Original Article

Bacterial Pathogens in Female Handbags and Their Antibiotic Susceptibility Profile

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Abstract

Background: Besides being present in the water, air, soil, and food, bacteria may also be found in the organisms of animals, including humans and plants. Bacteria can be found almost everywhere. A female handbag is a multifunctional personal item that can harbor various germs, including bacteria. Investigators had previously documented the existence of live harmful germs on inanimate objects. This study aims to examine the number of bacterial contaminants linked to female purses and their susceptibility to common antibiotics. **Methods:** This research is a quasi-experimental investigation conducted in April 2023. 100 samples were obtained from the purses (Female Handbags) of female undergraduate students at Tishk International University in April 2023. An interview with students through a structured questionnaire was done. For that reason, a specially designed questionnaire was prepared. The samples were obtained by completely revolving a cotton swab before being sent to the Microbiology laboratory for examination. **Results:** Following the analysis of 100 samples, 8 colonies were isolated. Seven different types of bacteria were found in these colonies: *Schizococcus coli*, *Pseudogenes aeruginosa*, *Streptococcus pyogenes*, *Staphylococcus aureus*, *Enterobacter spp*., and *Staphylococcus epidermidis*c. Each and every one of the discovered species exhibited susceptibility to either chloramphenicol or colistin. As an example, three species were resistant to ciprofloxacin, but four species were resistant to amoxicillin. **Conclusions:** Handbags could be a means of transmitting infections through contamination with types of bacteria: *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Enterobacter spp*., *Enterococcus spp*., etc. Resistant to a number of antibiotics: Amoxicillin was resistant to four of the bacteria, while ciprofloxacin was resistant to three of the bacteria.

Keywords: Handbag, Contamination, Bacteria, and Antibiotic.

Introduction

For a healthy existence, microbial hygiene requirements are required. It is common for people to believe that germs can only be detected in research laboratories, hospitals, and clinics. This misconception gives people a false feeling of security while they are in other environments. Health problems might arise due to insufficient comprehension of bacterial habitats. Actually, over 80 percent of infections are transmitted by direct physical touch with other individuals or objects. The reference is from the study conducted by Al-Ghamdi and colleagues in 2011[1] Bacteria may be found in a variety of environments, including the water, air, soil, food, and live creatures

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(including people). It is commonly known that inanimate things can transfer bacteria from their environment. Numerous bacteria can spread through infected phones and computer keyboards, including Gram-positive cocci (Staphylococcus spp., Micrococcus spp.), Gram-negative bacteria, and spore-forming rods (Bacillus spp.).[2] These microorganisms can spread to food or the human body once they are attached, where they can proliferate even more. Furthermore, the survival of several pathogens on the same surface may be impacted by the biofilm development of a single bacterial agent.[3]

If surfaces are not treated with Disinfection or sterilization, many harmful microorganisms can survive there for extended periods of time.[4] Depending on the surrounding environmental factors, pathogens can stay infectious on surfaces for several days or even weeks at a time.[5-7] A fomite is any inanimate item or material that has the potential to spread infectious germs between people.[8-10] Moisture, continuous usage, and general hygiene can all impact the infection rate of fomite. Fomites are things like door handles or knobs of showers, lockers, purses, cell phones, cash, conveniences, faucets and toilet seats, chairs, sinks, and tables that are frequently found in public places like restaurants, hotels, hospitals, and restrooms.[9,11,12] The contamination and exposure rate of the site, the likelihood of infectious agents being transferred to susceptible individuals, the quantity of pathogens excreted by the host, the immune competence of those in contact, the virulence of the organism, and the application of control measures like the use of disinfectants and personal hygiene are all thought to influence the risk of disease transmission through fomites.[8,9,13-15]

A female handbag (HB) is a multifunctional personal item that can harbor a variety of germs, including bacteria. Investigators had previously documented the existence of live harmful germs on inanimate objects.[1] Approximately 80% of illnesses are transmitted by direct touch or contact with other objects. Both Gram-positive and Gram-negative cocci are present in many commonplace objects, including computers, mobile phones, stethoscopes, and other gadgets. In Green and Goldman[16] owing to its usage, a ladies' handbag (HB) may offer an environment that is favourable for the growth of microorganisms.[16] These bags are often used to carry various objects such as mobile phones, cosmetics including face creams, lip gloss, and powder, partially eaten food items, and for nursing women, new or used diapers and milk bottles.[17-19] In an effort to raise awareness about microbial pollutants, particularly those with the potential to develop antibiotic resistance, this study examined the amount of bacterial contaminants linked to female purses and their susceptibility to the common antibiotics.

