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Review Article

A Study to Isolate and Identify the Bacterial Colonies Prevalent on the Surfaces of Common Gadgets of College Going Students

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Abstract

A study was carried out to identify and isolate pathogenic bacterial population present on the common gadgets used by college going students. A total of 100 samples of college bags, purses, wrist watches and mobile phones of staff and students were randomly collected by swabbing, and grown under controlled laboratory conditions. The bacterial colonies were identified by gram staining and standard biochemical tests. A total of 13 mobile phones, 12 purses, 12 pens, and 15 wrist watches showed multiple bacterial colonies growth on their surfaces. College bags harboured most dense multiple bacterial colonization. *Micrococcus*, *Coagulase-negative Staphylococcus, Staphylococcus schleiferi, Acenectobacter lwoffi, Klebeseilla, Enterococcus* bacteria *genus* were the most common microbes found on the surfaces of these gadgets. These pathogens are known to cause blood stream infections, urinary tract infections, skin infection in humans, and holds potential to cause opportunistic infections amongst patients with compromised immune system. Synthetic and leather gadgets harboured higher mean bacterial colony growth as they hold more moisture, sweat and dirt settlements ideal for bacterial growth than metal and glass gadgets. Unless necessary, the students community should avoid using synthetic belongings since they provide ideal platform for bacterial growth thereby increasing chances of transmitting diseases and opportunistic infections.

Keywords: Student gadgets; Pathogens; Bacteria; Infection

Introduction

Students are future of the Nation. Their life is full of vibrancy, and their approach is pretty optimistic towards life. But, at times students also show casualness towards hygiene and therefore are prone to infectious diseases, that may come through their callous handling of gadgets like cell phones, wrist watches, purses, pens etc. which are invariably present with them most of the time. Students gadgets are prone to attack from environmental agents like bacteria, fungi, viruses, that reside in school or college campus, class rooms. These places are hotbeds for microbes where different person contributes bacterial colonies each moment offering a unique setting to explore microbial diversity because of the activities that take place During their stay students use and keep their belongings unknowingly in the surroundings that may allow microbes to settle and contaminate the surface of their gadgets. These contaminated gadgets are then used by them at workplace and also by the infants and siblings at home, which may lead to many infectious diseases amongst the youngsters. Most of infectious diseases are transmitted by either by touching an infected person or by touching the infected objects.

Most people do not realize that microbes are found on many common objects, outdoors and indoors, in their kitchen and their educational institutions and offices. People believe that microbes are only present in research lab or in hospitals and clinic and thus they have a misleading feeling of security in other places. Lack of knowledge about where germs grow could be the cause of health problem. In fact 80% of infections are spread through hand content with hands or others objects [36]. Reynolds used an indivisible fluorescent tracer for artificial contamination of public surface, they found that contamination from outside surfaces was transferred to 86% of exposed individual's hands and 82% tracked the tracer to their home or personal belonging hours later [36].

The present study aims at screening pathogenic bacterial populations settled on the surfaces of college bags, cell phones, purses, pens and wrist watches in the college campus. According to the centres for disease control and prevention India, most of the infectious diseases are transmitted by direct contact, either by touching surfaces contaminated with pathogen.

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To our knowledge, there are few report from developing countries on the nature and extent of colonization of micro-organism in ladies purse, hand watch, and mobile screen and pen etc. By keeping this in mind the current study is planned to identify the safety of all these objects with respect to micro-biological aspects. Bacteria are single celled organism very tiny enough to be seen through naked eye and they are omnipresent. Normal skin is inhabited with two categories of bacteria, the transient and resident. The resident flora are more resistant to routine washing, Coagualage negative *Staphilococci* and Gram +ve diptheroids are members of this group (Boyce and Pittet, 2002). On the other hand transient flora colonizes the superficial layer of the skin and is more amenable to removal by routine hand washing. The capability of these bacteria to survive for more than 24 hours further increases their chances of contamination in other places.

