbes resisted shear butter (SB only) except Candida and Saccharomyces. Palm kernel oil (PKO only) was effective against all microbes except Bacillus. All isolates were sensitive to Black soap (BS only).

Nutrient agar (NA)	Sarboraud-dextrose agar	Malt extract	Potato-dextrose agar
Pseudomonas spp.	*Mucor* spp.	*Penicillium* spp.	*Penicillium* spp.
Staphylococcus aureus	*Aspergillus* spp.	*Epidermophyton* conidia	*Epidermophyton*
Escherichia coli	*Penicillium* spp.	*Aspergillus* spp.	Conidia
Bacillus spp.	*Saccharomyces* spp.		*Aspergillus* spp.
	Candida albicans		*Mucor* spp.
	Epidermophyton conidia		*Candida albicans*

Table 1: Isolated skin microflora.

Skin isolates	Shear butter (SB)	Palm kernel oil (PKO)	Black soap (BS)
Pseudomonas spp.	Resistant	*Sensitive	*Sensitive
Staphylococcus aureus	Resistant	*Sensitive	*Sensitive
Bacillus spp.	Resistant	Resistant	*Sensitive
Escherichia coli	Resistant	*Sensitive	*Sensitive
Mucor spp.	Resistant	*Sensitive	*Sensitive
Aspergillus spp.	Resistant	*Sensitive	*Sensitive
Epidermophyton	Resistant	*Sensitive	*Sensitive
Penicillium spp.	Resistant	*Sensitive	*Sensitive
Candida albicans	*Sensitive	*Sensitive	*Sensitive
Saccharomyces spp.	*Sensitive	*Sensitive	*Sensitive

Table 2: Effects of SB, PKO and BS on skin isolates.

Skin isolates	Shear butter (SB) +Palm kernel oil (PKO)	Shear butter (SB) + Black soap (BS)	Black soap (BS) +Palmkernel oil (PKO)/Zone of inhibition (mm)
Pseudomonas spp.	*Sensitive/2.8	*Sensitive/3.0	*Sensitive/3.0
Staphylococcus aureus	Resistant/1.9	*Sensitive/2.8	*Sensitive/3.0
Bacillus spp.	Resistant/1.9	Resistant/1.8	*Sensitive/3.0
Escherichia coli	*Sensitive/2.8	*Sensitive/2.8	*Sensitive/2.9
Mucor spp.	*Sensitive/2.8	*Sensitive/2.8	*Sensitive/2.8
Aspergillus spp.	*Sensitive/3.0	*Sensitive/2.7	*Sensitive/2.9
Epidermophyton	*Sensitive/3.0	*Sensitive/3.0	*Sensitive/2.8
Penicillium spp.	*Sensitive/3.0	*Sensitive/2.9	*Sensitive/2.9
Candida albicans	*Sensitive/2.8	*Sensitive/2.7	*Sensitive/3.0
Saccharomyces spp.	*Sensitive/2.8	*Sensitive/2.8	*Sensitive/3.0

Table 3: Synergistic effects of plant extracts on skin isolates.

Skin isolates	OMS1 Zone of inhibition (mm)	OMS2 Zone of inhibition (mm)	OMS3 Zone of inhibition (mm)
Pseudomonas spp.	*Sensitive/3.0	*Sensitive/3.0	*Sensitive/2.8
Staphylococcus aureus	*Sensitive/3.0	*Sensitive/2.9	*Sensitive/2.6
Bacillus spp.	*Sensitive/2.8	Resistant/1.3	Resistant/1.3
Escherichia coli	*Sensitive/2.9	*Sensitive/3.0	*Sensitive/2.7
Mucor spp.	*Sensitive/2.9	*Sensitive/3.0	*Sensitive/3.0
Aspergillus spp.	*Sensitive/3.0	*Sensitive/2.8	*Sensitive/2.8
Epidermophyton	*Sensitive/3.0	*Sensitive/2.8	*Sensitive/3.0
Penicillium spp.	*Sensitive/2.8	*Sensitive/3.0	*Sensitive/2.6
Candida albicans	*Sensitive/3.0	*Sensitive/3.0	*Sensitive/2.9
Saccharomyces spp.	*Sensitive/3.0	*Sensitive/2.7	*Sensitive/2.6

Table 4: Antiseptic effects of OMS on skin isolates. OMS= Orthodox Medicated Soap.

Products	% sensitivity in all organisms
SB	20
PKO	90
BS	100
SB+PKO	80
SB+BS	90
BS+PKO	100
OMS1	100
OMS2	90
OMS3	90

Table 5: Comparative antiseptic effects of all treatments on skin isolates. Shear butter (SB); Palm kernel oil (PKO); Black soap (BS) OMS= orthodox medicated soap.

