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Original Research Article

Bacterial Contaminants Associated with Female Handbags and Their Antibiotic Susceptibility Profile

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Abstract

Fomite is an inanimate object or substance that could serve as a vehicle for transmission of infectious organisms amongst individuals. A large number of factors may affect the contamination rate of fomite such as moisture, consistent use and overall cleanliness. Fomites that are found in public places, restaurants, hotels, hospitals and restrooms may include among others handbags, mobile phones, money, door handles or knobs of showers, conveniences, faucets and toilet seats, chairs, lockers, sink and tables. Ladies handbags are multipurpose personal gadgets which may usually habour several kinds of microorganisms such as bacteria. The presence of viable pathogenic bacteria on inanimate entities had been reported by earlier investigators. In this study, a total of one hundred (100) handbags from female undergraduate Microbiology students of Gombe State University (GSU), were investigated for bacterial contaminants and their resistance or otherwise to some commercial antibiotics using standard Microbiology procedures. The results obtained revealed the presence of six (6) different bacterial species, namely *Staphylococcus aureus, Escherichia coli, Proteus mirabilis, Pseudomonas aeruginosa, Klebsiella pneumoniae* and *Bacillus subtilis*. The antibiotic sensitivity test showed that all the six (6) bacteria were sensitive to Pefloxacin while five isolates (*S. aureus, E. coli, P. mirabilis, K. pneumoniae* and *Bacillus subtilis*) , two isolates (*B. subtilis* and *P. mirabilis*) and another two isolates (*K. pneumoniae and E. coli*) were sensitive to chloramphenicol, amoxicillin and streptomycin, respectively. In conclusion, high level of bacterial contaminants were observed from the studied handbags and found some of the contaminants resistant to the tested antibiotics hence, appropriate use of effective disinfectants is highly encouraged to reduce the magnitude of bacterial contaminants and likelihood of transmitting drug recalcitrant organisms.

Keywords: Handbags, bacterial contaminants, susceptibility test, antibiotics, resistance.

INTRODUCTION

A fomite is any inanimate object or substance that could serve as a vehicle of transmitting infectious organisms amongst individuals [1, 2]. Many factors may affect the contamination rate of fomite such as moisture, consistent use and overall cleanliness. Fomites that are found in public places, restaurants, hotels, hospitals and restrooms may include among others hand bags, mobile phones, money, door handles or knobs of showers, conveniences, faucets and toilet seats, chairs, lockers, sink and tables [1, 3, 4]. It is generally believed that the risk associated with the spread of diseases via fomites is measured by the rate of site contamination and exposure; likelihood of transfer of the infectious agents to susceptible individuals; level of pathogens excreted by the host; immune-competency of the persons in contact; virulence of the organism; the practice of control measures such as disinfectant use and personal hygiene [1, 2].

As a multipurpose personal gadget, a female handbag (HB) may usually habour various types of microorganisms such as bacteria. The presence of viable pathogenic bacteria on inanimate entities had been reported by earlier investigators [5]. Approximately 80% of infections are transmitted via hand contact or contact with other objects. A wide range of gram negative bacteria and Gram-positive cocci have been reported from the daily used gadgets such as stethoscopes, computer, mobile phones and the rest [6].

Ladies Handbag (HB) may serve as a favourable environment for the proliferation of microorganisms mainly due to the nature in which they are used [7]. These bags are known to be used for carrying mobile phones and cosmetic items like face creams, lip stick, powder, partially consumed food items as well as fresh/used diapers and milk bottles in the case of nursing mothers [8]. In order to promote

more awareness on microbial contaminants, especially those with drug resistance potential, this study was carried out to assess the level of bacterial contaminants associated with female handbags and their sensitivity or otherwise to some selected conventional antibiotics.

MATERIALS AND METHODS

Collection and Preparation of Samples

A total of one hundred (100) samples were collected from handbags of Microbiology undergraduate female students of Gombe State University. Sterile swab sticks were moistened with sterile normal saline and swabbed the inner surface of each bag. The samples were taken to the Microbiology Laboratory for analysis.

Serial dilution

The samples were subjected to serial dilution where each swab stick was placed into a test tube containing 9 ml of sterile peptone water and thoroughly mixed to obtain a stock dilution. One (1) ml was taken from this dilution and serially diluted in test tubes each containing 9 ml of sterile peptone water to obtain the next dilutions up to 10^{-5} as described by Pelczar *et al*., 2006 [9].