Scott and Bloomfield, 2008 in their study isolated Gram +ve bacteria were more frequently from all surfaces compared to Gram – ve. This could be in part due to the fact that survival of Gram negative organism. However Gram +ve and Gram –ve bacteria have been shown to have similar transfer rates from laminate surface to finger tips [39].

Scope of the Study

The current study will help us to negotiate the potential hazards masqueraded through college bags, purses, watches and cell phones anticipated to be carriers of pathogenic microorganisms owing to casual handling by students. These gadgets at homes may come in contact and unknowingly pose hazards to the infants and elderly people of family considered to be weak in their immunity power compared to youngsters. Based on the findings of the present study we will also focus on its remedies and best practices to minimize these hazards while handling.

Table 1: Cell Phone Associated Bacterial Colony.

Sr.No.	Android Mobiles	Bacterial Species	Colonies	Remark
1	Sample M1	Coagulase negative *Staphylscoccus*	1	Pathogenic
2	Sample M2	No Growth	Nil	-
3	Sample M3	*Staphyloccusaureus*	2	Pathogenic
4	Sample M4	Coagulase negative *Staphylococcus*	3	Pathogenic
5	Sample M5	*Staphylococcusaureus*	1	Pathogenic
6	Sample M6	No Growth	Nil	-
7	Sample M7	*Klebsiella* spp	4	Pathogenic
8	Sample M8	No Growth	Nil	-
9	Sample M9	No Growth	Nil	-
10	Sample M10	Coagulase negative *Staphylococcus*	2	Pathogenic
11	Sample M11	Coagulase negative *Staphylococcus*	1	Pathogenic
12	Sample M12	*Klebsiella* spp	1	Pathogenic
13	Sample M13	No Growth	Nil	-
14	Sample M14	No Growth	Nil	-
15	Sample M15	Coagulase negative *Staphylococcus*	3	Pathogenic
16	Sample M16	No Growth	Nil	-
17	Sample M17	*Staphylococcusaureus*	2	Pathogenic
18	Sample M18	No Growth	Nil	-
19	Sample M19	Coagulase negative *Staphylococcus*	4	Pathogenic
20	Sample M20	Coagulase negative *Staphylococcus*	1	Pathogenic
21	Sample M21	No Growth	Nil	-
22	Sample M22	No Growth	Nil	-
23	Sample M23	No Growth	Nil	-
24	Sample M24	Coagulase negative *Staphylococcus*	2	Pathogenic
25	Sample M25	No Growth	Nil	-

Table 2: Purse Associated Bacterial Colony.

Sr. No.	Purses	Bacterial Species	Colonies	Remark
1	Plastic purse	*Kliebsella*	2	Pathogenic
2	Plastic purse	No Growth	Nil	-
3	Leather purse	*Staphylococcusschleiferi*	2	Pathogenic
4	Metal purse	No Growth	Nil	-
5	Plastic purse	*Staphylococcusschleiferi*	2	Pathogenic
6	Plastic purse	No Growth	Nil	-
7	Fabric purse	*Staphylococcusschleiferi*	3	Pathogenic
8	Metal purse	No Growth	Nil	-
9	Plastic purse	No Growth	Nil	-
10	Leather purse	*Staphylococcusschleiferi*	1	Pathogenic
11	Fabric purse	*Acenetobacterlwoffii*	2	Pathogenic
12	Plastic purse	*Kliebsella*	2	Pathogenic
13	Plastic purse	No Growth	Nil	-
14	Leather purse	*Staphylococcusschleiferi*	2	Pathogenic
15	Metal purse	No Growth	Nil	-
16	Plastic purse	*Staphylococcusschleiferi*	3	Pathogenic
17	Metal purse	No Growth	Nil	-
18	Plastic purse	No Growth	Nil	-
19	Plastic purse	*Kliebsella*	2	Pathogenic
20	Plastic purse	No Growth	Nil	-
21	Plastic purse	No Growth	Nil	-
22	Metal purse	No Growth	Nil	-
23	Leather purse	*Klebsiella* sp.	2	Pathogenic
24	Fabric Purse	*Acenetobacterlwoffii*	2	Pathogenic
25	Plastic purse	No Growth	Nil	-

Hence the findings of the present study will be immensely helpful in focussing the health hazards posed by these gadgets that are neglected or least thought to be the potential carriers of pathogens too.

