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HOSPITAL PREFERENCE AND EFFICACY OF PURIT® AND DETTOL® AS SCRUBBING AGENTS DURING SURGICAL PREPARATIONS IN ENUGU STATE, NIGERIA

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Abstract
This study investigated preference for common hand scrubbing agents for peri-surgical uses in veterinary and human hospitals in Enugu State, Nigeria. It also evaluated their efficacies on common resident organisms in the hands of surgeons. Twenty hospitals, 14 human and 6 veterinary in Enugu and Nsukka urban of Enugu State were visited between June to July 2015 and data collected were used to select the test agents (Purit® and Dettol®). Twenty of the forty surgeons who consented to participate in the study were randomly selected and their hands were swabbed for culture to determine their common resident flora. A total of 40 moist swabs, 20 each were taken prior to and after hand scrubbing with each agent. Samples were cultured using appropriate media and colonies were identified and counted using standard methods. The results showed that Purit® had a higher Percentage (95%) uses whereas Dettol® had 60%. Two genera; *Staphylococcus* and *Escherichia* species were identified as common inhabitants found in the hands of the surgeons. The bacterial load on the hands of the surgeons reduced significantly post scrubbing. Efficacy based on the bacterial load counts showed no statistical difference ($P < 0.05$) in the antibiogram of both Purit® and Dettol®. It is concluded that as the awareness on the usefulness of Purit® and Dettol® as peri-surgical antibiogram hand scrubbing agents are widely known both in human and veterinary hospitals, the emphasis should now be centered on their judicious application to avoid development of resistance.
Keywords: Purit®, Dettol®, surgery, hand scrubbing, antiseptics.

Introduction
The purpose of a surgical hand scrubbing includes removal of transient micro-organisms and debris from the hands, and fore-arms, decrease in number of resident micro-organisms to a minimum and to inhibit rapid proliferation of micro-organisms on the nails, hands and fore-arms. Since the emergence of disinfections, there have been many reports of disinfectants used as scrubbing agents in medical practices (Gök *et al.,* 2016). According to Molinari and Runnel, (1982) an ideal disinfectant must be broad spectrum in activity, active in the presence of organic materials like blood or faeces, compactable with detergents which may enhance their penetration, must have a fast action, low toxicity and residual surface activity. The objectives of this work therefore were to i) determine which disinfectants are most widely used in human and veterinary clinics in the study area ii) to determine the most common bacteria flora harboured by surgeons' hands at Veterinary Teaching Hospital (VTH) and iii) to evaluate the bactericidal efficacy of the test agents -Chloroxylenol (Dettol®) and Chlorhexidine gluconate (Purit®) against the common resident organisms in the hands of the affected surgeons.

Materials and methods
Study design
The study adopted two protocols; structured interview and experimental techniques.
Area of Study: The study was conducted in Enugu State, South-East Nigeria. Nsukka is a border town to the Northern part of Nigeria and is located at latitude 6.8578 and longitude 7.3958, South-East Nigeria. There are 34-human and 21-veterinary hospitals in the State, hence a sampling frame of 55 hospitals. The sample size of 20 hospitals was computed for the study, using the formula: $n = Z^2P(1 - P)/d^2$, as described by Pourhoseingholi *et al*. (2013); where n = required sample size, Z = normal deviate (1·96) at 5% significance level, P = estimated prevalence and d = precision (corresponding effect size). This study assumed an estimated prevalence of 2.5%. The selection of nine and eleven hospitals was determined by proportionate sampling technique to reflect the number of hospitals in Nsukka and Enugu

area, respectively. Of this number, twenty hospitals; nine in Nsukka and eleven in Enugu urban were purposely selected to study the popular disinfectants in use among hospitals as pre-surgical hand scrubbing agents. Out of these twenty hospitals sampled, six were veterinary hospitals, while fourteen were human hospitals. One copy of a validated closed-ended questionnaire per selected hospital was used to obtain the data. The questionnaire was structured and pretested on 10 respondents outside the study area.

