BACTERIOLOGY AND ANTIBIOGRAM OF DIFFERENT BRANDS OF MALE CONDOMS SOLD IN IKOT EKPENE METROPOLIS

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ABSTRACT

A condom is a thin cover worn on the penis during intercourse to prevent female partners from becoming pregnant or getting an infection spread through sexual contact or giving one to a partner. This study aimed to carry out bacteriology and antibiogram of different brands of male condoms sold in Ikot Ekpene Metropolis. Four samples were purchased in triplicates from different pharmaceutical stores and analyzed in the laboratory. The mean heterotrophic count of the different samples showed the highest bacterial count of 5.0 x10^4 Cfu/cm2 from sample D while the least bacterial count was observed in sample C with 2.0 x 10^4 Cfu/cm2. The following isolates were obtained: Staphylococcus sp, *Pseudomonas* sp, *and Bacillus* sp. *The highest percentage of occurrence of the bacterial isolates was observed in Staphylococcus* sp *at 29.4 %* and *Pseudomonas* sp *at 23.0 %, while the least was obtained in Bacillus* sp *at 21.4 %. The antimicrobial susceptibility pattern of bacterial isolates shows that* Staphylococcus sp *was sensitive to Ciprofloxacin (34 mm), Azithromycin (30 mm), Gentamycin (31 mm),*

Cefuroxime (28 mm), Streptomycin (27 mm), Levofloxacin (24 mm), Amoxil (23 mm), Ceftazidime (23 mm), Erythromycin (22 mm) and Rifampicin (20 mm). Staphylococcus sp *(coagulase-negative) was sensitive to Levofloxacin (29 mm), Gentamycin (29 mm), Streptomycin (21 mm), Azithromycin (28 mm), Amoxil (27 mm), Erythromycin (26 mm), Ciprofloxacin (25 mm), Cefuroxime (25 mm), Ceftazidime (23 mm) and Rifampicin (20 mm).* Bacillus sp *was sensitive to Gentamycin (31 mm), Amoxil (28 mm), Ceftazidime (28 mm), Cefuroxime (28 mm), Azithromycin (27 mm), Ciprofloxacin (25 mm), Rifampicin (25mm) Streptomycin (23 mm), Levofloxacin (23 mm) and Erythromycin (22 mm). Pseudomonas* sp *was sensitive to Streptomycin (28 mm), Peflacine (28 mm) and Ofloxacin (27 mm). The bacterial growth may be due to the non-sterile nature of the equipment and the lubricant. Hence, there is a serious need to maintain aseptic conditions during manufacturing.*

Keywords: *Male condom, antibiogram, contamination, lubricant, bacteria.*

INTRODUCTION

A male condom is a sheath-shaped barrier device used by males during sexual intercourse to reduce the probability of pregnancy or a sexually transmitted infection (STI) (Robert *et al*., 2007). There are both male and female condoms used for every intercourse, but the male condom is the most popular one. The use of condoms has reduced pregnancy rates in women and the spread of sexually transmitted diseases such as Gonorrhea, Chlamydia, Trichomonas, Hepatitis B, and HIV/AIDs(Robert *et al*., 2007; WHO, 2019).

Most common male condoms are latex, consisting of a reservoir tip and base ring connected by a thin latex tube. There are top side and downside to each condom (Robert *et al*., 2007). When the condom bag is open, the side where the reservoir tip is pointing up, unimpeded, is the top. To apply, the

tip of the reservoir is pinched between two fingers while the ring is rolled over the erect penis.

Condoms to prevent STIs have been used since at least 1564.

Rubber condoms were invented in the 19th century, with latex condoms following shortly after in the early 20th century (Collier, 2007; Allen *et al*., 2001; McKibbin *et al*., 2000). It is on the World Health Organization's list of essential medicines (WHO, 2019). As of 2019, globally, around 21 % of those using birth control use a condom, making it the second most common method after female sterilization (24 %) (Kippley *et al*., 1996). The rate of condom use is highest in East and Southeast Asia, Europe, and North America (Hatcher *et al*., 2007).

The male condom is a thin cover that covers a man's erect penis before intercourse and works by forming a physical barrier that blocks semen from entering the body of a sexual partner (Robert *et al*., 2007; Speroff *et al*., 2011). Male condoms have the advantages of easy use, easy access, and few side effects. Individuals with allergies should use condoms made from a material other than latex. Male condoms come in different colours, types, materials, flavors, and textures.

The male condom offers more than 90 % protection against *Neisseria gonorrhoeae,* 50-90 % protection against *Chlamydia trachomatis* as well as *Treponema pallidum*, and 10-50 % protection against *Haemophilus ducreyi* (Holmes *et al*., 2004).

