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PURSES AND HANDBAGS AS A SOURCE OF FOMITES IN PATHOGEN TRANSMISSION- A MICROBIOLOGICAL INSIGHT

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Abstract:

Purses and handbags are everyday personal items that come into frequent contact with various public surfaces, making them potential vectors for pathogen transmission. This study investigates the microbial contamination on purses and handbags carried by college students and hospital personnel, and evaluates the effectiveness of Dettol antibacterial wipes in reducing microbial load. A total of 20 samples were collected from handbags, and microbiological analysis was performed to identify bacterial and fungal contamination. The results revealed a wide range of bacterial species, including *Staphylococcus aureus*, *Escherichia coli*, and *Salmonella* alongside fungal species such as *Aspergillus niger* and *Penicillium spp.* These pathogens, commonly associated with infections in both healthy and immunocompromised individuals, highlight the role of personal items in pathogen transmission. In addition, the study assessed the antimicrobial efficacy of dettol antibacterial wipes using the spread plate method. Before application, 113 colonies were observed, which reduced to 27 colonies post-application, demonstrating a significant 76% reduction in microbial contamination. The results suggest that personal items, such as handbags, can harbour a diverse array of pathogens, and the use of antibacterial wipes like dettol can effectively reduce microbial contamination, thereby lowering the risk of pathogen transmission. This emphasizes the importance of regular cleaning and disinfection of frequently handled personal items in preventing the spread of infectious diseases.

Keywords: Fomites, Microbial contamination, Handbags, Hospital personnels, Antibacterial wipes

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Introduction:

Any inanimate object or material that has the potential to spread pathogenic bacteria from one person to another is a fomite. Moisture, regular use, and general cleanliness are just a few of the variables that can impact the rate of fomite contamination. It is widely accepted that the rate of site contamination and exposure, the possibility of infectious agents being transferred to people with compromised immunity, the amount of pathogens expelled by the host, the immune competence of those in contact, the virulence of the organism, and the application of control measures like personal hygiene and disinfectant use are the main indicators of the risk of disease transmission through fomites (Ngonda, 2017; Reynolds, 2005).

There are microorganisms everywhere. The majority (~80%) of illnesses are transmitted by hand contact, according to numerous studies that show colonization and contamination of items like door handles, cell phones, cash, etc. (Oluduro *et al.*, 2011; Al Ghamdi *et al.*, 2011). In both societal and medical contexts, the possibility of disease transmission by inanimate items has frequently been studied. Computers, keyboards, and medical equipment from healthcare settings, as well as currency notes, cell phones, and playground equipment from the general public, have been found to harbor opportunistic microbes (Kalita *et al.*, 2013; Bhoonderowa *et al.*, 2014). Commensals and opportunistic pathogenic organisms, primarily Staphylococcus species, Enterococcus species, *Escherichia coli*, Pseudomonas species, and Micrococcus species, have been isolated from fomites (Messina *et al.*, 2013; Bures *et al.*, 2000).

Handbags and purses can provide an ideal environment for the growth of germs because of their characteristics. Mobile phones, cosmetics including face creams, lip gloss, and powder, partially eaten food, and, for nursing moms, new or used diapers and milk bottles are all known to be carried in these bags. Purses and handbags act as another important source for the growth of microorganisms. Due to its type of utilization the purses and handbags also provide moist environments for multiplication of microorganisms. These are used to store a lot of things including currency, cosmetics, and food. Not much attention is given towards cleaning of purses and handbags by the individuals. The present study seeks to identify the types of

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bacteria and fungi contaminating the purses and handbags and to highlight good cleaning practices.

Methodology:

Sample collection and Processing:

The samples were collected from handbags from the college students, office staff of a college and from hospital personnel. Forty samples (twenty for bacteria and twenty for fungi) were collected with the help of sterile swabs from the handbags used by the college students, office staff and from healthcare workers. The swabs were moistened with nutrient broth and normal saline to facilitate proper swabbing from the surface of the handbags. The samples were transported to the laboratory for further processing.

Isolation of bacteria:

Twenty samples with nutrient broth were incubated at 37^{o}C for 24 hrs. They were inoculated onto Nutrient Agar (NA), Mannitol Salt Agar (MSA), Blood Agar (BA) and Mac Conkey Agar (MAC). The plates were incubated at 37^{o}C for 24 hrs. Next day the colonies were picked up and Gram staining, motility, catalase and oxidase were done. The bacterial isolates were identified as per the standard protocols.

