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Public Health Implication of Artificial Finger Nails Used by Health Workers and Food Handlers in Port Harcourt, Nigeria

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Abstract: This study was undertaken to determine if artificial fingernails could contribute or serve as vehicles for transmission of food poisoning and nosocomial pathogens. Three hundred and fifty apparently healthy individuals were used. Of this number, 150 subjects were health care workers, while 200 subjects were unprofessional food handlers. Both groups were randomly selected for this study. Their artificial fingernails were swabbed and examined microbiologically by culturing them on different media. Oral interviews were also used to assess the social and educational status of subjects. Four genera of bacteria were isolated and identified, such as *Staphylococcus* sp., *Escherichia coli*, *Proteus* sp. and *Pseudomonas* sp. Among the organism identified, *Staph aureus* (41.7%) was predominant and frequently occurring, followed by *E. coli* (7.4%). From this study, it could be deduced that artificial fingernails could serve as means for transmission of pathogens to foods and causing nosocomial infections on patients. Hence, use of artificial or overgrown fingernails should be discouraged to avoid disease epidemics.

Key words: Artificial finger nails, health care workers, good handler, overgrown finger nails, transmission of pathogens

INTRODUCTION

The use of artificial fingernails has become popular and more fashionable in the past. These nails are frequently worn by ladies, health care workers and food handlers. It is estimated that over \$265 million is spent every year on acrylic nails and related products and their application in the United States (Shelly *et al.*, 2001). Acrylic is the generic name given to the type of plastic made from a chemical called methacrylate. Some potentially pathogenic organisms such as *Staphylococcus aureus*, Gram-negative bacilli and yeast are associated with artificial nails. Organisms acquired in this manner tend to be transient and have been repeatedly implicated as vehicles for transmission of nosocomial pathogens and outbreak of foodborne diseases, (Shelly *et al.*, 2001). A recent outbreak in a neonatal intensive care unit was linked to carriage of *Pseudomonas aeruginosa* on the nails of 2 nurses, one with long artificial nails and the other with long natural nails. Artificial nails facilitate colonization of bacteria on the hands and make hand washing less effective and the use of gloves less practical (Baran, 2002).

On the other hand, foodborne diseases are known to contribute to both human morbidity and mortality as well as health care costs. Besides outbreaks of foodborne

disease, health care costs associated with these outbreaks are enormous (Bean *et al.*, 1996; Campbell *et al.*, 1998; USFDA, 2004). These costs include the expenses entailed in controlling the disease, medical treatment costs, business and productivity losses.

This study was undertaken to determine if artificial fingernails could contribute to the transmission of pathogens and in addition lay more emphasis on the restriction of its use by health care workers and food handlers.

This study, which investigated the use of artificial fingernails by both health care workers and unprofessional food handlers in Port Harcourt, Nigeria, reports that artificial or long fingernails could serve as vehicle for transmission of pathogens to foods and causing nosocomial infections on patients. Proper hand

hygiene is the most effective means of preventing the spread of all infections among hospital patients, health personnel and food personnel. Removal of pathogens from the hand requires an appropriate cleansing agents, a proper protocol, compliance and thorough hand washing prior to and after handling a hospital patient or food. Factors such as type of pathogen, duration of contact with hands and characteristics of organic material present on hands must be considered when selecting an

appropriate hand washing agent. Additionally, health care workers and food handlers would be best advised to avoid wearing artificial nails and keep natural nails trimmed to less than 2 mm beyond the fingertips.

MATERIALS AND METHODS

Study population/subjects: The study populations were all located within Port Harcourt metropolis, Nigeria. The period of study was for one (1) year, (between February, 2006 to February, 2007), with a total of 350 apparently healthy individuals involved; of this number 150 subjects were health care workers, comprising trained nurses, auxiliary nurses, para-medical health care workers and hospital attendants from different private hospitals in Port Harcourt City. The remaining 200 subjects were obtained from various categories of unprofessional food handlers such as food hawkers, snacks hawkers, restaurants and roadside beakers. Females were the only group of people considered in this study because they were artificial and long nails more than the male (i.e., assuming the males were artificial fingernails). Also, women are into food business and nursing more than the men.

Ethical consideration: An informed consent was sought through the medical or managing directors of the various establishments or outfit before sample collection. Educational, family and social background of the employees were equally ascertained and none of the workers or subjects have been known to have any previous hospital acquired infection or case of food poisoning.