Isolation of Bacteria

Pour plate technique was employed for all bacterial isolations according to Cheesbrough, 2000 [10]. An aliquot of 0.1 ml of each dilution was dispensed in a sterile petri dish and poured Nutrient agar prepared according to manufacturer's recommendations. The plates were well-swirled, allowed to solidify and incubated for 24 hours at 37^{o}C. Colonies of different morphological appearances were sub-cultured onto MacConkey agar plates prepared according to manufacturer's instruction and incubated under the same conditions.

Identification of Bacteria

The bacterial isolates were identified based on cultural characteristics, Gram staining and biochemical tests [11, 12]. The various biochemical tests employed included coagulase test, catalase test, citrate utilization test, indole test, motility test, triple sugar iron test and oxidase test.

Antibiotic Sensitivity Testing

Antibiotic sensitivity test of the isolates was performed on Mueller-Hinton Agar (MHA) plates according to Yusha'u *et al*., 2008 [13]. Colonies of each isolate were emulsified in test tubes containing 9 ml of normal saline and matched with McFarland turbidity standard. A sterile swab stick was immersed into the standardized bacterial suspension, squeezed against the sides of the tubes to remove excess liquid and swabbed on the surfaces of prepared Mueller Hinton Agar plates. The plates were allowed to stand for 4-5 minutes and applied the antibiotic discs of Chloramphenicol (30 µg), Pefloxacin (10 µg), Streptomycin (30 µg) and Amoxicillin (30 µg).The plates were incubated for 24 hours at 37 ^{0}C and measured the zones of growth inhibition.

RESULTS AND DISCUSSION

A total of one hundred (100) samples were collected from handbags of female microbiology undergraduate students of Gombe State University from various levels (100, 200 and 400) and studied for bacterial contaminants. Using Gram staining reactions and different biochemical tests, six (6) bacterial species were identified including *Staphylococcus aureus, Escherichia coli, Proteus mirabilis, Pseudomonas aeruginosa, Klebsiella pneumoniae*, and *Bacillus subtilis* (Table-1).

Table-1: Gram Reaction and Biochemical Characteristics of the Bacteria

Gram Reaction	Ca	Ox	In	Co	Mo	Ci	La	Gl	Ga	H_2S	Organisms
Gram +ve	+	-	-	+	-	+	+	+	-	-	*S. aureus*
Gram -ve	+	-	+	-	+	-	+	+	+	-	*E. coli*
Gram -ve	+	-	-	-	-	-	+	+	+	-	*K. pneumonia*
Gram -ve	+	+	-	-	+	+	-	+	+	+	*P. mirabilis*
Gram -ve	+	+	-	-	+	+	-	+	-	-	*P. aeruginosa*
Gram +ve	+	-	-	-	+	+	-	+	-	-	*B. subtilis*

Key: Ca=Catalase, Co=Coagulase, In=Indole, Ci=Citrate, Mo=Motility, Ox=Oxidase, La=Lactose, Gl=Glucose, H2S= Hydrogen sulphide, +=Positive, -=Negative

The study revealed overall high bacterial contaminants in the handbags of 100L students (Table-2) followed by 200L (Table-3) and then 400L students (Table-4). Moreover, among the bacteria isolated, *S. aureus* has the highest percentage occurrence followed by *E. coli*, *K. pneumoniae*, *P. mirabilis*, *P. aeruginosa* and then *B. subtilis* in each level studied.

Table-2: Occurrence of bacterial contaminants from 100 level students' handbags

S/No	Organisms	Number of occurrence	Percentage (%)
1	*Staphylococcus aureus*	22	38.6
2	*Escherichia coli*	10	17.5
3	*Klebsiella pneumoniae*	9	15.8
4	*Proteus mirabilis*	8	14.0
5	*Pseudomonas aeruginosa*	5	8.8
6	*Bacillus subtilis*	3	5.3
	Total	**57**	**100**

Table-3: Occurrence of bacterial contaminants from 200 level students' handbags

S/No	Organisms	Number of occurrence	Percentage (%)
1	*S. aureus*	9	28.1
2	*E. coli*	7	21.9
3	*K. pneumoniae*	6	18.8
4	*P. mirabilis*	5	15.6
5	*P. aeruginosa*	4	12.5
6	*B. subtilis*	1	3.1
	Total	**32**	**100**

Table-4: Occurrence of bacterial contaminants from 300 level students' handbags

S/No	Organisms	Number of occurrence	Percentage (%)
1	*S. aureus*	6	33.3
2	*E. coli*	5	27.8
3	*K. pneumoniae*	4	22.2
4	*P. mirabilis*	2	11.1
5	*P. aeruginosa*	1	5.6
6	*B. subtilis*	0	0
	Total	**18**	**100**

Table-5 shows the diameters of zone of growth inhibition of the antibiotics used including Pefloxacin, Chloramphenicol, Amoxicillin and Streptomycin. All the bacterial species were found sensitive to pefloxacin, five were sensitive to chloramphenicol, four were resistant to amoxicillin and five were resistant to streptomycin.

