ANTIMICROBIAL EFFICACY OF COMMONLY USED DISINFECTANTS AGAINST *Escherichia coli* AND *Staphylococcus Aureus*

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U14/NAS/MCB/070

DEPARTMENT OF MICROBIOLOGY, FACULTY OF NATURAL AND APPLIED SCIENCES

GODFREY OKOYE UNIVERSITY UGWUOMU NIKE ENUGU STATE

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF MICROBIOLOGY, FACULTY OF NATURAL AND APPLIED SCIENCES

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SUPERVISOR

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DEDICATION

I dedicate this work to God Almighty who through him I was able to finish this work.

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I would like to thank the supreme power the Almighty God who is obviously the one who has guided me to work on the right path of life and also for all his favours, care and immense love upon me.

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**TABLE OF CONTENT**

Title page ………………………………………………….…………………………….. i

Approval page …………………………………………………………………………… ii

Dedication …………………………………………….…………………………………. iii

Acknowledgments ……………………………………...………………………………… iv

Table of contents …………………………………………………………………………. v

List of tables ……………………………………………………………………………… viii

Abstract ………………………………………………………….………………………… ix

**CHAPTER ONE: INTRODUCTION**

* 1. Background of study …………………………………………………………………… 1
  2. Statement of Problem …………………………………………………………………… 2
  3. Aim of study…………………………………………………………………………….. 3
  4. Specific objectives ……………………………………………………………………… 3

**CHAPTER TWO: LITERATURE REVIEW**

2.0 Literature Review ……………………………………………………………………….. 4

2.1 Nosocomial infections ……………………………………………………….………….. 4

2.1.1 Impact of Nosocomial infection ………………………………………..………….… 4

2.1.2 Implications of Nosocomial Infections ……………………………………….……… 5

2.2 Studies on antimicrobial activities of disinfectants against Nosocomial Infection …… 6

2.3 *Escherichia coli* ……………………………………………………………………….. 9

2.3.1 Scientific Classification …………………………………………………………….. 9

2.3.2 Morphology ………………………………………………………………………… 10

2.3.3 Epidemiology ……………………….……………………………….……………… 10

2.3.4 Infection ………………………………….…………………..……………………… 11

2.4 *Staphylococcus aureus* …………………………….………………………………….. 12

2.4.1 Scientific Classification ……………………………………………………………. 12

2.4.2 Morphology ………………………………….…………………………………….. 12

2.4.3 Epidemiology ………………………………………………………………………. 13

2.4.4 Infection ……………………………………………………………………………. 13

**CHAPTER THREE: MATERIALS AND METHODS**

3.0 Materials and Methods ……………………………………………………………...... 14

3.1 Determination of disinfectants commonly used in hospitals ……………………….. 14

3.2 Disinfectants used …………………………………………………………………….. 14

3.3 Test Organism ………………………………………………………………………… 14

3.4 Culture media used …………………………………………………………………… 14

3.5 Standardization of test organism …………………………………………………….. 15

3.5.1 Preparation of 0.5 McFarland Standard ……………………………………………. 15

3.5.2 Preparation of test inoculum ……………………………………………………….. 15

3.6 Dilution of Disinfectants ……………………………………………………………… 15

3.7 Minimum Inhibitory Concentration using Agar Well Diffusion Method ……..…….. 15

**CHAPTER FOUR: RESULTS**

4.1 Results …………………………………………………………………………………. 17

**CHAPTER FIVE: DISCUSSION AND CONCLUSION**

5.1 Discussion ……………………………………………………………………………… 24

5.2 Conclusion …………………………………………………………………………….. 26

REFERNCES ………………………………………………………………………………. 27

APPENDICES ……………………………………………………………………………… 32

LIST OF TABLES

Table Title Page 1: Lists of disinfectants and their uses in hospitals 17

2: Antimicrobial activities of the disinfectants against the test organisms at 100% concentration 19

3: Antimicrobial activities of the disinfectants against the test organisms at 50% concentration 20

4: Antimicrobial activities of the disinfectants against the test organisms at 25% concentration 21