Isolation of fungi

The fungal isolation was done with the other twenty samples with normal saline. They were inoculated onto Sabouraud Dextrose Agar (SDA) and the plates were incubated at 25^{o}C to 35^{o}C for a week. Identification of the fungus was done as per standard methods.

Effect of Dettol antibacterial wipes on the microbial load in handbags:

To determine if the Dettol antibacterial wipes could reduce the load of microorganisms on handbags, two swabs were collected. One swab was collected by rolling the swab moistened with normal saline on the 5 X 5 cm surface of the handbags before using the Dettol wipes. The surface area was allowed to dry and the same area was wiped using antibacterial Dettol wipes. After a contact time of 10 minutes another swab was collected. These samples containing the swabs were vortexed and spread plated. Next day the total colonies which developed were counted with the help of colony counter and the results were recorded.

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Results:

Prevalence of bacterial isolates from bags:

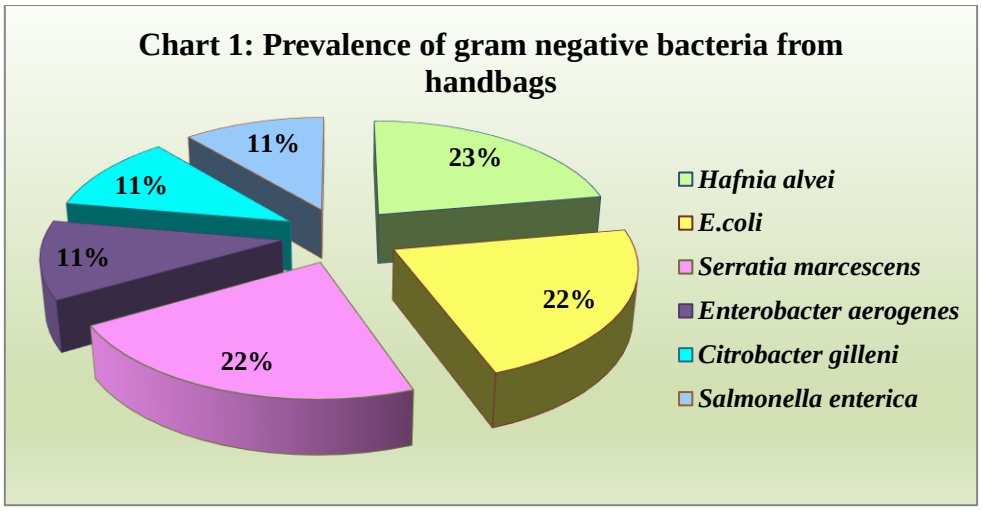
A total of 20 samples were collected from the bags and purses of college students, office staff and healthcare workers and were processed, of which 24 bacteria were isolated and identified. Out of the 24 isolates, 8 were found to be gram positive cocci in clusters (33%) followed by 9 gram negative rods (38%) and 7 were found to be gram positive rods (29%).

Prevalence of gram-positive cocci:

Among 8 gram positive cocci in clusters, 3 (37%) were found to be *Staphylococcus aureus* and 5 (63%) were found to be Coagulase negative Staphylococci (CoNS).

Prevalence of gram-negative rods:

Among 9 gram negative rods, 2 (22%) were found to be *Hafnia alvei* followed by 2 (22%) *E.coli,* 2 (22%) *Serratia marcescens,* 1 (11%) *Enterobacter aerogenes*, 1 (11%) *Citrobacter gilleni* and 1 (11%) *Salmonella enterica*. (Chart 1)



Prevalence of gram-positive rods:

Among 7 gram positive rods, 4 (57%) were found to be *Bacillus amyloliquefaciens*, 2 (29%) *Bacillus stearothermophilus* and 1 (14%) *Bacillus pumilus. (Chart 2)*

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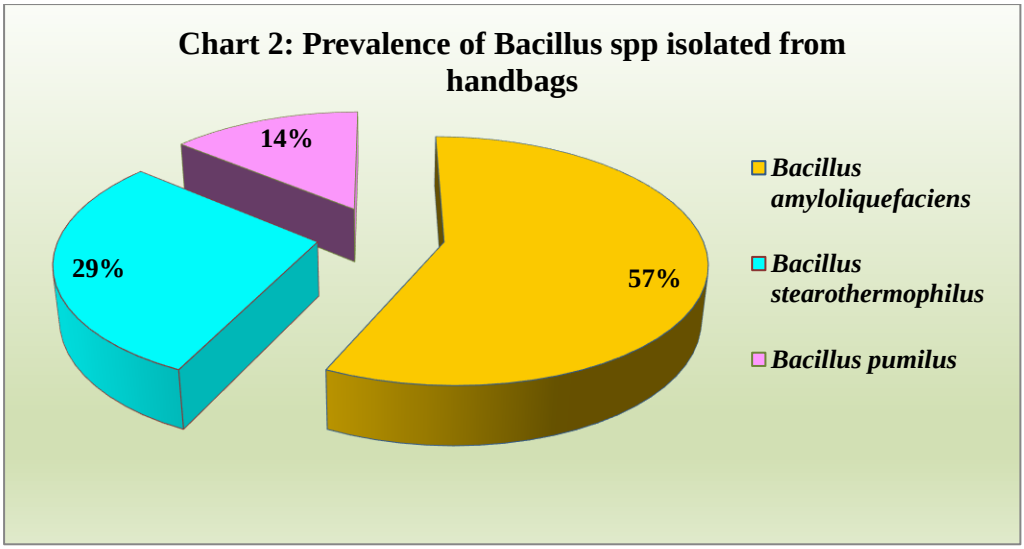