A detailed literature review was carried out related to the present study. Many interesting findings and extracts of studies done by different authors is listed below that has also helped us to carry out our present work.

Noskin (1995) and Burkan (2000) in the studies have shown that indoor surfaces are 'Hot Spots' of bacterial contamination. Several pathogenic bacteria are known to survive on surfaces for extended periods of time.

In environment, Spores of molds and bacteria may become air borne and are therefore ubiquitous. Although indoor environments are considered to be protected, they can become contaminated with different particles that sometime cause more serious risks when their concentrations exceed recommended maximum limits than those related to outdoor exposures [6].

The traditional identification of bacteria on the basis of phenotypic characteristics is generally not as accurate as identification based on genotypic methods. The skin flora (commonly referred to as skin microbiota) refers to the micro-organisms which reside on the skin. Many of them are bacteria of which there are around 1000 species upon human skin from nineteen phyla. It is commonly non-pathogenic and they are commensal (are not harmful to their host) or mutualistic (offer a benefit.) [21].

Previous studies conducted by Larson in 2002 have the bacterial isolates from the phones that the bacterial skin flora were epidemiologically important pathogens and can be reduced by regular cleaning of phones with alcohol.

The prospective study examined bacterial colonization on writing pens touched by heathcare professionals and hospitalized patients with and without cleaning the pen with alcohol based hand sanitizing agent after each patient visit. A significant reduction in potential healthcare-associated pathogens, especially gram negative cocci was observed in the intervention group [22].

Women's handbags as little as six months old have found to contain unsafe levels of potentially lethal bacteria in new laboratory tests. All of them tested positive for harmful strains of bacteria including *Salmonella* which causes chronic food poisoning (Mark Smith, 2016).

High levels of *Staphylococcusaureus* were revealed to be contaminating the watch- a bacteria responsible for skin infections. The wrists and hands of hospital based healthcare workers; were sampled for bacterial contamination in two consecutive cross- sectional cohort studies of wrist watch wearers and non-wrist watch wearers [26].

Traditional methods of bacterial identification of the causative organism using gram staining, culture and biochemical methods. However, these methods of bacterial identification suffer from two major drawbacks. First, they can be used only for organisms that can be cultivated in vitro. Second, some strains exhibit unique biochemical characteristics that do not fit into patterns that have been used as a characteristics of any known genus and species. Thus, this study proposes isolation and identification of bacteria with conventional gram staining as well as its confirmation with molecular marker [38].

Hence previous studies reveal that identification of bacteria is a careful and systematic process that uses many different techniques to narrow down the types of bacteria that are present in an unknown bacterial culture. Accurate and definitive microorganism identification and pathogen detection, is essential for correct disease diagnosis, treatment of infection and trace-back of disease outbreaks associated with microbial infections [3].

Materials and Methods

All the reagents, chemicals and apparatus procured in the study were of analytical grade and standard company.

Isolation and Identification of bacterial colony were carried out at Mahatma Gandhi Institute of Medical Sciences, Sewagram, Wardha (MGIMS) popularly known as Sewagram hospital. With official approval from Dean, MGIMS, Sewagram we carried out the work at Department of Microbiology, MGIMS, Sewagram.

Proper training of sample collection, media preparation, and colony identification was obtained by the postgraduate scholars from the faculties of Department of Microbiology, MGIMS, Sewagram, Wardha. Samples (cell phones, purses, watches, and pen) were collected from communities of students and teachers of the campus from Wardha, Maharashtra, India. Total 100 samples were collected. 25 samples each of cell phones, purses, pens and watches were randomly collected from the population of students and staff of the campus. The samples were obtained by swabbing the surfaces of the gadgets with the help of prepared sterile swab sticks and were placed into the sterile test tubes and stocked.

Materials

All the glasswares were used of Borosil make, and nutrient agar powder was of Himedia.