5: Antimicrobial activities of the disinfectants against the test organisms at 12.5% concentration 22

6: Antimicrobial activities of the disinfectants against the test organisms at 6.25% concentration 23

ABSTRACT

The antimicrobial effectiveness of two selected disinfectants (Izal and Jik) was determined using agar diffusion method. The test organisms used (*Escherichia coli* and *Staphylococcus aureus)* were obtained from Enugu State University Teaching Hospital, Enugu. The disinfectants were diluted to 100%, 50%, 25%, 62.5%, 12.5% concentrations. The diluted concentrations showed different zones of inhibition against the test organisms. At 100% concentration Izal completely cleared both *Escherichia coli* and *Staphylococcus aureus* while Jik had 25mm zone of inhibition for *Escherichia coli* and 24mm zone of inhibition for *Staphylococcus aureus*. At 50% concentration Izal cleared both *Escherichia coli* and *Staphylococcus aureus* while Jik had 20mm zone of inhibition for both test organisms. At 25% concentration Izal completely cleared both test organisms while Jik had 15mm zone of inhibition for *Escherichia coli* but no zone of inhibition for *Staphylococcus aureus*. At 12.5% concentration Izal completely cleared both test organisms while Jik had no zone of inhibition. At 6.25% concentration Izal completely cleared the test organisms while Jik had no zone of inhibition for the test organisms. The results showed that Izal was more effective at any concentration while Jik was effective only at high concentration of 100% and 50%. *Escherichia coli* and *Staphylococcus aureus* obtained from hospital are both susceptible to the disinfectants used in this research. Therefore, disinfectants such as Izal and Jik can help to control incessant spread of some of the hospital acquired infections when used at the right concentration.

CHAPTER ONE

* 1. BACKGROUND OF STUDY

INTRODUCTION

Disinfectants are chemical agents used to kill microorganism on the surface or in order to eliminate them from the environment (Melike *et al*, 2016).

Ever since the identification of microorganism as the causative agents of infectious diseases, various methods have been devised in reducing the population and prevalence of these organisms. The various methods embarked upon include, chemotherapy, immunization, sterilization and disinfection (Kim *et al*, 2007).

Disinfectants are used extensively in hospitals and other health care settings for a variety of topical and hard surface applications (Olowe *et al.*, 2004). Chemical agents used in disinfection are referred to as disinfectants and the three main types of disinfection available are cleaning, heating and disinfection with chemical agents (Geo *et al.*, 2004). Disinfectants take time to act, they are greatly inactivated by excess organic matter and show higher activity at adequate concentrations (Olowe *et al.,* 2004). Disinfectants are an essential part of infection control practices and aid in the prevention of nosocomial infections (Olasehinde *et al*., 2008).

Disinfectants are toxic not only for microbial pathogens but for host cells as well and because of this they can only be used to inactivate microorganism in the inanimate environment (Brooks *et al*., 2004).

There are four classes of disinfectants. They include:

1. **Sterilants**: are required for critical instruments that penetrate tissue or present a high risk if non- sterile, for e.g. implants, needles and other surgical instruments. E.g. heat, steam, higher concentrations of hydrogen peroxide and paracetic acid, glutaraldehyde.
2. **High level disinfectants**: are required for semi- control items that do not penetrate tissues or contact mucous membranes (except dental) such as endoscopes, respiratory therapy equipment and diaphragms. Examples; hydrogen peroxide , glutaraldehyde, formaldehyde, ortho-phthaladehyde, paracetic acid.
3. **Intermediate level disinfectants**: are required for non-critical items that touch intact skin [e.g thermoters and hydrotherapy tanks] examples; alcohols, hypochlorite, iodine and iodophor disinfectants.
4. **Low level disinfectants**: are required for non-critical items such as stethoscopes, bedpans, blood pressure cuffs and bedside tables. Examples; phenolic, quaternary ammonium compounds.