Table-5: Antibiotic susceptibility testing of the Bacterial contaminants

Bacteria	Antibiotics and Zones of growth inhibition (mm)											
	PEF			CHL			AM			ST		
	Level			Level			Level			Level		
	100	200	400	100	200	400	100	200	400	100	200	400
S. aureus	28	25	32	25	27	25.2	15	10	17	13	6	12.5
E. coli	25	24	24	30	28	34	11	9	12	21	24	21.2
K. pneumoniae	26	30	28	25	22.8	30	8.5	12	9	28	32	28
P. mirabilis	26	25	22	32	27	21.5	28	13	25	10	4	6
P. aeruginosa	31.4	26	22	12	10	11	13	11	13	12	13	8
B. subtilis	22.6	19	NA	24	22	NA	18	8	NA	20	22	NA

PEF=Pefloxacin, CHL=Chloramphenicol, AM=Amoxicillin, ST=Streptomycin, S=Sensitive, R=Resistant. Zone of inhibition: ≤13 mm=Resistance, ≥14 mm= Sensitive, NA=Not applicable

Drugs (antibiotics) resistance has significantly increased among pathogens perhaps as a result of versatile microbial genetic system exposed to the pressure of numerous control agent(s) [14, 15]. Drug resistance is acquired by bacteria through various mechanisms including mutations and exchange of genetic information involving plasmids or transposons and chromosome which result in the alterations of cellular membranes of the target cell. These phenomena impede the entry of control agents or develop substitute enzymes that are not the key drugs target or may entirely release drug degrading enzymes [14, 16, 17].

Handbags could be considered as a vehicle for the spread of pathogens from one individual to another. Consequently, personal hygiene and decontamination of these bags is highly encouraged. The presence of Gram- negative rods particularly the *E. coli* as a prominent coliform bacterium suggests the possibility of the presence of faecal contamination in the handbags.

Gram negative sepsis is most commonly caused by *E. coli*, *Klebsiella* spp, *Enterobacter* spp and *Pseudomonas aeruginosa* [18]. Despite differences in the study subjects, socio-economic status and many other factors, the bacteria observed in our study as shown in Tables 2-4 are very similar with the report of previous study by Jaya Chandra *et al*., 2014 [19]. Moreover, contrary to our study in which *Staphylococcus aureus* and *Escherichia coli* were observed as the most occurring bacteria from all the handbags, *Micrococcus* and *Staphylococcus* spp were the most dominant bacteria according to a report by Susheela *et al.*, 2015 [20].

The diameters of the zones of growth inhibition of the antibiotics tested (Table-5) were compared with the zone interpretation chart to determine the sensitivity or otherwise of the bacteria [7]. It was observed that all the bacterial contaminants were sensitive to Pefloxacin and also Chloramphenicol except *P. aeruginosa* whereas *S. aureus, E. coli, K. pneumoniae and P. aeruginosa* were resistant to Amoxicillin which inhibited *P. mirabilis*. Moreover, *P. aeruginosa, P. mirabilis, B. subtilis and S. aureus* were found to be resistant to Streptomycin which was active against *K. pneumoniae and E. coli*.

CONCLUSION

At the end of this research, different bacterial contaminants were isolated from the handbags of female students and identified as *S. aureus, E. coli, K. pneumoniae, P. mirabilis, P. aeruginosa* and *B. subtilis*. The antibiotic sensitivity profile of these bacteria revealed that only Pefloxacin was active against all the six (6) isolates, one (1) isolate was resistant to Chloramphenicol, four (4) were resistant to amoxicillin and another four (4) isolates were resistant to Streptomycin. Hence, appropriate use of effective disinfectants is highly encouraged to reduce the magnitude of bacterial contaminants and possible transmission of drug recalcitrant organisms.