Condoms come in various textures, such as ribbed or studded, and are located on the inside, outside, or both sides of the condom. They also come in a bulb shape. These different textures and shapes are proposed to provide extra sensation to male or female partners (Thamban *et al*., 2005).

Condom sizes range from small to extra-large. It is important to choose a condom that fits properly. In addition to being uncomfortable, an ill-fitting condom can reduce its effectiveness, increasing the risk of pregnancy, Sexually transmitted diseases (STDs), and sexually transmitted infections (STIs). Latex has since been the material of choice for condom manufacturers due to its mobility, ease of production, and non–porous nature, making it an ideal barrier for semen introduction and sexually transmitted infection(STIs)

prevention (Santibenchakul *et al*., 2019).

Condoms function as barrier contraception, preventing contact between semen and the opposite genitalia. It also prevents direct skin–skin contact of the penile glans and the penis shaft and prevents contact with penile, vaginal, or anal secretions. Contamination of condoms can occur where the manufacturing environments are not hygienic, where the equipment and instruments are not sterile, and in poor packaging conditions. Microbial Contamination may also occur from unclean hands and contaminated surfaces that have not been completely disinfected. Some sources of microbial Contamination are air, water, humans, raw materials used, and lubrication. Therefore, this research aimed to isolate and identify bacteria associated with male condoms sold within the Ikot Ekpene metropolis and to carry out an antimicrobial susceptibility profile of the isolated bacteria.

MATERIALS AND METHOD

Materials

The materials and reagents employed for this research work include different brands of condoms, a weighing balance, distilled water, a beaker, Whatman filter paper, a measuring cylinder, a spatula, foil paper, paper tape, test tubes, a test-tube rack, disposable Petri dishes, a conical flask, a syringe, a wire loop, a glass slide, an autoclave, and an incubator.

STERILIZATION OF MATERIALS

All glassware used in this research was washed thoroughly, drained of excess water, and sterilized in a hot air oven at 160 ^{0}C for 1 hour. The media used was prepared according to the manufacturer's instructions and sterilized at 121 ^{0}C for 15 minutes.

METHOD

Sample Preparation

Different brands of male condoms were obtained from different pharmaceutical stores in Ikot Ekpene Local Government Area of Akwa Ibom State. The samples' manufacture and expiry dates were recorded, and they were taken to the microbiological laboratory for analysis.

SAMPLE PREPARATION

The laboratory working bench was disinfected with cotton wool soaked in 70 % alcohol. The condoms were aseptically transferred into sterile

10 ml peptone in a beaker labeled A, B, C, and D. The beakers were covered with foil paper for 30 minutes and vigorously shaken at intervals of 10 minutes.

CULTIVATION OF BACTERIA

Nutrient agar was prepared according to the manufacturer's instructions. It was sterilized by autoclaving at 121 ^{0}C for 15 minutes. After sterilization, the media was allowed to cool at 45 ^{0}C. After that, ten 10-fold serial dilutions were carried out on each condom suspension. Using the pour plate method, 1 ml of each sample suspension was introduced into sterile Petri dishes respectively, 15 ml of the molten nutrient agar was aseptically dispensed into it, and it was swirled to mix, then it was allowed to solidify. The plates were incubated invertedly at 37 ^{0}C for 24 hours. After 24 hours of incubation, visible colonies of bacteria were enumerated. Discrete colonies were subcultured onto a fresh medium and incubated. Pure colonies were introduced on nutrient agar slant, incubated for 24 hours, and then preserved in the refrigerator at 4 ^{0}C for further analysis.

CHARACTERIZATION OF BACTERIAL ISOLATES

To identify the characteristics, a visual inspection of the colonial appearance was carried out. The inspection was done by observing the colony's appearance, shape, edge, pigmentation, and elevation. Following this, a systematic series of biochemical tests were conducted to further characterize bacterial isolates: gram stain, spore stain, motility, oxidase, citrate, catalase, coagulase, urease, and sugar fermentation. Presumptive identification was done by comparing each isolate's colonial and biochemical features to a standard identification manual.

Antimicrobial Susceptibility Testing of Bacterial isolates

Sterile nutrient agar was prepared and allowed to solidify and surface dried. Using a sterile incubation loopful, the test organisms were picked and aseptically inoculated uniformly to cover the entire surfaces of the agar using streaking methods. Using sterilized forceps, the commercial antibiotic-sensitive discs were transferred onto the plates, labeled, and pressed gently to have firm contact with the surfaces of the agar, then incubated invertedly at 37 ^{0}C for 24 hours.