1.2 STATEMENT OF PROBLEM

The current increase in the prevalence of nosocomial infections within the hospital environment despite adequate cleaning and disinfection is due to ineffectiveness of the various disinfectant formulations used in infection control and development of resistance to the various chemical disinfectant formulations being used in the hospitals by various micro-organisms

1.3 AIM OF STUDY

To determine the antimicrobial activity of disinfectants used in hospitals against *Escherichia coli* and *Staphylococcus aureus.*

1.4 SPECIFIC OBJECTIVES

* To determine the disinfectants used in hospitals.
* To determine the antimicrobial activities of the disinfectants used in the hospitals against the test organisms.
* To determine the Minimum inhibitory concentration of those disinfectants.

**CHAPTER TWO**

**LITERATURE REVIEW**

2.1. HOSPITAL ACQUIRED INFECTIONS/NOSOCOMIAL INFECTIONS

According to the World Health Organization, Nosocomial Infection is an infection acquired in hospitals by a patient who was admitted for a reason other than that infection. This includes infections acquired in hospitals but appearing after discharge and also occupational infections among staff of the facility (WHO, 2002).

In other words, Nosocomial Infections are infections acquired in hospitals or healthcare service unit that first appear 48hours or more after hospital admission or within 30 days after discharge following in- patient care (Nasir and Kadri, 2014).

Nosocomial Infection is a localized or systemic condition that results from adverse reactions to the presence of an infectious agent that was not present or incubating at the time of admission to the hospital from the centre for disease control (Horan and Gaynes, 2004). The history of nosocomial infections can be traced to the origin of hospitals themselves (Mbim *et al.,* 2016). Studies have revealed that nosocomial infections are becoming more alarming in the present century which is due to the increased use of outpatient treatment meaning that people who are in the hospitals admit large number of sick people and whose immune system are often compromised (Samuel *et al.,* 2010).

2.1.1. IMPACT OF NOSOCOMIAL INFECTIONS

Hospital Acquired Infections add to functional disability and emotional stress of the patient and may in some cases lead to disabling conditions that reduces the quality of life (Mbim *et al.,* 2016). The costs of Nosocomial Infection in terms of both money and human suffering are enormous (Emori and Gaynes, 1993).

In March 2009, Center for Disease Control (CDC) released a report estimating overall annual direct medical cost of healthcare associated infections that range from 28-45 billion. (Horan and Gaynes, 2004)

Nosocomial Infections are also one of the leading causes of death. The increased use of drugs, the need for isolation and the use of additional laboratory and other diagnostic studies also contribute (Plowman *et al.,* 2001).

Different types of infections acquired in hospitals

* Bloodstream infections
* Ventilator associated pneumonia
* Urinary tract infections
* Lower respiratory infection
* Gastrointestinal infection
* Skin, soft tissue, surgical site infections
* Ear, nose and throat infections (Weistein, 1993).

2.1.2. IMPLICATIONS OF NOSOCOMIAL INFECTIONS

There are numerous risk factors which predispose a host to acquire Nosocomial Infections including low body resistance as in infancy and old age, serious underlying illness, major surgeries (Dunn, 2001) immune deficiency state (Nasir and Kadri, 2014) and prolonged hospital stay (McNicholas *et al.,*2011).

There are areas in the hospital which carry a greater risk in patients acquiring Nosocomial Infections which include intensive care unit, dialysis unit, organ transplant unit, burns unit, operation theatres, delivery rooms, post-operative wards (Nasir and Kadri, 2014).

According to Mbim *et al,* (2016),several studies have shown that patients admitted into the hospitals are usually at a high risk of infections. Akingbade *et al.,* (2013); Jose *et al.,* (2014), observed that patients skin and openings are colonized by prevailing nosocomial agents. Bereket *et al.,* (2012), also observed that the practices and conditions in a hospital enhances colonization by nosocomial agents.

The most important factor for acquisition of nosocomial infections has been found as the length of hospital stay (Mbim *et al.,* 2016). At serious disadvantage are new-borns admitted into neonatal intensive care units that may possess several host factors that makes them prone to infections and also increases their risk of getting even more fatal illnesses (Samuel *et al.,* 2010; Polin *et al.,* 2013).