REFERENCES

1. Ngonda, F. (2017). Assessment of bacterial contamination of toilets and bathroom doors handle/knobs at Daeyang Luke hospital. *Pharmaceutical and Biological Evaluations*, *4*(4), 193-197.
2. Reynolds, K. A. (2005). Hygiene of environmental surfaces. *International Journal of Environmental Health Research*, *15*(3), 225-234.
3. Bright, K. R., Boone, S. A., & Gerba, C. P. (2010). Occurrence of bacteria and viruses on elementary classroom surfaces and the potential role of classroom hygiene in the spread of infectious diseases. *The Journal of School Nursing*, *26*(1), 33-41.
4. Sattar, S. A. (2001). Survival of microorganisms on animate and inanimate surfaces and their disinfection. *Disinfection, sterilization and antisepsis: principles and practices in healthcare facilities. Association for Professionals in Infection Control and Epidemiology, Inc., Washington, DC*, 195-205.
5. Al-Ghamdi, A. K., Ashshi, S. A. A., Faidah, H., Shukri, H., & Jiman-Fatani, A. A. (2011). Bacterial contamination of computer keyboards and mice, elevator buttons and shopping carts. *African Journal of Microbiology Research*, *5*(23), 3998-4003.
6. Mackie, M. C., Collee, J. G., Fraser, A.G., Marnion, B. P., & Simmons, A. (1999). Practical Medical Microbiology. Tests for identification of bacteria. 14th Edition. Churchill living stone publishers, UK.
7. Bauer, A. W., Kirby, W. M. M., Sherris, J. C., & Turck, M. (1966). Antibiotic susceptibility testing by a standardized single disk method. *American journal of clinical pathology*, *45*(4_ts), 493-496.
8. Oluduro, A. O., Ubani, A. O., & Ofoezie, I. E. (2012). Bacterial assessment of electronic hardware user interfaces in Ile-Ife, Nigeria. *Revista de Ciências Farmacêuticas Básica e Aplicada*, *32*(3), 323-334.
9. Pelczar, M. J., Chan, E. C., & Kruz, N. R. (2006): Microbiology. 5th edition. Teta McGraw-Hill publishing Company Ltd. New Delhi.
10. Cheesbrough, M. (2000). Medical Laboratory Manual for tropical countries co- published by Tropical Health Technology. *Microbiology*, 2, 225-288.
11. Cheesbrough, M. (2006). *District laboratory practice in tropical countries*. Cambridge university press.
12. Jonathan, M., Mustapha, A., Moi, I. M., Lawal, G., & Abimbola, O. (2016). Antibacterial susceptibility spectrum of some gram negative bacteria from suspected Otitis media patients. *African Journal of Microbiology Research*, *10*(32), 1280-1285.
13. Yusha'u, M., Garba, L., & Shamsuddeen, U. (2008). In vitro inhibitory activity of garlic and ginger extracts on some respiratory tract isolates of gram-negative organisms. *International Journal of Biomedical and Health Sciences*, *4*(2).
14. Garba, L., Yusha'u, M., Abdullahi, M. M., Abubakar, M. U., Inuwa, A. B., Isa, S., & Adamu, M. T. (2018). Effectiveness of Double Discs Synergy Test in the Confirmation of Extended Spectrum β-lactamase (ESβL) Production. *Journal of Biochemistry, Microbiology and Biotechnology*, *6*(2), 15-18.
15. Rout, S., Dubey, D., Panigrahy, R., & Padhy, R. N. (2014). Surveillance of extended-spectrum β-lactamase producing bacteria in an Indian teaching hospital. *Journal of Taibah University Medical Sciences*, *9*(4), 274-281.
16. Rath, S., Dubey, D., Sahu, M. C., & Padhy, R. N. (2014). Surveillance of ESBL producing multidrug resistant Escherichia coli in a teaching hospital in India. *Asian Pacific journal of tropical*

disease, *4*(2), 140-149.
17. Shu'aibu, I., Hadiza, J. A., Yusha'u, M., Kabiru, M. Y., Ahmad, M. M., Lawal, G., ... & Khairiyya, M. (2018). Assessment of foods and drinks for the presence of extended spectrum beta lactamase (ESBL) producing bacteria in Gombe Metropolis, Nigeria. *Advanced Science Letters*, *24*(5), 3646-3651.
18. Bone, R. C. (1993). Gram-negative sepsis: a dilemma of modern medicine. *Clinical Microbiology Reviews*, *6*(1), 57-68.
19. Chandra, J. T., Sowndarya, A. J., Sirisha, I., & Sharma, Y. V. (2014). How Safe Ladies Hand Bags Are: A Microbiological View. *Biology and Medicine*, *6*(3), 212.
20. Biranjia-Hurdoyal, S. D., Deerpaul, S., & Permal, G. K. (2015). A study to investigate the importance of purses as fomites. *Advanced biomedical research*, *4*.