Method

Sample Collection, Swabbing and Culture: Nutrient Agar Medium for microbial growth was prepared and Autoclaved as described above. Swab was prepared using thin wooden stick and sterilized cotton, training was impacted by MGIMS technical staff for preparing swabs. 100 swab sticks prepared as above were enclosed in 100 testtubes, were autoclaved for 30 mins following norms prescribed as above. Sterilized swab stick was pre-moistened with saline water.

All the 100 samples were obtained with the help of these swabs. Generally 0.9% NaCl (Saline solution) is used for the preparation of culture suspension or serial dilution. 0.9% sodium chloride solution is isotonic in nature. The 0.9% saline solution can support significant growing of potentially pathogenic bacteria according to Manual of Practical Microbiology, C. P. Baveja.

Sampling procedure was carried out as described by Cheesporough (1984) and Baker and Siverton.

Nutrient agar medium was prepared and autoclaved as per Saif aldeen et al., while 0.9% saline solution, microbial colony growth on Agar, Agar plate inoculation and storage, streaking, incubation, subculturing and examination of smear blot was done as per the process described in Manual of Practical Microbiology by C. P. Baveja.

25 samples each of cell phones, college bags, watches, purses, and pens were collected from student and staff communities of the campus. Separate swabsticks were used for each sample, to obtain microbial flora from surface of sources like cell phones, college bags, watches, purses, and pens. After swabing, these swabsticks were again enclosed in testubes and recapped with cotton plugs. All the collection of 100 samples were done in a similar way in Laminar Air flow under sterilized conditions. Nutrient Agar was used for the study. It was prepared by dissolving 28 gm nutrient agar powder (Himedia, India) in 1000 ml distilled water. It was Sterilized in Autoclave (121'C for 15 min). Sterilized Petri plates were filled with the agar medium, and kept overnight to solidify. Agar plates are stored upside down (i.e. media in upper dish, and lid at the bottom), as during cooling when the moisture is formed it will not drop into the medium and hence bacterial growth will not be hampered.

Streaking was strictly done in sterilized environment. The laminar was sterilized by standardized protocol before streaking. Agar plates were brought to room temperature before streaking, swab sticks containing microbial flora were streaked over the agar plates and were incubated for growth. The incubation period for bacterial culture is 24 to 48 hours at 37' C temperature. Identification of the colonies of bacteria and further investigation is carried out in the Microbiology Laboratory of MGIMS Sewagram.

Gram Staining Procedure

The smear is prepared from culture plate, it is first fixed and then stained. Dried smear is heated gently by flaming the slide

from underneath. This is done to fix the smear. Fixed smear was fully covered with crystal violet solution for one minute. Pour Gram's iodine over the smear for one minute. Wash the smear with water. Decolourise the smear with acetone or alcohol for 10-30 seconds taking care not to over decolourise. Cover the smear with a dye safranin (counterstain) for 1-2 minutes. (Dilute carbol fuschin or neutral red may also be used as counterstain. Wash the smear with water. The smear is then blot dried. Examine under oil immersion (X100) objective.

Results

Students' college bags, purses, wrist watches, cell phones, and pens were anticipated to be the probable carriers of the pathogens, and the present study was successful to prove it. Laboratory investigation documented that the cell phones, wrist watches, purses, pens are prospective carriers of pathogenic bacterial populations that has the potential to cause infection to humans. Although, the surface of college bags of student community harbored very dense colonization and proved to be the major source of contamination of bacterial population and made us to believe to have maximum bacterial flora on its surface, but due to limitations of the laboratory conditions, the identification of bacteria could not be done as it was hard to isolate the bacteria's for subculture. But it has given us a clue that college bags can be taken as a source material to study bacterial flora in the laboratories that have facilities to isolate them.

Altogether 100 samples were collected and processed to assess the bacterial flora on their surfaces. Purses, wrist watches, cell phones, and pen were found to have highest pathogenic bacterial population in their order respectively. The types of bacteria isolated and identified from Cell Phones, Purses, Wrist Watches and Pens of the staff and students communities are presented in Table 1 to Table 4.