2.2. STUDIES ON ANTIMICROBIAL ACTIVITIES OF DISINFECTANTS AGAINST NOSOCOMIAL ORGANISMS

According to Iroha *et al.,* (2011), the antimicrobial activities of Savlon, Izal and Z- germicide disinfectants against 23 clinical isolates of *Pseudomonas aeruginosa* were evaluated. The overall result of the study showed that Savlon and Izal have high antimicrobial activity against *Pseudomonas aeruginosa* isolates, while Z-germicide produced low activity. The use of Savlon and Izal disinfectants in hospitals and clinics in Nigeria were highly recommended.

Alabi and Sanusi, (2012), found out that the current increase in the prevalence of nosocomial infections within the hospital environment despite adequate cleaning and disinfection is due to ineffectiveness of the various disinfectant formulations used in infection control on the various hospital equipment and wards, development of resistance to the various chemical disinfectant formulations being used in the hospitals by various micro-organisms. The resistance demonstrated by some of the nosocomial agents developing some mechanisms against the various disinfectant formulations. The effectiveness of Jik formulation at half the manufactures prescribed dilution showed that Jik is still an important disinfectant formulation in the control of nosocomial agent most especially the resistant strains.

“Obi *et al.,* (2016)”, assessed the commonly used hospital disinfectants on bacterial isolated from the operating theatre of Usmanu Danfodiyo University Teaching Hospital, Sokoto. Bacterial species were isolated by setting plate method using Nutrient and MacConkey agar as the isolating medium. The in-house disinfectants (Povidone iodine and Izal) used in the operating theatre was obtained and evaluated using Agar ditch diffusion method. It was conducted that disinfection remains one of the most effective ways of reducing nosocomial pathogens in hospital environment as demonstrated in the results of the research work. However, from time to time the potency of the in house disinfectant used must be checked in order to keep pace with degradation of disinfectant which normally occurs with time. The disinfectants, Savlon, Jik, Methylated Spirit and Kerosene were observed for their inhibitory activities on *Bacillus subtilis, Pseudomonas aeruginosa* and *Candida albicans.* This was done by measuring the zone of inhibition of the disinfectants on the tested organism. The results showed that Savlon was very effective at 100% concentration as it inhibits the growth of *Pseudomonas aeruginosa*, *Bacillus subtilis*. There was no inhibitory activity on *Candida* albicans at 6.25%. Jik at 100% concentration inhibited the growth of *Pseudomonas aeruginosa, Bacillus subtilis and Candida albicans*. The study showed that methylated spirit and Jik have inhibitory activities on both fungi and bacteria while kerosene had only antifungal activities and savlon had only antibacterial activities (Awodele *et al.,* 2007).

This study aimed at comparing the efficacy of commercially available disinfectants on microorganism isolated from clinical samples. Four commonly used disinfectants namely savlon, 70% ethanol, Dettol and Lysol were tested for clinical samples from impatient admitted at Sri Siddhartha Medical College Hospital, Tumkur. The disinfectants savlon and Dettol can be used as alternatives to phenol and sodium hypochlorite solution to manage liquid spills in small health care settings. Agar well diffusion method was used to assess the effectiveness of disinfectants used in the hospitals to have quality control on the disinfectants (Sharoda *et al.,* 2013).

The antimicrobial effectiveness of four selected disinfectants (Dettol, Izal, Z-germicide and Jik) were determined using agar diffusion (paper disc method). The test organism used include; *Escherichia coli*, *Staphylococcus aureus*, *Streptococcus spp* and *Mucor spp*. The results showed that Dettol was more effective against the test organisms than the other disinfectants. Izal recorded the least antimicrobial activity. Disinfectants for external uses are necessary to avoid related infections or diseases caused by those test microorganisms (Okore *et al.,* 2014).

Five frequently used disinfectants in specialist Hospital, Yola, Nigeria were analysed for bacterial contamination and sensitivity to antibiotics. For ach disinfectant, 20 different samples of stock and left over diluted solutions were used for the analysis. All the stock were free from any bacterial growth. The Minimum inhibitory concentration and minimum bacterial concentration of the isolates were significantly higher than that of the control sensitive strains, but were lower than the values quoted by the manufactures of the disinfectants, all the isolates showed variable sensitivity to antibiotics with each disinfectant showing sensitivity to at least four antibiotics tested in the study (El-Mahmood and Doughari, 2009).