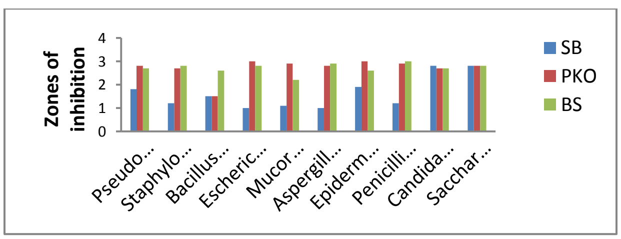

Figure 1: Comparative zones of inhibition of SB, PKO and BS.

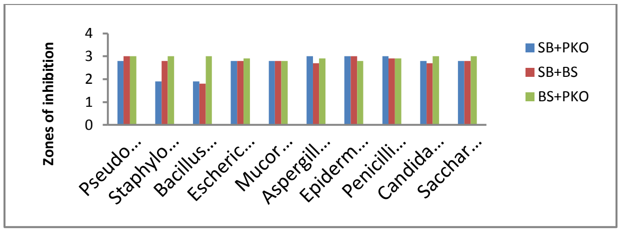

Figure 2: Comparative zones of inhibition of SB+ PKO; SB+ BS and BS+PKO.

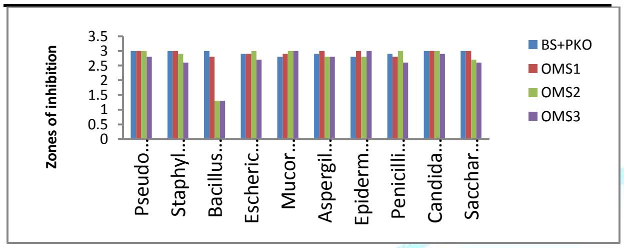

Figure 3: Comparative zones of inhibition of BS+PKO and three medicated soaps.

(**Table 3**) presents the synergistic effects of plant extracts on skin isolates. SB+PKO were 80% effective whereas SB +BS were 90% effective. BS+PKO were 100% effective against all microbes. Only one of the three OMS (OMS 1) was 100% effective on skin isolates as given in (**Table 4**). As shown in Table 5, Black soap has proven more effective than the two popularly used medicated soaps to fight against skin microflora. Palm kernel oil was also highly effective but 100% efficacy was observed when mixed with black soap due to their synergistic effect. Shear butter was the least effective (20% sensitivity) but it clearly inhibited Candida and Saccharomyces **(Figure 1).** Its antiseptic action may be enhanced to 80% when mixed with PKO or 90% when mixed with black soap, although shear butter synergy had less significance on Bacillus subtilis **(Figure 2).** BS+PKO were confirmed equal to or better than some OMS tested against only five of the isolates namely: Pseudomonas spp., S. aureus, Bacillus spp., C. albicans and Saccharomyces spp. **(Figure 3).**

Present report is consistent with previous investigations on the use of natural plant products to kill skin microbes (Balogun and Owoseeni, 2013; Ikotun et al., 2017a; Ugbogu, 2006). Ikotun et al. (2017a) reported the significance of naturally occurring additives against skin microbes including S. aureus, B. aureus, P. aeruginosa and Escherichia coli. Phytochemical studies have shown that these plant products are rich in saponin, flavonoid and terpenoid which are considered highly antimicrobial (Ikotun et al., 2017a). The structural chemistry of the African black soap made from palm kernel oil (Elaeis guineensis) and cocoa pods (Theobroma cacao) have been studied (Ikotun et al., 2017b). The outcome revealed quality physicochemical parameters of desirable of excellent soap and the presence of transition metal complexes. The African black soap is a natural source of vitamin A, vitamin E and iron (Grieve, 1997). It also contains fatty acids like beta carotene, lauric, caprylic, oleic and linoleic acids. The vitamin A and E content balance the skin pH levels (Ugbogu, 2006). Palm kernel oil has long shelf life and zero cholesterol. It is loaded with antioxidant, unsaturated fats, vitamin K. It has been reported to: prevent aging, increase hair growth, soften the skin and tackle body odor (Grieve, 1997). The unique properties mentioned above may be responsible for the potent antimicrobial action of the natural plant products observed in the present report.

Conclusion

Black soap has proven more effective than the two out of three popularly used medicated soaps in the combating skin microflora. Palm kernel oil was also highly effective but 100% efficacy was observed when it mixed with black soap due to their synergistic effect. Shear butter was the least effective but its antiseptic action may be enhanced when mixed with black soap. Mixture of palm kernel oil and palm kernel oil was confirmed equal to or better than some orthodox medicated soaps tested against only five of the isolates namely: Pseudomonas spp., S. aureus, Bacillus spp., C. albicans and Saccharomyces spp. The information provided is useful in the search for cheap, effective natural products in the prevention and treatment of common dermatophytic infections in Nigeria.

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