Prevalence of fungal isolates from bags:

A total of 20 samples were collected from the bags of college students and healthcare workers and were processed, of which 21 fungi were isolated and identified. Out of the 21 isolates, 6 (28%) were found to be yeasts followed by 6 (28%) *Aspergillus niger*, 3 (14%) *Aspergillus flavus*, 2(10%) *Aspergillus fumigatus*, 1(5%) *Aspergillus sydowii*, 1(5%) *Absidia*, 1(5%) Penicillium spp and 1(5%) Fusarium spp. (Table 1)

Table 1: Prevalence of fungi (n =21)

S.No.	Name of the bacteria	Percentage of the bacteria
1	*Yeasts*	6 (28%)
2	*Aspergillus niger*	6 (28%)
3	*Aspergillus flavus*	3 (14%)
4	*Aspergillus fumigatus*	2(10%)
5	*Aspergillus sydowii*	1(5%)
6	*Absidia*	1(5%)
7	Penicillium spp	1(5%)
8	Fusarium spp	1(5%)

Effect of Dettol antibacterial wipes on the microbial load in handbags:

Efficiency of Dettol antibacterial wipes on microbial reduction from handbags was performed by spread plate method which was done before and after the

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application of Dettol antibacterial wipes. The before and after results of application of Dettol antibacterial wipes on handbags was observed to be 113 colonies before use when compared to after use, the number of colonies reduced to 27 colonies.

Discussion:

Handbags and purses come into regular contact with our hands and a variety of surfaces laden with bacteria like, kitchen tables, handbags, restroom countertops, and fast-food counters. As a result, purses are susceptible to contamination by infectious agents and could act as conduits for the spread of illness.

In the present study, it was found that 54% of the purses and handbags of the health care workers from a medical setting were colonized by bacteria, which was higher than the 46% for purses and handbags from the community setting. Our study showed the presence of bacterial and fungal contaminants in ladies' handbags and purses which was found in agreement with Bakunas *et al., (*2009) and Gerba *et al., (*2011) who also reported that ladies' handbags and purses were laden with bacteria. Cross infection of microbes, between environmental surfaces and host, has been established (Hardy *et al.,* 2006). According to Chandia *et al.,* (2014), microorganisms found on healthcare personnel' interior handbag surfaces have the potential to contaminate devices and infect patients.

The microbial load could possibly increase due to different materials stored inside the handbag and purses which provides favourable conditions for the microbes. In the present study, the handbags and purses examined were found to be contaminated with both gram positive and gram-negative bacteria which was found in agreement with the research done by Yazah *et al.,* (2012). 8 gram positive cocci in clusters among which 3 (37%) were found to be *Staphylococcus aureus* and 5 (63%) were found to be Coagulase negative Staphylococci (CoNS) were isolated in our study. Coagulase-negative Staphylococcus were among the most common organisms isolated in our study, which were similar with findings from the previous studies in the community done by Kalita *et al.*, (2013) and Bhoonderowa *et al.*,(2014). Coagulase-negative Staphylococcus are a part of normal skin microflora which validates its presence in the handbags and purses.

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Microbial population constantly inhabits the community and hospital environment. The hospital surfaces are often contaminated with flora excreted by patients, visitors and healthcare workers. Potential reservoirs for the spread of microbes in hospitals and the community are the polluted environmental surfaces. Persistence of pathogens in hospital environments increases the risk of infection among susceptible hosts (Mann *et al.*,2014). In the present study, most of the *Staphylococcus aureus* were isolated from the hand bags and purses of health care workers in a hospital setting. One well-known nosocomial infection that can persist in a hospital setting for several days is caused by *Staphylococcus aureus.* High prevalence of *Staphylococcus aureus* in hospital settings can lead to MRSA associated diseases (Chaibenjawong & Foster, 2011).