“Elias *et al.,* (2014)” carried out a research on disinfectants, the aim of the study was to evaluate the efficacy of disinfectants using standard methods in hospitals in Kogi State. Dettol and Izal which phenolic disinfectants were evaluated for efficacy against phenol using locally isolated multi drug resistant *Pseudomonas aeruginosa* as test organism in randomly selected hospitals in Kogi state. The disinfectants tested were considered effective for use in the health care facilities. The study was conducted to evaluate the activities of three commonly used hospital disinfectant on *Pseudomonas aeruginosa* at the University College Hospital, Ibadan. Fifty five clinical isolates of *Pseudomonas aeruginosa* were subjected to the three commonly used disinfectants namely Jik, Izal and Dettol. Based on the results of this study Izal can be effectively used in University College Hospital while Dettol and Jik are either discarded or the use concentration increased.

***2.3. Escherichia coli***

*Escherichia coli* is a gram negative, facultative anaerobic , rod shaped coliform bacterium of the genus *Escherichia* that is commonly found in the lower intestine of warm blooded organisms (endotherms) (Tenaillion *et al.,* 2010; Singleton, 1999).

2.3.1. SCIENTIFIC CLASSIFICATION

Domain Bacteria

Phylum Proteobacteria

Class Gammaproteobacteria

Order Enterobacteriales

Family Enterobacteriaceae

Genus *Escherichia*

Species *coli*

2.3.2 MORPHOLOGY

*Escherichia coli* is a Gram-negative, facultative anaerobic (that makes [ATP](https://en.wikipedia.org/wiki/Adenosine_triphosphate) by [aerobic respiration](https://en.wikipedia.org/wiki/Aerobic_respiration) if [oxygen](https://en.wikipedia.org/wiki/Oxygen) is present, but is capable of switching to [fermentation](https://en.wikipedia.org/wiki/Fermentation_(biochemistry)) or [anaerobic respiration](https://en.wikipedia.org/wiki/Anaerobic_respiration) if oxygen is absent) and [nonsporulating](https://en.wikipedia.org/wiki/Endospore) bacterium. Cells are typically rod-shaped, and are about 2.0 [μm](https://en.wikipedia.org/wiki/Micrometers) long and 0.25–1.0 μm in diameter, with a cell volume of 0.6–0.7 μm (Yu *et al.,* 2014 and Kubitschek, 1990).

Escherichia coli stains gram negative because the cell because the cell wall consist of a thin peptidoglycan layer and an outer membrane. During the staining process *Escherichia coli* picks the colour of the counterstain safranin and stains pink. The outer membrane surrounding the cell wall provides a barrier to certain antibiotics such that *Escherichia coli* is not damaged by penicillin (Tortora, 2010). They grow at 37°c.

2.3.3. EPIDEMIOLOGY

*Escherichia coli* are responsible for most clinically important infections in the world (Ezeanya, 2013). *Escherichia coli* is one of the most common causative agents of gram negative sepsis, endotoxins induced shock, urinary tract and wound infections, pneumonia in immunosuppressed hospitalized patients, meningitis in neonates and diarrhoeal diseases (Ezeanya, 2013). They account for 90% of urinary tract infections in young women (Omeregie *et al.,* 2008). In Nigeria, the prevalence of *Escherichia coli* infection varied from 23.3% to 54.6% (Ngwai *et al.,* 2010). Reports from southern Nigeria showed prevalence of *Escherichia coli* in hospitals from south- south, South east and south west as 34.4%, 31.5% and 30% respectively (Umolu *et al.,* 2006; Oreh and Attama, 2003; Akujobi and Ezeanya, 2013).

Treatment of *Escherichia coli* infections in hospitals ranges from tetracycline, cotrimoxazole, Augmentin and amoxicillin (Ezeanya, 2013). Studies have shown a high resistance to these previously used antibiotics in Southern Nigeria and also worldwide (Umolu *et al*., 2006 and Oreh and Attama 2013).