From the list of 40 surgeons on clinical posting who consented to participate in the study, twenty of them on surgery clinical posting were randomly selected. A total of 40 moist swab samples were collected; 20 were taken prior to hand scrubbing of each surgeon's hand with each agent, while 20 were collected after hand scrubbing.

Sample Collection: Prior to sample collection, each sterile swab stick was moistened in sterile normal saline. A sterile swab stick was used for each collection prior to and after scrubbing. The swabs were rolled on the hand's surface area, (2 cm x 2 cm) after which they were placed into 10 ml of sterile normal saline. Each scrubbing lasted for 2 min and the collected samples were all preserved for use.

The collected samples were cultured using appropriate media. The colonies were identified and counted using standard methods as shown below.

Hand scrubbing: The survey results (protocol I) on common disinfectant agents in use in the studied hospitals showed that Dettol® and Purit® were the most commonly used as hand scrubbing agents among the clinicians. Accordingly, the Dettol® and Purit® used for the study were then purchased (from So-Divine Pharmaceutical Store Enugu, Enugu State) as commercially formulated products and used as the hand scrubbing agents by the consented clinicians. While ten of the surgeons used Purit® as hand scrubbing the other ten used Dettol®. The method of scrubbing has been described as above.

Media preparation and culture: The bacteriological media used in the study were prepared following their respective manufacturers' instructions. **MacConkey agar (FLUKA®) and Salt agar** were done according to the method of Elazhary *et al.* (1973) and Humphries and Linscott (2015) respectively.

Determination of *Staphylococcal* and ***Enteric*** **bacteria load** was carried out according to the method of Chengula *et al*. (2014). Identification of isolates was achieved by a combination of colonial and microscopic characteristics of the isolates.

Colonial morphology: The shape, size, and moistness of the colonies on the media were used to identify the organisms. Microscopic characteristics was carried out as described by Bergmans *et al.* (2005). Eosin methylene blue agar (EMB), Catalase and Oxidase tests were carried out as described by Leininger *et al.* (2001), Taylor and Achanzar (1972)and of Boswell *et al.* (1972 respectively.

Data Analysis: Data obtained were subjected to statistical analysis (Student T-test) using SPSS 16.0 and results were presented in tables.. Value of $P < 0.05$ were accepted as significant.

Results

Dettol® consists of chloroxylenol 4.8% (v/v), olium pine Aromaticum 9% (v/v), denature spirits 11.3% (v/v), and sapovegetalis 5% (v/v), while Purit® were of chlorhexidine gluconate BP 0.3 % w/v and cetrimide BP 3.0 % w/v). From the hospital survey, Purit® and Dettol® are being used in 95% and 60% as hand scrubbing agent respectively during surgery in the hospitals studied (table 1). Two main organisms, *Staphylococcus* and *Escherichia coli* species were harboured by the hands of the surgeons. However, comparing the pre and post scrubbing antibiogram activities of both Purit® and Dettol®, the two agents significantly ($P < 0.05$) reduced the total bacterial load after hand scrubbing (tables 5 and 6).

TABLE 1: Percentage level of uses of hand scrubbing agents among the surgeons

Hospitals	**No Sampled**	**Purit®**	**Dettol®**
Veterinary	6	2	2
Human	14	17	10
Total	20	19(95)	12(60)

TABLE 2: Comparison of bacterial load with Purit® and Dettol® post hand scrubbing

CULTURE MEDIA	Dettol® Mean ± S.E	Purit® Mean±S.E.

SCSA	31.75 ± 12.22[a]	34.50 ± 11.88[a]
SCMA	20.10 ± 9.83[a]	15.90 ± 4.07[a]
ECMA	15.75 ± 6.16[a]	13.60 ± 6.16[a]
TCMA	35.85 ± 16.00[a]	29.50 ± 10.22[a]

Significant difference at p ≤0.05.

