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Microbial Contamination of White and Brown Cosmetic Powders Sold in Abakaliki, Ebonyi, Nigeria

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Abstract
Powder is a cosmetic product used by men, women and children to improve their looks and prevent prickly heat. They can either directly add or alter colour and can be applied alone or over a foundation that serves to make the colour even and smooth. The aim of this study was to assess the microbial contamination of white and brown powders sold in Abakaliki, Ebonyi. Ten (10) samples of cosmetic powders (5 white and 5 brown powders) were bought from Abakpa market Abakaliki and analysed. Two methods were used for extraction of the organisms; sprinkling and centrifugation methods. The result revealed the following microorganisms; *Bispora* spp., *Puciniopsis* spp., *Aspergillus* spp., *Rhizopus* spp and *Fusarium* spp. in white and brown powders. *Aspergillus* spp.. constituted 81.82 % and 75 % in white and brown powders, *Puciniopsis* spp. were 9.09 % in white powder, *Bispora* spp. were 8.33 %, *Rhizopus* spp and *Fusarium* spp. achieved 8.33 % in brown powders but absent in white powders, *Streptococcus* sp. was identified only in brown powder. *Aspergillus* spp. had higher prevalence in both white and brown powders with 90 % and 71.43 % respectively. The study shows that both white and brown cosmetic powders harbor microbes could be responsible for facial rashes, eczema and other dermatitis.
Keywords: Bacteria, fungi, health risks, microbes, cosmetic powders

1. Introduction

Powder is a cosmetic product used by people to improve their looks, prevent prickly heat, which sometimes cause body odour (Mirhosseini *et al.,* 2011). Their functions could include beautification, reduction in appearances of wrinkles, smoothening the skin, reduction of shininess caused by oily skin, prevention of prickly heat etc. Some powders with sunscreen can also reduce skin damage from harsh sunlight and environmental stress (Tran and Hitchins, 1994). Despite these functions, they provide a favourable conditions for fungal growth. Cosmetic powders could be contaminated either during their preparation, storage, transportation and usage (Álvarez-Lerma *et al.,* 2008). Contamination of powders by fungi cause spoilage, which may lead to alteration in organoleptic properties of the product and when fungal organism is pathogenic, it renders the product unfit for use and could cause serious health risk for consumers (Tamalli and Alghazal, 2015: Álvarez-Lerma *et al.,* 2008).

Many people are unaware that powder harbor fungi and other microbes and spread infections. Some women even share powders and applicators with others, increasing their chances of facial infection. Others do not replace powders until it's completely finished despite how long they purchased and used them, the longer the microbes stay in powder, rapid growth and multiplication and production of metabolite would be expected, this could lead to biodegradation of product and hence the risk of infection to consumers of the product (Behravan *et al.,* 2005: Anderson and Parkin, 2007). Microbial spoilage of organic product are known for many years. The microbial contamination of cosmetics have received little attention recently. This is due to the belief that the added preservatives could prevent microbial growth upon storage and/or during usage. However, some studies have shown that inspite of preservative constituents microbes still thrive in cosmetics (Omorodon and Ezediokpu, 2014). There are different types of preservatives, those commonly used are parabens, formaldehyde, methylisothiazoline (Muhammed 2011), among the various preservatives, parabens and its derivatives are widely used in cosmetics due to their cost effectiveness and preservative efficiency (Rajagopal and Agrawal 2011). The warm and rather humid climatic conditions that prevail in most tropical countries including Nigeria, would tend to support the survival and growth of many microorganisms (Anelich and Korsten, 1996:Omorodon and Ezediokpu, 2014). Microbial quality of cosmetic products have been reported in temperate countries and often found to be in response to outbreaks of infectious diseases (Omorodon and Ezediokpu, 2014). The aim of the study was to assess the microbial contamination of some white and brown cosmetic powders sold in Abakaliki, Ebonyi, Nigeria.

2. Materials and Methods

2.1 Study Area

Ten samples of white and brown powders were procured in Abakpa market, Abakaliki, Ebonyi They were taken

to Department of Biological Science for analysis. Potato dextrose agar (PDA) media were prepared from raw irish potato, two hundred gram of unpeeled potatoes were weighed and cut into smaller piece, washed and boiled with 250 ml of distilled water for 30 minutes on a stove. The boiled potatoes were sieved using muslin cheese cloth, the extracted water was poured into a beaker and residues disposed, 20 g of glucose and 15 g of agar powder were weighed and added into the extracted water and then mixed gently. The mixture was autoclaved at 121^{o}C for 15 minutes and allowed to cool for some seconds and then poured aseptically into petri dishes.