Table 3: Pen Associated Bacterial Colony.

Sr. No.	Pens	Bacterial Species	Colonies	Remark
1	Sample W1	*Micrococcus*	2	Pathogenic
2	Sample W2	No Growth	Nil	-
3	Sample W3	No Growth	Nil	-
4	Sample W4	No Growth	Nil	-
5	Sample W5	*Staphylococcus*	1	Pathogenic
6	Sample W6	No Growth	Nil	-
7	Sample W7	No Growth	Nil	-
8	Sample W8	*Staphylococcus*	2	Pathogenic
9	Sample W9	No Growth	Nil	-
10	Sample W10	No Growth	Nil	-
11	Sample W11	*Staphylococcus*	3	Pathogenic
12	Sample W12	No Growth	Nil	-
13	Sample W13	No Growth	Nil	-
14	Sample W14	No Growth	Nil	-
15	Sample W15	*Micrococcus*	1	Pathogenic
16	Sample W16	No Growth	Nil	-
17	Sample W17	No Growth	Nil	-
18	Sample W18	*Enterococcus*	2	Pathogenic
19	Sample W19	No Growth	Nil	-
20	Sample W20	No Growth	Nil	-
21	Sample W21	*Enterococcus*	2	Pathogenic
22	Sample W22	No Growth	Nil	-
23	Sample W23	*Micrococcus*	1	Pathogenic
24	Sample W24	No Growth	Nil	-
25	Sample W25	No Growth	Nil	-

Cell Phones Associated Pathogens

Cell phones were found to contain bacterial species on their surfaces. 25 android cell phone samples from staff and students were analyzed as per the protocol discussed earlier in material methods. All the cell phones were smart phones, out of 25 cell phones 13 cell phones surfaces (Table 1) were having bacterial colonies of *Staphylococcus aureus*, Coagulase egative *Staphylococcus* (CoNS), and *Klebsiella* genus all of them being pathogenic species known to cause infections in humans. The related infections caused is reflected in discussion session.

The frequent handling of mobile phones exposes the handler to an array of micro-organisms, as cell phones are often used for study and entertainment purposes throughout day and night. Dust particles, atmospheric moisture, body sweat on the skin and palm of humans together with the heat generated by mobile phones favours colonization and multiplication of microbes on their surfaces, so these devices are potentital sources of microbial contamination and can serve infections to children and elders while operating these devices at home.

Purses Associated Pathogens

We collected purse samples made up of different materials and patterns to verify relation of microbes with materials. Not to our surprise many of the purses were found to contain bacteria on their surfaces.

Table 2 highlights the colonies of bacteria present on their surfaces. 25 samples were collected from staff and students communities out which 12 samples were found to contain bacterial colonies of the genus *Staphylococcus schleiferi*, *Kliebsella*, *Acenetobacter lwoffii.* Infections caused by these bacteria is deliberated in discussion section.

Table 4: Wristwatch associated Bacteria Colony.

Sr. No.	Wrist Watches	Bacterial Species	Colonies	Remark
1	Leather belt	Multiple	3	-
2	Metal belt	No Growth		-
3	Metal belt	No Growth		-
4	Leather belt	*Staphylococcusschleiferi*	2	Pathogenic
5	Leather belt	*Staphylococcusschleiferi*	3	Pathogenic
6	Leather belt	*Staphylococcusschleiferi*	4	Pathogenic
7	Metal belt	No Growth		-
8	Metal belt	No Growth		-
9	Metal belt	Multiple		-
10	Leather belt	Multiple	5	-
11	Metal belt	No Growth		-
12	Metal belt	No Growth		-
13	Leather belt	*Staphylococcusschleiferi*	3	Pathogenic
14	Leather belt	*Staphylococcusschleiferi*	4	Pathogenic
15	Leather belt	*Staphylococcusschleiferi*	3	Pathogenic
16	Leather belt	*Staphylococcusschleiferi*	3	Pathogenic
17	Leather belt	*Staphylococcusschleiferi*	2	Pathogenic
18	Leather belt	*Staphylococcusschleiferi*	3	Pathogenic
19	Leather belt	*Staphylococcusschleiferi*	2	Pathogenic
20	Metal belt	No Growth	Nil	-
21	Metal belt	No Growth	Nil	-
22	Metal belt	No Growth	Nil	-
23	Metal belt	No Growth	Nil	-
24	Leather belt	*Staphylococcusschleiferi*	3	Pathogenic
25	Leather belt	*Staphylococcusschleiferi*	2	Pathogenic