Objectives

− To evaluate bacterial contamination of female handbags.
− To evaluate the antibiotic susceptibility test for obtained bacterial species.
− To raise awareness for this kind of contamination.

Methodology

Collection and Preparation of Samples

This is a quasi-experimental study that was done during April of 2023. The quasi-experimental design allowed us to conduct the study in a real-world setting, which is essential for understanding the bacterial contamination in everyday objects like handbags. From the purses (Female Handbags) of undergraduate female students at Tishk International University, a total of one hundred (100) specimens were taken during the month of April in the year 2023. An interview with students through a structured questionnaire was done; for that reason, a specially designed questionnaire was prepared. This technique was chosen to ensure the study could effectively capture a variety of handbag types and usage patterns, which are critical for understanding the potential for bacterial contamination.

The samples were taken by swabbing the inside surface of each bag with a cotton swab that had been saturated with sterile normal saline and then completely rotating the cotton swab. The types of inner bags considered were velvet, Leather, Polyester, and Nylon. The samples were taken to the microbiology lab and cultivated on Blood agar, MacConkey agar, Mannitol salt agar, and nutrient agar, in that order. For a whole day at 37°C, swabs were grown both aerobically and anaerobically on nutritional broth, nutrient agar, MacConkey agar, and blood agar media. The isolates were found using conventional methods based on phenotypic, cultural, and biochemical traits.[20]

Antibiotic Sensitivity Testing

According to Yusha'u *et al*.[21] the testing of antibiotic sensitivity of the isolates was carried out on plates made of Mueller Hinton Agar (MHA). By emulsifying the colonies of each isolate in 9 milliliters of normal saline, we were able to evaluate their turbidity in comparison to the McFarland standard. A sterile swab stick was pressed up against the tubes' walls to wipe away any extra liquid after the tubes had been dipped into the standardised bacterial solution. Subsequently, the surfaces of Mueller Hinton Agar plates that had been used before experiment B were swabbed with the stick. The antibiotic discs of Ciprofloxacin, Ofloxacin, Ceftriaxone, Ceftazidime, Gentamicin, Amikacin, Chloramphenicol, Meropenem, Imipenem, Piperacillin, Colistin, were applied after the plates had been let to stand for four to five minutes. After a 24-hour incubation period at 37°C, the growth inhibition zones on the plates were inspected. A ruler determined the zone of inhibition, and according to a specific standard chart, the sensitivity, intermediate, and resistance were determined.[22]

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS), Microsoft Office Excel, and Graph Pad Prism were used to help with the data input and analysis procedures. The results are expressed using descriptive statistics, which include frequencies, percentages, and the mean plus or

minus the standard error of the mean.

Ethical Considerations

The participation of individuals in our research was entirely voluntary. Participants had the option to withdraw from the study at any moment, without being required to justify. All data collected for this study was acquired anonymously, and participant anonymity was ensured by excluding their roll numbers in the publication.

Results

One hundred (100) samples were obtained from the purses (female handbags) of Tishk International University's undergraduate female students. These samples were examined to determine whether or not they contained any bacterial contamination. 48 bacterial colonies were isolated and seven (7) bacterial species were discovered: *Escherichia coli, Staphylococcus aureus, Enterobacter spp., Enterococcus spp., Streptococcus pyogenes, Pseudogenes aeruginosa, and Staphylococcus epidermidis.*

In (Table 1) there are the positive samples according to the types of the inner lining of the bag which are divided into rough and smooth surfaces and materials made of (Velvet, Leather, Polyester, and Nylon). In this particular instance, it was discovered that leather bags had the greatest incidence of bacterial contamination, and the rough surfaces had a higher level of bacterial contamination.

Table 1: An Examination of the Impact that the Inside Lining of the Bags Had on the Colonization of Bacteria.

