



Research Article

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**Biosafety: Microbiological analysis of jackets of university students of health courses**

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**ABSTRACT**

Health care students are in permanent contact and handling with biological agents, and using jackets in inappropriate environments and can contaminate clothing, other students, the environment and the population. The present study aimed to verify the contamination rate of jackets of students investigating the situation of biosafety. The collect was held with sterile swab in the tissues, in an area of approximately 4 cm<sup>2</sup> of the sleeves and of the front of the jackets of 100 students and the samples were plated on Petri containing Blood Agar for microbiological analysis. Microbial contamination was detected in 85% of the jackets; being 78,84% Pharmacy students, 95% Nursing, 94,44% Dentistry and 80% Medicine. There were observed the presence of Gram-negative and Gram-positive cocci, bacilli, hemolytic bacteria. It concludes that the jackets are contamination vectors, requiring awareness from the students to the practice of Biosafety.

**Key words:** Exposure to biological agents, Personal protection. Surveillance, Agar, Count microbial colony.

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**INTRODUCTION**

Biosafety, subject much discussed in recent decades is defined as the series of measures to prevent, minimize or eliminate the risks involved in research, production, education, technological development and provision of services that can jeopardize the health of humans, animals, the environment or the quality of the work performed [1-2].

Health professionals (PAS) are exposed to many of these risks in their workplaces. Among the risks to which, biohazards stand out, which expose the worker to pathogenic microorganisms that can cause serious illness and currently incurable, as the virus of hepatitis B and C and Human Immunodeficiency Virus (HIV) [3-4].

Exposure to biological hazards is present in the daily life of healthcare workers from the beginning of their training at university. It is known that when the condition of students participate in practical and educational activities in care institutions to public health, performing clinical activities and participating in procedures with biological hazards. These curricular activities expose students to contact with patients, which can be sources of infection, and require the use of coats to avoid or reduce the risk of contamination of clothing and skin of the students. Due to the

large exposure to infectious agents, it recommended a series of biosafety standards that must be followed in search of individual and collective security. Among which stands out the appropriate use of coats, which are Personal Protective Equipment (PPE), and function as barriers against bodily fluid spills and bodily secretions from patients, thus avoiding exposure to biological hazards [5].

The World Health Organization (WHO) recommends the use of the coat is restricted to appropriate environments, minimizing the risk of infection, though it is often the presence of coats dresses students in nearby locations to the university environment (restaurants, streets, cafes and centers of coexistence), neglecting thus the risks [6].

In England, the British Medical Association has established strict guidelines for trouble. The organization condemns the use of ties, watches, and ornaments and, above all, the circular habit with aprons and coats in non-hospital environments, since studies have isolated many germs that can cause diseases, especially the sleeves and pockets of these garments [6].

So the jacket emerges as a source of disease transmission if used outside the environment to which is necessary because, becomes the first contact site in terms of clothing with skin, fluids and secretions from patients, making is a real vector [5].

The objective of this study was to investigating the microbial contamination in coats of students of Pharmacy, Dentistry, Nursing and Medicine, Federal University of Ceará, as well as the current situation regarding the biological safety of students in order to arouse the students to practice safe of personal protective equipment (PPE).

## EXPERIMENTAL SECTION

### Origin of the study and ethical aspects

This is a field of study, of a quantitative nature, of descriptive and exploratory character. The study was approved by the ethics committee of the university under Protocol 16/12.

### Studied population

A total of one hundred (100) students of the Federal University of Ceará participated as volunteers in this study, where 52 were students of the Pharmacy course, 20 students of the Nursing course, 18 students of Dentistry and 10 students of the Medical School.

There were included in the research graduating students who wore coats out of the laboratory or hospital, and agreed to participate by signing the free and informed consent form (ICF). There were excluded from the sample postgraduate students and those who did not have the habit of using it out of academic activities.

### Material collection and microbiological analysis

There were collected 100 samples from 100 coats of student volunteers, who were duly identified by a number. Data collection was carried out in Pharmacy, Dentistry, Nursing and Medicine, Federal University of Ceara. After collection, the material was sent for laboratory analysis at the same university.

The samples were collected in a defined part of the coat, as the sleeves and the front of the tissue, which was used previously swab moistened with sterile water Peptone, performing smear the fabric of an area of approximately 4cm<sup>2</sup> and placing them on the tube containing the solution. The samples, properly identified, were taken in a cooler to the laboratory for analysis.

For the procedure of the microbiological testing, the test tube containing the swab submerged in water inside Peptone previously homogenized and then seeded in Petri dishes containing blood agar (Mueller Hinton Agar medium with 5% human blood). The plates were incubated at 37°C for 48 hours; after this time, the reading of the plates and colony counts were performed. The plates in which microbial growth was very high (> 300 colonies), thereby preventing the count, were classified as countless. The cultures in which there was the appearance of visible colonies is conventionally refer to them as no growth.