In sprinkling method, white and brown powders were sprinkled on top of the PDA media. In centrifugation method, white and brown powders were dissolved in 150 ml of distilled water, shaked to obtain a homogenous mixture and allowed to settle for an hour. The upper part of the mixture were poured into centrifuge tubes and centrifuged at 2500 rpm for 5 minutes to obtain the sediment. The sediments were inoculated onto PDA. The number of colony forming unit on mixed culture were noted, pure cultures of different organisms were produced, a thin smears of fungal organism were mounted on slides, two drop of lactophenol cotton Blue (LPCB) were dropped on the slide and covered with a cover slip. Bacteria pathogens were identified by Gram staining technique and slides were observed with light microscope at x400 and photomicrographs taken.

3.Result

Centrifugation method revealed more quantitative abundance of colonies forming unit, dominated by black and brown colonies. *Aspergillus* spp. were very dominant in the two cosmetics powder among other fungi species (Table 1 & Table 2). The following fungal organisms were identified in the white and brown powders using sprinkling method; *Bispora* spp., *Puciniopsis* spp., *Aspergillus* spp., *Rhizopus* spp. and *Fusarium* spp. *Aspergillus* spp. contributed 81.82 % and 75 % in white and brown powders respectively. *Puciniopsis were* 9.09 % in white powder. *Bispora* spp., *Rhizopus* spp. and *Fusarium* spp. were absent in white powders but present in brown powders. *Bispora* spp. were 8.0 % whereas *Rhizopus* spp. and *Fusarium* spp achieved same value (8.33 %) (Table 3). In centrifugation method, *Aspergillus* constituted 90 % and 71.43 % in white and brown powders respectively. *Streptococcus* sp. was not present in white powders but achieved 14.29 in brown powders (Table 4).

Table 1: Organisms isolated from white and brown powders using sprinkling method

Sample	COC	NCSFU	ORGANISMS
A	Black	2	*Aspergillus* spp
B	Brown, Black	2, dominant	
C	Black	2	*Aspergillus* spp
D	Black	3	*Aspergillus* spp
E	Green, Black	4,dominat	*Aspergillus* spp
F	Black	dominant	*Aspergillus* spp
G	Black, brown	2, dominant	*Aspergillus* spp
H	Black	2	*Aspergillus* spp
I	Brown, grey, black	2,2,4	*Bispora* spp., *Aspergillus* spp.,*Fusarium* spp.
J	black	dominant	*Aspergillus* spp.

A-E, white powder
F-J, brown powder
COC, colour of colonies
NCSFU, Number of colony species forming unit

Table 2: Fungi and bacteria isolated from white and brown powders using centrifugation method

Sample	COC	NCSFU	ORGANISMS
A	Black	dominat	*Aspergillus* spp.
B		4, dominant	*Puccinopsis* spp. *Aspergillus* spp.
C		dominant	*Aspergillus* spp.
D		dominat	*Aspergillus* spp.
E		dominant	*Aspergillus* spp.
F		dominant	*Aspergillus* spp.
G		4	*Aspergillus* spp.
H		4	*Aspergillus* spp.
I		dominant	*Streptococcus* sp.
J		dominant	*Aspergillus* spp.

A-E, white powder
F-J, brown powder
COC, colour of colonies
NCSFU, Number of colony species forming unit

Table 3: Percentage of fungi and bacteria isolated from cosmetic powders using sprinkling method

Organisms	No. of isolates from white powder	(%)	No. of isolates from Brown powder	(%)
Bispora spp.	0.0	0.0	1.0	8.33
Puciniopsis spp.	1.0	9.09	0.0	0.0
Aspergillus spp.	9.0	81.82	9.0	75.0
Rhizopus spp.	0.0	0.0	1.0	8.0
Fusarium spp.	0.0	0.0	1.0	8.3
Total	11	100	12	100

Table 4: Percentage of fungi and bacteria isolated from cosmetic powders using centrifugation method

Organisms	No of isolates from white powder	(%)	No of isolates from brown powder	(%)
Aspergillus spp.	9	90	5	71.43
Rhizopus spp.	1	10	1	14.29
Streptococcus sp.	0.0	0.0	1	14.29
Total	10	100	7	100