Escherichia coli comprises of non-pathogenic commensal isolates that form part of the normal flora and various animals (Tenaillon *et al.,* 2010).In humans they are the major aerobic organism residing in the intestine typically with around 106- 109 colony forming unit per gram (Tenaillon *et al.,* 2010). Several variants or pathotypes of *Escherichia coli* have been described that cause infections of the gastro intestinal system (i.e. intestinal pathogenic *Escherichia coli*) while other pathotypes cause infections outside the gastro intestinal system (Croxen *et al.,* 2010).

2.3.4 INFECTION

Escherichia coli is responsible for a wide range of hospital and community onset infections affecting patients with normal immune systems as well as those with pre-existing conditions (Pitout, 2013).

**2.4 *Staphylococcus aureus***

Gram positive cocci that tend to be arranged in grape like clusters.

2.4.1 SCIENTIFIC CLASSIFICATION

Domain Bacteria

Phylum Firmicutes

Class bacilli

Order Bacillales

Genus Staphylococcus

Specie Aureus

2.4.2. MORPHOLOGY AND IDENTIFICATION

*Staphylococci are* spherical cells about 1m in diameter arranged in irregular cluster. Single cocci, pairs, tetrads and chains are also seen.

In liquid cultures young cocci strains strongly gram positive, on aging, many cells become gram negative. *Staphylococci are* non-motile and do not form spores (Brooks *et al*., 2007).

*Staphylococcus* is a facultative anaerobe that grows at an optimum temperature of 37°c and an optimum pH of 7.5. Staphylococcus aureus produces white colonies that tend to turn a butt golden color with time, which is the basis of the species *Epithet aureus* (golden) most, but not all strain show a rim clear Beta haemolysis surrounding the colony (Ryan and Ray, 2004).

2.4.3 EPIDEMIOLOGY

*Staphylococci* are highly successful colonies of humans and animals. They reside mainly on the skin, particularly in moist areas such as anterior nares (nose), axilla and grown. Staphylococcal infections are worldwide and newly emerging hyper virulent or multiresistant strains spread rapidly over wide geographical areas. The bacteria survive in the air, in objects or in dust for days. Therefore they can contaminate environments (such as hospitals) and continue to be transmitted over long periods of time. Some individuals may shed the organism more heavily than others. Staphylococcal infections are acquired from either self (endogenous) or external (exogenous) sources (Irving *et al.,* 2006).

2.4.4 INFECTION

*Staphylococcus aureus* causes serious infections of the skin, soft tissues, bone, lung, heart, brain or blood (Irving *et al.,* 2006). Diseases caused by Staphylococcal toxins include scaled skin syndrome and toxic shock syndrome.

CHAPTER THREE

**3.0 MATERIALS AND METHODS**

**3.1 Determination of disinfectants commonly used in the hospitals**

Disinfectants used in two hospitals were determined.

* Enugu State University Teaching Hospital uses Jik and Izal for disinfection
* Poly sub-district Clinic uses Jik for disinfection

**3.2 Disinfectants used**

Jik (contains sodium hypochlorite) and Izal (contains 7% Tar acid phenol and 2% Cresylic Creosote) were obtained from the Ogbete main market, Enugu State, Nigeria.

**3.3 Test Organisms**

Two (2) bacteria were obtained from stock cultures in Microbiology Laboratory of Enugu State University Teaching Hospital.

* *Escherichia coli*
* *Staphylococcus aureus*

**3.4 Culture media and reagents**

The media used were Nutrient Agar and Muller Hinton Agar which was prepared according to the manufacture’s instruction.