Types of Bags	Smooth Surface Positive (%)	Rough Surface Positive (%)	Total Number Positive (%)
Velvet	3 (6.25%)	7 (14.5%)	10 (21%)
Leather	7 (14.5%)	19 (39.8%)	26 (54%)
Polyester and Nylon	4(8.33%)	8(16.7%)	12 (25%)
Total (%)	14 (29%)	34 (71%)	48 (100%)

Table 2 shows the sizes of the zones of growth inhibition caused by the antibiotics that were utilized, including Pefloxacin, Ciprofloxacin, Ofloxacin, Ceftriaxone, Ceftazidime, Gentamicin, Amikacin, Chloramphenicol, Meropenem, Imipenem, Piperacillin, and Colistin. Colistin shown sensitivity against all bacterial species, whereas chloramphenicol showed sensitivity against three species. Conversely, four species displayed resistance to amoxicillin, while three species were resistant to Ciprofloxacin. A questionnaire, which is designed for this study was given to each of the participants in this study there are several questions such as how long do you use this bag, the places that you go most, do you clean your handbag, etc. Furthermore, most participants carry in their handbags Makeup, Money, Phones, Wallet, Keys, Food, masks, and others routinely use them. Sometimes, they carry another person's stuff in their bags.

Table 2: Bacterial Contaminants were Tested for Antibiotic Susceptibility.

Antibiotics	*Sensitive No.	*Intermediate No.	*Resistant No.
Ciprofloxacin	8	17	23
Ceftriaxone	12	20	16
Ceftazidime	14	33	1
Gentamicin	10	29	13
Amikacin	7	31	10
Chloramphenicol	31	17	0
Cefoperazone	29	16	3
Meropenem	39	9	0
Imipenem	32	15	1
Piperacillin	27	19	2
Colistin	41	7	0

* Table displaying interpretative criteria for zone diameter measurements in order to determine the sensitivity and resistance status of antibiotics using the Disk Diffusion technique (14).

As shown in the Bar chart (Figure 1) the intermediate zone is nearly equal to the sensitive zone of inhibition.

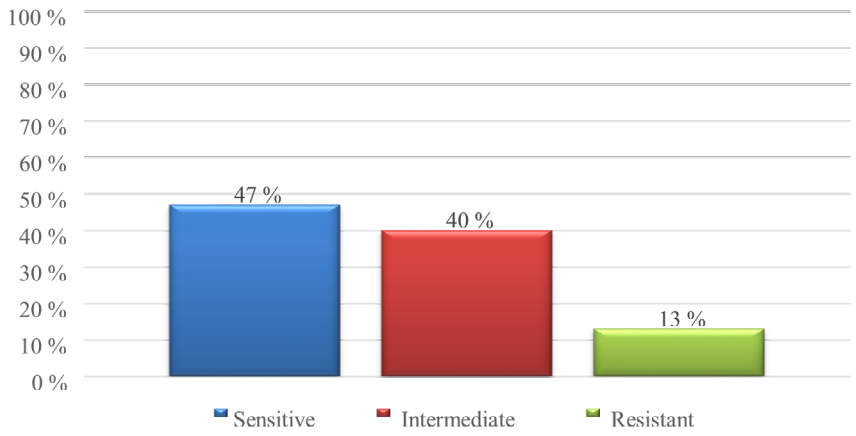

Figure 1: Shows the Zones of Inhibitions According to a Specific Standard Chart (14).

Discussion

The emergence of bacterial infections in humans is increasing, similarly, the occurrence of community infections is increasing.[23] The bio-contamination of surfaces of various products and equipment used by the public is one of the primary causes of epidemics acquired from the environment and nosocomial illnesses. Contaminated surfaces act as fomites, spreading infectious organisms between inanimate and living things, and serve as a reservoir for pathogens in the infectious chain, from which they spread further by hand-to-hand transmission.[12] Weber[24] found that the potential of the disease to spread further is determined by the interplay between the host, pathogenic agent, and the environment. [24] The transmission of germs to surfaces and from hands to mouth plays a crucial role in the spread of illness.[25,26]