Sample collection: Samples were collected during the time of food preparation and service for food handlers, while the health care workers samples were collected during working hours (8 am-4.00 pm). The 10 fingernails of reach individual were wetted with sterile normal saline, using Pasteur pipettes to drop the saline on the end regions of the fingernails. This was to allow the dirt on the fingernails to soften and for easy adherence to the swabs. Sampling the 10 fingers will ensure that no organism was missed. The fingernails were then thoroughly swabbed with a sterile swab stick and the contents transferred into a bijoux bottle containing 0.1% peptone water (Oxoid CM509, Oxoid Ltd., Basingstoke, UK). The length of the swab stick was reduced to fit into the bijoux bottle. Thereafter, cultures were made by streak plating on surface dried nutrient agar (Oxoid CM3), MacConkey agar (Oxoid CM7) and Deoxycholate agar (DCA) (Oxoid CM163). The culture plates were incubated aerobically at 37°C for 24 h.

Isolation and identification of bacteria: Culture plates showing significant growth (30-300 colonies) were selected and counted. Typical colonies were picked and subcultured onto fresh nutrient agar and MacConkey agar plates for purity checks. Isolates were identified using the method of Harrigan and McCance (1976) and Cheesborough (1987). The values obtained for colony forming units per milliliter (cfu mL⁻¹) and other parameters were calculated using a Chi-square (χ^2) test.

RESULTS AND DISCUSSION

A total of 350 fingernails obtained from health care workers and food handlers were swabbed and studied. Table 1 shows the frequency of microbial isolates among the subject groups (i.e., Health care providers and food handlers). *Staphylococcus aureus* accounted for a higher prevalence of 146 (41.7%) in both study groups. This is followed by *Escherichia coli* 26 (7.4%), while *Proteus* sp. and *Pseudomonas aeruginosa* had the least prevalence of 6 (1.7%) and 5 (1.4%), respectively. Long nails both natural and artificial can facilitate colonization of bacteria on the hands by making hand washing less effective and the use of gloves less practical. The longer the nail, the more likely it is for bacteria to reside under its free edge. Reports from North America have shown that nurses who wear acrylic fingernails may become colonized or infected by bacteria and thus become a possible risk to susceptible patients (Baran, 2002).

Also in the routine care of patients, hands of health workers become contaminated. However, despite the potency of hand cleansing agents used in removal of bacteria from their hands, health personnel have been incriminated repeatedly as vehicles for microbial transmission (Schaberg *et al.*, 1996). Similarly, hand contact with foods represents a mode by which contamination and foodborne outbreaks may occur (Jack and Marianne, 1999). In this study, *Staphylococcus aureus* were more prevalent 146 (41.7%) and this is in contrast to reports obtained from other studies. Baran (2002) recorded increased carriage of Gram negative rods such as *Pseudomonads* (44%) *Acinobacter* (16%) and *Serratia* (37%) from the fingertips of operating room nurses wearing artificial nails than from those with natural nails. Also from Oklahoma City, of 439 infants admitted to the neonatal intensive care unit 46 (11%) acquired *Pseudomonas aeruginosa*, 16 (35%) of whom died. This was traced to artificial fingernails worn by the nurses. Also, Hedderwick *et al.* (2000) in their research work isolated more Gram negative bacilli than other pathogens. This research work recorded a reduced occurrence of Gram negative bacilli with a range of *Escherichia coli* 26 (7.4%), *Proteus* sp. 6 (1.7%) and *Pseudomonas aeruginosa* 5 (1.4%), respectively.

Table 1: Frequency of microbial isolation among the subject groups (%)

Subject groups	No. examined	<i>Staph aureus</i>	<i>E. coli</i>	<i>Proteus</i> sp.	<i>P. aeruginosa</i>	Total
Health Workers	150	51 (34.0)	9 (6.0)	3 (2.0)	4 (2.7)	115
Food Handlers	200	95 (47.5)	17 (8.5)	3 (1.5)	1 (0.5)	175
Total (%)	350	146 (41.7)	26 (7.4)	6 (1.7)	5 (1.4)	290 (82.9)

Values in parenthesis represents the percentages

Table 2: Influence of nature/length of fingernails on frequency of microbial isolation on subject groups

Nail nature	Health care workers			Food handlers		
	Positive	Negative	Total	Positive	Negative	Total
Artificial Nail	30 (93.8)	2 (6.3)	32	39 (97.5)	1 (2.5)	40
Long Natural Nail	44 (84.6)	8 (15.4)	52	55 (90.2)	6 (9.8)	61
Short Natural Nail	41 (62.1)	25 (37.9)	66	81 (81.8)	18 (18.2)	99
Total (%)	115 (76.7)	35 (23.3)	150	175 (87.5)	25 (12.5)	200

Values in parenthesis represents the percentages. p>0.05

Table 3: Morphological and biochemical characteristics of bacterial isolates from fingernails of subject groups