**3.5 Standardization of test organism**

**3.5.1 Preparation of 0.5 McFarland Standard**

0.5ml of 1.175% w/v Barium Chloride Dehydrate (BaCl.2H2O ) solution was added to 99.5ml of 15%w/v Sulphuric acid (H2SO4). The mixture was dispensed into tubes identical to the ones used in preparing inoculum suspension of test organisms. The tubes containing McFarland standard were stored in well-sealed container at room temperature until when needed (Cheesebrough, 2006)

**3.5.2 Preparation of Test Inoculum**

The test inoculum was standardized using the method described by Vandepite *et al.,* (2003). Saline solution was prepared by dissolving 8.5g of Sodium Chloride (NaCl) into 100ml of water, sterilized by autoclaving at 121°c for 15minutes. 4ml of the solution was dispensed into sterile test tubes. Sterile wire loop was used to pick a loopful of inoculum from the pure culture of test organisms. The turbidity was compared with the turbidity standard and adjusted by adding more test organism or more normal saline until it gets to 0.5 McFarland which is approximately 1x106 CFU/ml. the inoculum suspension was used within 15minutes to avoid further growth.

**3.6 Dilution of disinfectants**

Serial dilution method was used to dilute the disinfectants into 100, 50, 25, 12.5 and 6.25% concentration. The disinfectants were diluted with sterile water.

**3.7 Minimum Inhibitory Concentration using Agar Well Diffusion Method**

15-20 mL of Mueller-Hinton agar was poured on sterile petri dish plate and allowed to solidify. Agar surface of each plate was streaked by a sterile swab stick with the reference bacterial strain. The agar plate was punched with a sterile cork borer of 8mm size and 100 μL (0.1ml) of each sample was poured with micropipette in the holes bored. The plates were allowed to standby for 30 min. The plates were incubated at 37°C for 24- 48hours.

CHAPTER FOUR

RESULTS

TABLE 1: Name of disinfectants and their uses in hospitals

|  |  |  |
| --- | --- | --- |
| Name of the hospital | Disinfectants used | Applications |
| Enugu State University Teaching Hospital | Jik  Izal | Used for cleaning the floor, tables  Used for cleaning toilets |
| Poly Sub District Clinic | Jik | Used for cleaning floors and tables |

In Table 2, Jik showed some zones of inhibition while Izal showed complete clearance of the test organisms at 100% concentration. Jik at 100% concentration showed higher zone of inhibition against *Escherichia coli* than *Staphylococcus aureus.* At 50% concentration, Jik had equal zones of inhibition against *Escherichia coli* and *Staphylococcus aureus.* Izal showed complete inhibition against the test organisms. Table 4 illustrates that Jik had equal zones of inhibition against *Escherichia coli* and *Staphylococcus aureus* whileIzal showed complete inhibition against the two test organisms at 25% concentration. Table 5 illustrates that Jik had equal zones of inhibition against *Escherichia coli* and *Staphylococcus aureus* whileIzal showed complete inhibition against the two test organisms at 12.5% concentration. Table 6 illustrates that Jik had no zones of inhibition against *Escherichia coli* and *Staphylococcus aureus* whileIzal showed complete inhibition against *Staphylococcus aureus* but *Escherichia coli* was resistant against it at 6.25% concentration.

TABLE 2: Antibacterial activities of the disinfectants against the test organisms at 100% concentration

|  |  |  |
| --- | --- | --- |
| Organism | Zones of inhibition (disinfectants) |  |
|  | Jik | Izal |
| *Escherichia coli* | 25mm | complete inhibition |
| *Staphylococcus aureus* | 24mm | complete inhibition |

TABLE 3: Antibacterial activities of the disinfectants against the test organisms at 50% concentration

|  |  |  |
| --- | --- | --- |
| Organism | Zones of inhibition (disinfectants) |  |
|  | Jik | Izal |
| *Escherichia coli* | 20mm | Complete inhibition |
| *Staphylococcus aureus* | 20mm | Complete inhibition |

TABLE 4: Antibacterial activities of the disinfectants against the organisms at 25% concentration

|  |  |  |
| --- | --- | --- |
| Organism | Zones of inhibition (disinfectants) |  |
|  | Jik | Izal |
| *Escherichia coli* | 15mm | complete inhibition |
| *Staphylococcus aureus* | Resistant | complete inhibition |