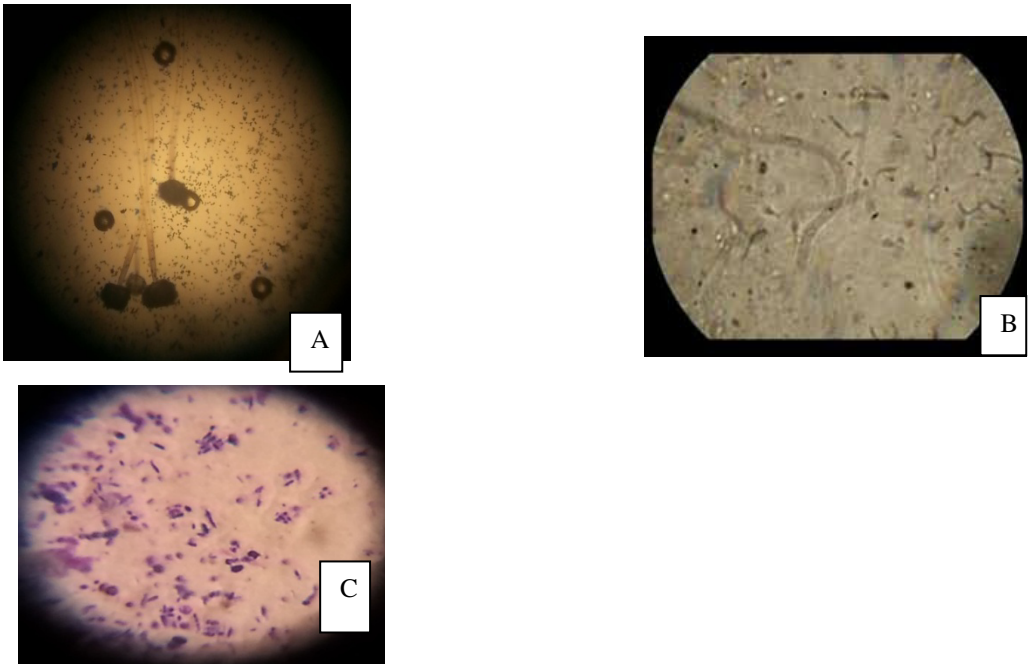

Plate 1: Photomicrographs some fungi and bacteria species isolated from white and brown powders

A = *Aspergillus* sp.
B = *Puciniopsis* sp.
C = *Streptococcus* sp.

Discussion and Conclusion

The frequency of occurrence of fungi in the samples shows that all the samples were contaminated with fungi, indicating that cosmetic powders permit the growth of fungi. In comparison, it was observed that brown powders were more contaminated with *Aspergillus, Rhizopus, Streptococcus, Bispora,* and *Fusarium* than the white powders. In similar study, Dashen *et al.* (2011) isolated *Staphylococcus aureus*, *Clostridium tetani, Candida albicans, Bacillus spp, Aspergillus niger, Aspergillus fumigatus, Penicillium spp, Rhizopus oligosporus, Fusarium* sp.in powders while Ashour *et al.* (1989) isolated *Staphylococcus* aureus, *Escherichia coli*, *Enterobacter agglomerans* and *Citrobacter freundii.* Omorodon and Ezediokpu (2014) isolated the following bacteria; *Staphylococcus*, *Baccillus* spp., *Strptococcus*, *Micrococcus*, *Esherichia coli* whereas the fungal isolates were; *Aspergillus* spp., *Rhizopus*, *Candida* spp., *Trichoderma* and *Penicillium.* Hugbo *et al.* (2003) isolated *Aspergillus fumigatus*, *Penicillium* spp., *Microsporium* spp. and reported that *Staphylococcus* spp. and other Gram +ve cocci were the most predominant in cosmetic powder whereas gram negative isolates were scarcely found. This leads to a presumption that powders are more susceptible to gram positive bacteria than gram negative bacteria. This however agrees with the present work which also revealed presence of gram positive

bacteria in brown powder. Tamalli and Aghazal (2015) observed that gram positive organisms were the predominant contaminants in the cosmetic eye preparations. They found *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Bacillus subtilis* and *Clostridium perfringens*, to be predominant bacteria. In related study, Sewant and Kelkar-mane identified *Staphylococci*, gram negative organisms of *Pseudomonas*, *Proteus*, *Morganella*, Providencia species in lipsticks before and after consumers use. Behravan *et al*., 2005 described that the presence of these organism could pose serious ill health and cause spoilage of product and when pathogenic, they represent serious health risk for consumers worldwide.

The persistence presence of *Aspergillus* spp. and *Rhizopus* spp in brown and white powders indicated the susceptibilities of these cosmetic powders to these organisms. Contamination of the powders may be due to poor storage, manufacturing practices or handling. The presence of more fungal species could be an indication that powders are more susceptible to fungi than bacteria species.

Aspergillus species cause Aspergillosis, they are found all over the world. More than 300 different types of *Aspergillus* have been identified . Some Asergillus spp are harmless, however, some spp. can cause a variety of diseases in humans ranging from simple allergic reactions to life-threatening invasive disease(Zukiewicz-Sobczak, 2013).

Rhizopus is the most common organism responsible for case of mycormycosis., agents of mucormycosis are incapable of penetrating into the skin. However, burns, traumatic disruption of the skin, and persistent maceration of skin enables the organism to penetrate into deeper tissues (Ibrahim *et al*., 2012).

The present findings are in concordant with the reports of some researchers who also showed that microorganism can contaminate cosmetics powders. This study shows that both the white and the brown powders could cause facial diseases such as rashes, eczema etc. due to microbial loads.

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