One type of temporary hand flora that is easily eliminated by hand washing is enteric pathogens. In our study, enteric bacteria like *Hafnia alvei*, *E.coli, Enterobacter aerogenes*, *Citrobacter gilleni* and *Salmonella enterica*. were isolated. They are present in faecal matter, soil and water. Their presence indicates faecal contamination and poor hygiene practices food handlers are not taking enough care of hand hygiene. They can cause infection in the individual through oral route when there is no hand hygiene and handbag hygiene culture in the individual. *Salmonella* spp. is known to cause severe gastroenteritis in various age groups. Its presence in this study also shows possible faecal contamination and portends danger to the owners of these bags.

In the present study, 7 gram positive rods were isolated from handbags and purses of which 4 (57%) were found to be *Bacillus amyloliquefaciens*, 2 (29%) *Bacillus stearothermophilus* and 1 (14%) *Bacillus pumilus. Its* presence could be due ubiquitous nature of Bacillus spp with their spores able to resist environmental changes. This was found in agreement with the research carried out by Datta *et al.,* (2009) who reported that large number of isolated *Bacillus* species was transferred from fingertips or hands touching inanimate surfaces.

Fungi are ubiquitous microorganisms present in the environment. Exposure to environmental fungi and its impact on human health are related. Fungal exposure is known to cause several health problems, such as infection, mycotoxin-related illnesses, and hypersensitivity disorders. In addition to the health risks associated

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with prolonged exposure to high concentrations of mycotoxins, bronchial asthma is one of the several health issues that can result from high concentrations of fungus spores. The spores of fungi could get settled down on the surfaces of the handbags and purses and could cause serious health implications. Our study shows 21 fungal isolates from handbags and the purses which included yeasts, *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus sydowii*, *Absidia*, Penicillium spp Fusarium spp.

The organisms are able to colonize better on rough surfaces and furrowed materials as they provide hidden sites, which could favour bacterial adhesions when compared to smooth surfaces. Furthermore, microorganisms adhered more to knitted materials than to flat ones (Katsikogianni & Missirlis,2004). Therefore, increased bacterial growth on the synthetic purses could be due to their rough and grooved surfaces.

Towels soaked in diluted disinfectant and additional chemical products including surfactants, preservatives, enzymes, and fragrances make up disinfection-impregnated wipes (DIWs). The process of a disinfectant-impregnated wipe (DIW) can be divided into two parts that constitute the overall decontamination activity. One part is related to the microorganisms taken away by the wipe itself by means of mechanical action. The disinfectant solution that the wipe releases onto the surface has an active microbicidal effect, which is the subject of the other section. A vast range of active chemical agents, or biocides, make up disinfectants. The active ingredients found in the market are generally alcohols, chlorine, aldehydes, peroxygens, and quaternary ammonium compounds (Abreu *et al.*,2013). In the present study, Dettol disinfectant wipes were used to determine the efficiency of the wipes on the microbial reduction from cleaning the handbags.

Dettol disinfectant wipes are composed of ethanol and quaternary ammonium compounds which had bactericidal activity on the microbes found on the surface of handbags. Therefore, the before and after results of application of Dettol disinfectant wipes on handbags was observed to be 113 colonies before use when compared to after use, the number of colonies reduced to 27 colonies. Alcohol is cheap and easy to obtain, allowing an efficient wetting of the surfaces with a rapid bactericidal effect

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(Eggerstedt, 2013). The most widely used disinfectant on typical environmental surfaces is Quaternary Ammonium Compounds (QACs), which have a wide range of biocidal properties and good cleansing and deodorizing capabilities and sporostatic activity (lipid, enveloped viruses) (Ghanbar *et al.*,2018; Jiao *et al.*,2017).

Conclusion:

This study demonstrates the significant microbial and fungal contamination present on purses and bags, emphasizing the role of personal items as potential reservoirs for harmful pathogens. The presence of both bacteria and fungi on these items highlights the diverse risks posed by everyday objects in terms of pathogen transmission. The application of dettol antibacterial wipes on handbags was highly effective in reducing microbial contamination, with a 76% reduction in microbial colonies. This accentuates the importance of incorporating personal item hygiene, including the cleaning of handbags, in everyday routines to minimize the potential for pathogen transmission. Regular disinfection, particularly of high-contact surfaces, can help mitigate the spread of infections and contribute to improved public health practices.The findings suggest that greater awareness and improved hygiene practices are necessary to minimize the potential for cross-contamination and infection.

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