TABLE 5: Antibacterial activities of the disinfectants against the test organisms at 12.5% concentration

|  |  |  |
| --- | --- | --- |
| Organism | Zones of inhibition (disinfectants) |  |
|  | Jik | Izal |
| *Escherichia coli* | Resistant | complete inhibition |
| *Staphylococcus aureus* | Resistant | complete inhibition |

TABLE 6: Antibacterial activities of disinfectants against test organism at 6.25% concentration

|  |  |  |
| --- | --- | --- |
| Organism | Zones of inhibition (disinfectants) |  |
|  | Jik | Izal |
| *Escherichia coli* | Resistant | complete inhibition |
| *Staphylococcus aureus* | Resistant | Resistant |

CHAPTER FIVE

**5.1 DISCUSSION**

All over the world, Nosocomial Infections is a recognized public health problem. Nosocomial Infections rates vary substantially by body site, by type of hospital and by the infection control capabilities of the institution. In Nigeria, Nosocomial Infections at a rate of 2.7% was reported in Ife while 3.8% was reported in Lagos and 4.2% in Ilorin. (Kesah *et al.,* 1999 and Odimayo *et al.,* 2008). These continue to increase yearly. Although viruses, fungi, bacteria and parasites are recognized as sources of Nosocomial Infections, bacterial agents remain the most commonly recognized cause (Dembri *et al.,* 1998).

The results obtained showed that the antimicrobial activities of the tested disinfectants were concentration dependent. It showed the zone of inhibition of the disinfectants on various test microorganisms. The results obtained from this study showed that disinfectants screened for antimicrobial activity have considerable antibacterial effects on the test organisms (*Escherichia coli* and *Staphylococcus aureus*). The disinfectants showed remarkable zones of inhibition against the test organisms. The results obtained from this study showed Izal was more effective against the test organisms at all concentrations. This result is consistent with Elias *et al.,* 2014, that showed Izal to be an effective disinfectant for cleaning.

Jik showed zones of inhibition at 100% and 50% concentration for the test organisms but at 25% concentration Jik was effective against only *Escherichia coli* while *Staphylococcus aureus* was resistant to Jik. At 12.5% and 6.25% concentration the test organisms were resistant to Jik. This is same with Okore et al., (2014) which showed Staphylococcus aureus to be resistant to Jik.

Izal inhibited the test organism completely in each plate with very little growth, this result was similar to Obi *et al*., 2016. Jik at 100% concentration showed broad spectrum of activity on the test organisms with 25mm for *Escherichia coli* and 24mm for *Staphylococcus aureus*, at 50% concentration showed 20mm for *Escherichia coli* and 20mm for *Staphylococcus aureus*, at 25% concentration it showed 15mm for *Escherichia coli* and no zone of inhibition for *Staphylococcus aureus*. And at 12.5% and 6.25% concentration there was no zone of inhibition which in order with the work of (Okore *et al.,* 2014) that showed Jik to have low antimicrobial effects on organisms when used at low concentrations.

The outcome of this study suggests that Izal is a more effective antimicrobial agent irrespective of the dilutions when compared with Jik. Jik is also effective but at high concentrations. The use of these disinfectants may be a means to reduce cases of nosocomial infections caused by these test organisms.

**5.2 CONCLUSION**

In conclusion, the potency of disinfectants is very important to enhance the antimicrobial activity of these disinfectants towards controlling microbial population which includes prevention of disease transmission and infection. Determination of antimicrobial effectiveness of disinfectants is essential to achieve total disinfection of hospital surfaces.

This study revealed that Izal is very effective against both *Escherichia coli* and *Staphylococcus aureus* at any concentration, while Jik is effective against both organisms at very high concentrations. Therefore the study suggests that Jik and Izal may be good disinfectants.

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` **APPENDICES**



Zones of inhibition of Jik on *Staphylococcus aureus*



Zones of inhibition of Jik on *Staphylococcus aureus*

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Zones of inhibition of Jik on *Escherichia coli*

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Zones of inhibition of Izal on *Escherichia coli*

KEYNOTES

* 1= 100% Concentration
* 2 = 50% Concentration
* 3 = 25% Concentration
* 4 = 12.5% Concentration
* 5 = 6.25% Concentration