Physical and biochemical characteristics	Isolates			
	Smooth raised Yellowish colonies With entire margin.	Smooth raised pinkish colonies	Swarming colonies with fishy smell	Raised blue green colonies
Colony description				
Gram reaction	Gm+ve cocci in glusters	Gm-ve rods	Gm-ve rods	Gm-ve rods
Motility	Non-motile (-ve)	Motile (+ve)	Motile (+ve)	Motile (+ve)
Coagulase	+ve	-ve	-ve	Motile (+ve)
Indole	-ve	+ve	-ve	-ve
Acid from lactose	+ve A/G	+ve A/G	-ve	-ve
Glucose	+ve A/G	+ve A/G	+ve	+ve
Sucrose	+ve	+ve	+ve	-ve
Urease	-ve	-ve	+ve	-ve
Probable identity of Isolates	<i>Staph aureus</i>	<i>E. coli</i>	<i>Proteus</i> sp.	<i>P. aeruginosa</i>

GM+ve = Gram positive, A/G = Acid and Gas, GM-ve = Gram Negative

The type of fingernails and microbial isolation is shown in Table 2. The nature and length of fingernails have an influence in propagation of microorganisms and this was statistically significant in both health care workers and food handlers. Artificial nails from health care workers yielded 30 (93.8%) isolates out of 32 samples cultured, long natural fingernails had 44 (84.6%) isolates from 52 samples examined, while short natural nails recorded 41 (62.1%) isolates from 66 samples examined. Conversely, a similar result was obtained among food handlers. Out of 40 artificial nails examined 39 (97.5%) yielded a positive result, while 55 (90.2%) isolates was recorded in long natural nails from 61 samples examined, short natural nails gave 81 (81.8%) positive cases from 99 samples (Table 2). This figure agrees with the reports obtained by Hedderwick *et al.* (2000). During their study 92 out of the 104 health care workers were assessed for fingernail length and presence of artificial nails. Those with short or medium length nails have a low risk of *Pseudomonas aeruginosa* colonization, whereas those with long natural or artificial nails had a significant risk.

This study equally confirms the fact that health workers as well as food handlers wearing artificial fingernails had more pathogens isolated from their nails. About 290 (82.9%) of the population (350) under study yielded positive cultures. This high prevalence and

frequency in microbial isolation observed in this work could be attributed to social and educational background of subject groups under study. Health care workers mainly comprised of auxiliary nurses and hospital attendants who have not obtained formal education. Similarly food handlers were made up of unprofessional cooks/waiters and waitresses, food/snacks hawkers and roadside restaurants. However, further investigations revealed that government hospitals, health centres, five-star Hotels and fast food centres prohibit the use of acrylic fingernails by staff. This implies that operational policies and standards are already implemented in these areas.

Table 3 shows the biochemical characteristics of bacterial isolates from fingernails of both health care workers and food handlers. Four genera of bacteria were isolated from the fingernails of the subject groups. Among these were *Staphylococcus aureus*, *Escherichia coli*, *Proteus* sp. and *Pseudomonas aeruginosa*. A breakdown of the occurrence of the bacterial flora shows that *Staph. aureus* and *E. coli* occurred in most of the fingernails examined, followed by *Proteus* sp. and *P. aeruginosa*. *Staphylococcus aureus*, *Escherichia coli* are known to be involved in food poisoning cases. Therefore, food handlers should ensure that their fingernails are trimmed.

The danger in isolating or identifying some recalcitrant pathogens like *P. aenigiorosa* is that they are resistant to most antibiotics and disinfectants, hence, when transferred to foods or wounds through the longnails of food handlers or health workers, food poisoning may occur and the wound may not heal easily. In the same vein, most of the ready-to-eat foods that are contaminated with *Staphylococcus aureus* and *E. coli* that does not require further heat treatment could result to food borne illnesses. (Wachukwu *et al.*, 2002). Therefore, the Hazard Analysis Critical Point (HACCP) should be seriously considered when handling ready to eat foods, since some of them does not require further heat treatment that could kill organisms.

CONCLUSIONS

In Nigeria, most women wear artificial nails (particularly young ladies) without knowing the health implications. The present study highlighted different intervention measures that can be used to minimize or eliminate contamination of foods by food handlers or transmission of pathogens to patients by health workers. Implementation and adherence to infection control practices are the keys to preventing the transmission of hospital acquired infections and food poisoning pathogens.

Also, rings and jewelries are thought to harbour food debris, microbial contaminations and food allergens. Therefore, their use should be discouraged in health organizations and food industries.

Finally, the information gathered in this study that artificial fingernails have impact in the transmission of pathogens should be of great importance and concern to the general public, especially those that live around the coastal or riverine areas of the Niger Delta in Nigeria, who use water and bare-hands to wash up after defeacation without adequate hand washing.

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