In our study seven (7) bacterial species were discovered: *Escherichia coli, Staphylococcus aureus, Enterobacter spp., Enterococcus spp., Streptococcus pyogenes, Pseudogenes aeruginosa, and Staphylococcus Epidermidis*. Multiple studies have shown that handbags may serve as a means for transmitting diseases between individuals. Therefore, it is strongly recommended to practice personal hygiene and decontaminate these bags. The identification of Gram-negative rods, namely E. coli, as a prevalent coliform bacteria indicates the potential existence of fecal contamination in the handbags. Gram-negative sepsis is mostly caused by *E. coli*, *Klebsiella spp*., *Enterobacter spp*., and *Pseudomonas aeruginosa*.[27] In this study, All the bacterial species were found to be sensitive to Colistin, three were sensitive to chloramphenicol, four were resistant to amoxicillin, and three were resistant to Ciprofloxacin. In the research conducted by Yusha'u *et al*.[21], they made a diagnosis. In terms of antibiotic susceptibility testing, chloramphenicol shown a 93.5% effectiveness against Gram-positive bacteria, whereas amikacin showed a 63.9% effectiveness against Gram-negative bacteria. Out of the total of 47 S. aureus samples, it was discovered that two of them were resistant to methicillin, often known as MRSA. Amoxycillin resistance was observed in 89.4% of S. aureus. S. aureus exhibits resistance to β-lactam antibiotics due to its synthesis of penicillinase, an enzyme that catalyzes the hydrolysis of the β-lactam ring.[28] Rough surfaces and grooved materials provide a greater surface area compared to smooth surfaces, which potentially promote bacterial adherence by providing hidden spaces.

Conclusions and Recommendations

Conclusions

Several bacterial contaminants were isolated and detected from female students' handbags: *Staphylococcus aureus, Staphylococcus epidermidis, Enterobacter spp., Enterococcus spp., Streptococcus pyogenes, Pseudogenes aeruginosa,* and *Streptococcus pyogenes.* All the bacteria were sensitive to Colistin, out of the total, three bacteria exhibited sensitivity to chloramphenicol, while four bacteria showed resistance to amoxicillin. Additionally, three bacteria were found to be resistant to Ciprofloxacin, as shown by their antibiotic sensitivity profile.

Recommendations

As a result, regular disinfectant use is strongly advised to reduce bacterial contamination and the spread of drug-resistant species. Hand and handbag hygiene should be performed to prevent infections from colonizing.

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QUESTIONNAIRE

Part A: Demographic Information

1. Age

- Under 18
- 18-24
- 25-34
- 35-44
- 45 and above

2. Educational Level

- Undergraduate
- Graduate
- Postgraduate
- Other (Please specify): _____

3. Major/Field of Study

1. Nursing
2. Dentistry
3. Medical Lab Technology
4. Physics
5. Other (Please specify): _____

Part B: Handbag Usage Habits

4. How Often do you Use Your Handbag?

1. Daily
2. A few times a week
3. Once a week
4. Less frequently

5. What Type of Material is Your Handbag Made of? (You may select more than one)

1. Leather
2. Polyester
3. Nylon
4. Velvet
5. Other (Please specify): _____

6. What Type of Inner Lining does Your Handbag have?

1. Smooth surface
2. Rough surface

7. How Long have you been Using this Handbag?

1. Less than 6 months
2. 6 months to 1 year
3. 1-2 years
4. More than 2 years

8. How often do you Clean Your Handbag?

5. Daily
6. Weekly
7. Monthly
8. Rarely/Never

Part C: Handbag Contents

9. What Items do you Usually Carry in your Handbag? (You may select more than one)

1. Mobile phone
2. Wallet
3. Makeup (Lipstick, Powder, etc.)
4. Food/Snacks
5. Keys
6. Books/Notebooks
7. Diapers (if applicable)
8. Water bottle
9. Masks
10. Other (Please specify): _____

10. Do you Ever Carry Another Person's Belongings in Your Handbag?

1. Yes
2. No

11. Where do You Usually Place Your Handbag when Not in Use? (You may select more than one)

1. On the floor
2. On a chair or table
3. In a locker
4. In a bag compartment
5. Other (Please specify): _____

Part D: Awareness and Hygiene Practices

12. Are You Aware that Handbags can Harbor Bacteria? –

1. [ ] Yes
2. [ ] No

13. Do You Take any Specific Measures to Prevent Bacterial Contamination in Your Handbag?

1. Yes (Please specify): _____
2. No

14. Do you Believe that Bacteria Found on Handbags can Contribute to Illness?

1. Yes
2. No

15. Would You Consider Cleaning Your Handbag more Frequently if You Knew it could Reduce Bacterial Contamination?

1. Yes
2. No