Keys:

SCSA Staphylococcus Colonies on Salt Agar
SCMA Staphylococcus Colonies on MacConkey Agar
ECMA E. coli Colonies on MacConkey Agar
TCMA Total Colonies on MacConkey Agar

TABLE 3: Mean value of the bacterial load prior to and post hand scrubbing using Purit®.

AGAR	Pre-scrubbing	Post-scrubbing
SCSA	323.25 ± 81.73[a]	34.50 ± 11.88[b]
SCMA	400.25 ± 82.15[a]	42.00 ± 9.91[b]
ECMA	126.00 ± 28.40[a]	15.90 ± 4.07[b]
TCMA	526.25 ± 110.55[a]	57.90 ± 13.98[b]

Significant difference at p≤0.05

TABLE 4: Mean value of the bacterial load prior to and after hand scrubbing using Dettol®

AGAR	Pre-scrubbing	Post-scrubbing
SCSA	656.50 ± 121.00[a]	31.75 ± 12.22[b]
SCMA	484.00 ± 127.32[a]	20.10 ± 9.83[b]
ECMA	93.00 ± 24.77[a]	15.75 ± 6.16[b]
TCMA	577.00 ± 152.09[a]	35.85 ± 15.99[b]

Significant difference at p ≤0.05

Discussion

Both Purit® and Dettol® were in popular use among the veterinary and human hospital proprietors in the study area. The findings of this study also showed that both *Staphylococcal* and *E. coli* species were the two organisms found in the hands of all the surgeons sampled. While *Escherichia coli* are regarded as transient flora, *Staphyloccocus aureus* is considered a resident flora in the hands of surgeons. These are picked by contact with other people, objects or the environment and do not survive indefinitely on the hands. These organisms have the potential to do harm as they have the ability to survive long enough to be transferred to others (Boyce *et al.,* 1990). They are also called a non-colonizing or contaminating flora. They are present on the skin and are consistently found on the majority of people (Stull and Weese, 2015, Fish, 2002). Their location makes them both readily removable with hand scrubbing and washing, and more prone to bring the pathogen responsible for an infection (Parvizi *et al*., 2009. In a sample of 169, Castro, *et al.* (2016) found that about 17.9% of individuals were carriers of methicillin-resistant *Staphyloccocus aureus* (MRSA) in the nose and 4.7% on hands. On the other hand, *E. coli* bacteria normally live in the intestines of people and animals, mostly as harmless and important part of a healthy human. However, Extra intestinal pathogenic *E. coli* are important cause of urinary tract infection, neonatal meningitis and septicaemia in humans (Belanger, *et al*., 2011). In the present study, though *E.coli* species were found to be present in the hands of the respondents, their growth was very scanty in samples collected compared to that of Staphylococcus. However, their presence in the hands of the respondents calls for concern in cases of compromised immune individuals. It was also discovered they were equally absent in most scrubbed hands using both hand scrubbing agents. This supports the assertion that they are easily removed in certain areas of the body particularly the hands. From the study also, both Purit®and Dettol® significantly (P <0.05) reduced the pre hand scrubbing bacterial loads in the hands of the surgeons. Alcohol solutions containing 60-95% alcohol are the most effective pre surgery scrubbing agent (Hibbard, 2005). Alcohols have broad spectrum antimicrobial properties including the ability to destroy Gram-positive and Gram-negative bacteria, as well as

multidrug resistant pathogens including Methicillin Resistant *Staphylococcus aureus* (MRSA), *Mycobacterium tuberculosis* and fungi (Kampf *et al.,* 1998). It is probably due to these qualities that health professionals mostly prefer its use as both hand scrubbing and in other perioperative uses. It is however recommended that alcohol based solutions should not be used when hands and or forearms are visibly dirty or contaminated with proteinaceous materials since that decreases the antimicrobial action of the alcohol (Larson and Bobo, 1992).

Conclusion

It is concluded from this study that since the awareness of the usefulness of Purit® and Dettol® as antibiogram hand scrubbing agent during surgery are widely known both in human and veterinary hospitals, the emphasis should now be centered on its judicious application to avoid development of resistance of microbials to its use in the hospital environment.

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