Pen Associated Pathogens

This prospective study examined bacterial colonization on writing pens touched by students and staff. The purpose of this study was to assess the potential of writing pens as a source of transmission of healthcare associated pathogens. Total 25 pen samples were collected from students and staff of the campus. 8 samples of pen were found to be contaminated with bacterial colonies of *Micrococcus*, *Enterococcus*, and *Staphylococcus* genus, their infection causing ability emphasized in discussion section (Table 3).

Wrist Watches Associated Pathogens

25 wrist watch samples of staff and students having leather, cloth and steel belts were chosen for the study. The reason was to compare these synthetic and steel materials in response to bacterial contamination. Bacterial settlement was more in leather and fabric belts than the steel belts. Leather belt and cloth belt watches comparatively absorbs moisture, dust, water and sweat from underneath skin pores, hence could provide better platform for bacterial growth and therefore can become source of infection to the wearer. Metal belt does not hold moisture and sweat, and therefore is not ideal for dense bacterial growth. Hence the chances of infection to the wearer is less. Table 4 predicts 15 samples out of 25 to hold *Staphylococcusscheliferi*, and multiple colonies of other bacteria.

Discussion

Students cell phones, purses, wrist watches, and pens are found to be carriers of bacterial pathogens that are capable of transmitting infectious diseases among humans. Since these gadgets are exposed to dirt, dust, sweat, water and heat in the environment, and therefore are easily prone to microbial settlement on their surfaces. Our findings confirm that these gadgets are potential carriers of pathogens and can cause infection to the handlers if aesthetics is not practiced. This study holds true for even schools where small childrens carry school bags, tiffin boxes and therefore inference can be drawn to observe hygienic norms.

Several factors such as type of gadgets, material surface of gadgets, duration of usage, and number of persons using these gadgets may influence the rate of contamination of these inanimate objects. Aesthetic handling and hand washing can help prevent transmission of bacteria from these contaminated objects.

Bacterial colonies of *Staphylococcusaureus*, *Staphylocccusschleiferi*, Coagulase Negative *Staphylococcus*, *Kliebsella, Enterococcus*, *Micrococcus*, *Acenetobacterlowii* were found growing on the surfaces of sampled student gadgets raising concerns and also inviting attention towards aesthetical handling of these inanimate gadgets.

*Staphylococcus aureus*is a frequently found and known to cause diseases in the upper respiratory tract and on the skin surface of humans. Staphylococcus *schleiferi* is a pathogen responsible for bacteremia, brain abscess, and have been described to be found typically on skin and mucosal surfaces of humans. Coagulase negative Staphylococcus is known to cuase blood stream infections, skin related infection and urinary tract infection if inside the body of human beings. *Klebsiella pneumoniae* is commonly found in our intestines and feces and are harmless in intestines but if they spread to another part of our body, they can cause severe infections *Enterococcus* and *Klebsiella* spp. are easily transferred from hard plastic or metal and soft surfaces to the hands of students by touch [32]. *Escherichia coli* is a type of bacteria that normally lives in your intestines even help keep your digestive tract healthy. But some strains can cause diarrhea if ingested through contaminated food or drinks.

Staphylococcusaureus, *Enterococcus*, *Acinetobacter* and *Diphtheroid* spp. were also isolated from pens. *S. aureus* survived upto 48 hours on rubber grip pens, whereas the minimum duration of survival 24 hrs was observed on plastic pens and 18 hrs on pens (N Cinar 2014).