Observation of inhibition zones around the disc on plates was measured with a ruler in millimeters

(mm), and the level of the organism's sensitivity or resistance to the different disinfectants at different concentrations was measured as described by Collin and Lynes (2000). All tests were duplicated with discs soaked in distilled water, which served as a control (NCCL, 2000).

RESULT AND DISCUSSION

Result

Total Heterotrophic Bacterial Count of Different Samples.

Table 4.1 shows the total bacterial count of different samples. The result revealed total bacterial count of 2.0 x 10^4 Cfu/cm^2, followed by 2.9 x 10^4 Cfu/cm^2, 2.0 x 10^4 Cfu/cm^2 and 5.0 x 10^4 Cfu/cm^2 for sample A, B, C and D respectively.

Morphological and Biochemical Identification of Bacterial Isolate.

Table 4.2 shows the morphological and biochemical identification of bacterial isolates which revealed bacteria genera of the species *Staphylococcus sp*, *Staphylococcus sp* (Coagulase negative), *Pseudomonas sp* and *Bacillus sp*.

Percentage frequency of Occurrence of Bacterial Isolates.

Table 4.3 shows the percentage frequency of occurrence of bacterial isolates obtained from samples. The result revealed the highest percentage occurrence for *Staphylococcus sp* (Coagulase negative) at (29 %), followed by *Staphylococcus sp* at (26.2 %), *Pseudomonas sp* at (23 %) and *Bacillus sp* being the least at (21.4 %).

Antimicrobial Susceptibility Patterns of Bacterial Isolates from Different Samples.

Table 4.4 shows the antimicrobial susceptibility pattern of Gram positive and Gram negative bacteria of different samples. From the result *Staphylococcus sp* was sensitive to Ciprofloxacin (34 mm), Azithromycin (30 mm), Gentamycin (31 mm), Cefuroxime (28 mm), Streptomycin (27 mm), Levofloxacin (24 mm), Amoxil (23 mm), Ceftazidime (23 mm), Erythromycin (22 mm) and Rifampicin (20 mm). *Staphylococcus sp* was sensitive to Levofloxacin (29 mm), Gentamycin (29 mm), Streptomycin (21 mm), Azithromycin (28 mm), Amoxil (27 mm), Erythromycin (26 mm), Ciprofloxacin (25 mm), Cefuroxime (25 mm), Ceftazidime (23 mm) Rifampicin (20 mm). *Bacillus sp* was sensitive to

Gentamycin (31 mm), Amoxil (28 mm), Ceftazidime (28 mm), Cefuroxime (28mm), Azithromycin (27 mm), Ciprofloxacin (25 mm), Rifampicin (25 mm), Streptomycin (23 mm), Levofloxacin (23 mm) Erythromycin (22 mm). *Pseudomonas sp* was sensitive to Streptomycin (28 mm), Peflacine (28 mm) and Ofloxacin (27 mm).

Table 4.1: Mean Total Heterotrophic Bacterial Count of Different Condom Sample.

Samples	Total bacterial Count per surface area of the samples (Cfu/cm^2)
Sample A	2.7×10^4
Sample B	2.9×10^4
Sample C	2.0×10^4
Sample D	5.0×10^4

Table 4.2. Biochemical characteristics of bacteria isolates .

S/N	Biochemical Tests	Test Organisms		
		Bacillus sp	*Staphylococcus sp*	*Pseudomonas sp*
1	Gram reaction	+	+	-
2	Citrate	+	+	+
3	Oxidase	-	-	+
4	Catalase	+	+	+
5	VP	+	+	-
6	Urease	-	+	-
7	Indole	-	-	-
8	Spore	+	-	-

Key:

+ = Positive
- = Negative

Table 4.3: Percentage frequency of occurrence of bacterial Isolates.

Isolates	Frequency Occurrence	Percentage Occurrence (%)
Staphylococcus sp	33	26.2
Staphylococcus sp	37	29.4
Pseudomonas sp	29	23.0
Bacillus sp	27	21.4

Table 4.4: Antibiotics sensitivity profile of Gram – positive bacteria and their zones of clearance in (mm).

Isolates	RD	S	LEV	CN	AMX	AZM	CEFT	CPX	E
Staphylococcus sp	20	27	24	31	23	30	28	34	22
*Staphylococcus sp*c (coagulase negative)	20	29	33	29	27	28	25	25	26
Bacillus sp	25	23	23	31	28	27	28	25	22
Pseudomonas sp	28								

Antibiotics sensitivity profile of Gram – negative bacteria and their zones of clearance in (mm).