Thus, crowded classrooms, cafeterias gyms in schools can be hot spots for a variety of pathogens like bacteria, viruses, fungi and molds that are agents for diseases including colds, influenza, norovirus and *Staphylococcus, Enterococcus, Kliebsella, Micrococcus species.*

On high to low ratio wrist watches, purses, cell phones and pens were found to contain pathogenic bacteria on their surfaces respectively. Wrist watches of fabric or leather belts were found to contain more germs that steel or metal belts, it may be because fabric and leather absorbs more moisture and dirt settlement as compared to metals that do not absorb moisture and therefore less prone for microbial contamination. Therefore fabric and leather material holds more infection than metals.

Previous studies done by (Melaniz duzyj 2010) Bacteria can grow on steel and plastic surfaces too. Steel being hygienic is frequently used in food processing industries for packaging. A lot of research has been done to prevent bacteria from growing on these surfaces.

Bacterial species *Shigellasonnei* is known to survive longer at -20^{0}C and shortest at 45^{0}C on steel surfaces. *Shigella* causes Shigellosis disease in childrens and adults, it is a gram negative rod shaped, non motile, and non-spore forming bacterium known to cause blood stream infection, diarrhea, inflammation to joints in humans (Melaniz duzyj 2010).

A variety of selective and differential microscopic media was used for presumptive identification of contaminating microorganisms. Gram staining, microscopic examination and confirmatory tests were performed to further identify bacteria.

It was observed that college bags having maximum number of colonies therefore, it has a potential for bacterial contamination. We got multiple colonies on college bags but it is not possible to subculture the multiple colonies of bacteria, that's why we didn't analyze the college bags as they contribute to increased bacterias were found to contain heavy loads of pathogens as they in direct contact of environment of campus, public places that holds moisture, dirt, oil, carbon gases and heat that settles directly on their surfaces.

Conclusion

All the gadgets collected from students and staff were found to contain pathogenic bacterial contamination on their surfaces.

- Leather Purses and Leather wrist watches were more contaminated than Pens and Cell phones.
- These gadgets may also be having fungi, viruses, molds and other microbes, hence further studies are also needed in terms of these microbes.
- The highest population of bacteria was found on the

leather purse. *Staphylococcusaureus*, Coagulase negative *Staphylococcus*, *Staphylococcus schleiferi*, *Acenectobacter lwoffii* , *Klebesiella* genus were found to contaminate leather purses

- Staphyloccus aureus causes upper respiratory tract infection and skin infections.

- Coagulase negative *Staphylococcus* inside the body causes severe bloodstream infections, urinary tract infection, skin infections in humans.

- *Staphylococcus schleiferi* is known to cause bacteremia, brain absesses, skin infection in humans.

- *Acenectobacter lwoffii* is known to cause septicemia, pneumonia, meningitis, urinary tract infections, skin and wound infections in patients with weak immune systems like AIDS patients.

- *Klebesiella* is a common resident of intestine of mans, but known to cause severe infection if spread to other body parts in humans.

- *Micrococcus* can cause opportunistic infections of skin and pulmonary region in patients with compromised immune system.

- *Enterococcus* cause cellulitis, wound infections, prostatitis, intra-abdominal infections in humans.

- Pathogenic bacteria that were isolated holds potentital to cause opportunistic infection to the bearer and more prominently to the bearer with weaker immune system.

- Metal surfaces holds lesser bacterial colonies than leather belts giving a clue to utilize steel material than leather

- Leather or cloth holds moisture, sweat and dirt as compared to steel to provide platform for the growth of bacteria

- College bags harboured dense multiple colonization of bacteria, but due to lack of suitable laboratory arrangements we could not identify them, but holds good promise for the researchers to study them.

- Studies also holds good promise to pay special attention towards the cleanliness of school bags of childrens and the handling of school bags is more casual rather pathetic.

- Investigations of pathogens suggest that purses, pens, cell phones, and wrist watches need periodic cleaning by some disinfectants for better hygiene.

- Handwashing is the most effective methods for prevention of bacterial transmission after usage of these gadgets and especially during snacks and meals.

Author Statements

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