Isolates	**OFX**	**PEF**	**CFX**	**CEP**	**AU**	**CETZ**
Staphylococcus sp			23			
Staphylococcus sp (Coagulase negative)			23			
Bacillus sp			28			
Pseudomonas sp	27	28				

KEYS

S = Sensitive
I = Intermediate

R Resistance

Gram Positive Disc
Key 1.
CPX- Ciprofloxacin 34mm
S – Streptomycin 21mm
CN – Gentamycin 31mm
AMX – Amoxil 28mm
AZM – Azithromycin 28mm
CEPT –Ceftazicime 23mm
CPX- Ciprofloxacin 25
Erythromycin – 26mm
Gramm Negative Disc
OFX – Ofloxacin -27mm
PEF – Ampiclox 30µg
CEP – Levofloxacin 29
AU- Augmentin
CETZ- Ceftazidime 23mm

Keys 2:
S - Sensitive ≥ 18mm and above)
I - Intermediate (12mm and below)
R - Resistance (13 – 17mm)

DISCUSSION OF RESULTS

The bacteriological analysis and antibiogram of male condoms were carried out using standard microbiological methods. The highest bacterial count was observed in sample D (5.0 x 10^4 Cfu/cm2), followed by Sample B (2.9 x 10^4 Cfu/cm2), sample A (2.7 x 10^4 Cfu/cm2), and the least bacterial count was observed in sample C (2.0 x10^4 Cfu/cm2). This could be due to inadequate process control, poor standard of hygiene, and post-production contamination caused by incorrect handling and packaging of samples.

The cultural, microscopic and biochemical characteristics of bacterial isolates obtained from samples revealed the presence of three bacterial isolates, including *Staphylococcus sp*, *Bacillus* sp, *and*

Pseudomonas sp, respectively. The prevalence of *Staphylococcus sp*, a known pathogen associated with urinary tract infection (Gillespie *et al*., 1978), underscores the potential health risks associated with these bacterial isolates in male condoms.

The result also shows the percentage frequency of occurrence of the bacterial isolates obtained from samples .The highest percentage frequency of occurrence of the bacterial isolates was observed in *Staphylococcus sp* (29.4 %) followed by *Pseudomonas sp* (23.0 %) while the least was observed in *Bacillus sp* (21.4 %). This variation in the percentage frequency among the different brands might be influenced by the manufacturing date and expiry date of samples as well as the type of lubricant used on the surface of the condom and environmental factors, highlighting the need for standardized manufacturing processes to ensure consistent quality.

The results of the antibiotics susceptibility pattern of bacterial isolates show that *Staphylococcus sp* was sensitive to Ciprofloxacin (34 mm), Azithromycin (30 mm), Gentamycin (31 mm), Cefuroxime (28 mm), Streptomycin (27 mm), Levofloxacin (24mm), Amoxil (23 mm), Ceftazidime (23 mm), Erythromycin (22 mm) and Rifampicin (20mm). *Staphylococcus sp* (Coagulase negative) was sensitive to Levofloxacin (29 mm), Gentamycin (29 mm), Streptomycin (21 mm), Azithromycin (28mm), Amoxil (27 mm), Erythromycin (26 mm), Ciprofloxacin (25 mm), Cefuroxime (25 mm), Ceftazidime (23 mm) Rifampicin (20 mm). *Bacillus sp* was sensitive to Gentamycin (31mm), Amoxil (28 mm), Ceftazidime (28 mm), Cefuroxime (28 mm), Azithromycin (27 mm), Ciprofloxacin (25mm), Rifampicin (25 mm) Streptomycin (23 mm), Levofloxacin (23 mm) and Erythromycin (22 mm). *Pseudomonas sp* was sensitive to Streptomycin (28 mm), followed by Peflacine (28 mm) and Ofloxacin (27 mm). The antibiotic profile illustrates the isolates' sensitivity pattern to various antibiotics classes. Gentamycin is an aminoglycoside mainly directed at treating infections caused by aerobic Gram-negative bacteria like *Pseudomonas*. Ciprofloxacin is the third generation antibiotics and is reported to be frequently used for the treatment of urinary tract infection

CONCLUSION AND RECOMMENDATION

CONCLUSION

The study highlights bacterial contamination in some commercially available male condoms and the possibility of health hazards. In light of this finding, it is necessary to consider seriously the maintenance of the aseptic technique during manufacturing and its delivery package. Treatment of packed male condoms with a low dose of Gamma rays can be used as an efficient method for sterilization before distribution, keeping in mind that condoms are one of the best methods of contraception as they prevent unwanted pregnancy and sexually transmitted infections (STIs).

RECOMMENDATION

From the study, the following

recommendations are made;

- Condom manufacturers should consider maintaining aseptic conditions during the manufacturing of the condom and its delivery package.
- Condom manufacturers should meet the regulatory requirements regarding product quality and quality control management.
- Condom users should not expose it to air for longer before use to avoid attracting air microbes.

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