For quantitative analysis of colonies was calculated the number of colony forming units (CFU), when it was possible to perform this procedure. Thus, related to the number of colonies in accordance with the collected area 4cm<sup>2</sup>, and then displaying the result in CFU/ cm<sup>2</sup>.

Colonies of the culture medium were also evaluated for their morphology and were classified by microscopy and the Gram method, which classifies the bacteria according to the composition of its cell wall of Gram-positive and Gram-

negative. Thus, for each sample, they were fixed two slides for bacterial meningitis. This test is used in microbiology laboratories use as an important aid in the diagnosis of bacterial disease, from a certain profile dye-stain bacteria and purple are classified as Gram-positive or stain is termed as roses and Gram –negative [7].

## RESULTS

Among the participating students, 60% were female and 40% male. Most belonged to the course of Pharmacy (52%), followed by Nursing course (20%), Dentistry (18%) and Medicine (10%).

After collection of the samples, followed by seeding has been observed that in 85% (n = 85) samples was microbial growth. This fact indicated that there was contamination of collected microorganisms of coats of students, thus exposing them existed microbial contamination. The division of samples per stroke can be seen in Table 1.

**Table 1: Result of microbiological evaluation of samples collected from the coats of participants per course. Fortaleza, 2012**

	There was bacterial growth	There was no bacterial growth
Pharmacy	78,84% (41 samples, n=52)	21,15% (11 samples, n=52)
Nursing	95% (19 samples, n=20)	5% (1 samples, n=20)
Dentistry	94,44% (17 samples, n=18)	5,55% (1 sample, n=18)
Medicine	80% (8 samples, n=10)	20% (2 samples, n=10)

It was observed that from the 85 infected plates, 18 (21,18%) had counts between 0,5 and 2 CFU/cm<sup>2</sup>, 16 (18.82%) in the range between 2.1 and 5 CFU/cm<sup>2</sup>, 20 (23,53%) exhibited a higher count than 5 CFU/cm<sup>2</sup> and 31 samples (36,47%) were countless. It is noteworthy that the largest number of samples in which cannot be performed the count were the Pharmacy course (67,74%, n = 21).

Microbial colonies had morphology, sizes and hues ranging. In order to achieve greater diversity of grown colonies copies were made blades to perform the Gram stain for all contaminated plates, and thus, the colonies were assessed as to their microscopy.

In Blood Agar environment (AS), the most commonly encountered bacterial forms were Gram-negative bacteria (62,35%) present in white colonies and pale yellow tint. In just six coats of students found only Gram-positive bacteria (7,06%) and 26 samples (30,59%) bacteria Gram-positive and Gram-negative.

Furthermore, was visualized the presence of hemolytic bacteria detected by the appearance of translucent halos around some colonies, characteristic microorganisms capable of causing lysis of blood cells Blood Agar medium constituents.

## DISCUSSION

The jackets should only be used in the workplace, laboratory environments or suitable for such use, but notes the use of such clothing in inappropriate places. This overuse of coats may be related to the limited time available for the exchange of clothing, because professional or healthcare students do not give due importance to the risk of contamination, or because their use would be listed as a status [8]. Such uniform can be a potential vehicle for transmission of microorganisms can act as a source of infections associated to health caregivers and may cause serious consequences to public health [5].

Data from a qualitative study aimed at identifying the knowledge about biosafety nursing students revealed that after the analysis of the responses of the participants identified that they had concerns about the risk prevention and the relationship of biosafety with the environment beyond point out the education and the study of biosafety at graduation as a proposal to minimize the risks. Another understanding of academic involves the importance of using personal protective materials, as well as the destination of contaminated materials, and these actions to prevent the contamination and possible accidents are related to biosafety norms [9].

Wonders the daily use of coats by health professionals in contact with patients and compared the colonization of pathogenic bacteria, such hypothesis was confirmed in research in which the coat of medical students are more likely to be contaminated with bacteria at sites of much contact as sleeves and pockets. In a survey of 100 medical students, all coats of the students were bacterially contaminated to varying degrees on the sleeves, the pockets and on the back of the coat, the main identified microorganisms were *Staphylococcus aureus*, skin commensals. For researchers of the study, there was a relationship between the cleaning of coats held by students with microbial contamination, showing that a significant proportion washed his coat only occasionally. Such a study, the survey serves as an argument that the coats of the students are a potential source of cross-infection [10].

A study examining the presence of *Staphylococcus aureus* in coats of a hospital nursing staff in Porto Alegre-RS, found in the presence of 106 samples positive for the species. The results showed 21 (19,8%) isolates of *Staphylococcus aureus* and 5 (4,71%) showed resistance profile against cefoxitin disk, being characterized as MRSA. By analyzing the various areas of the coat used for sampling, this study enabled us to verify a more prevalent contamination in the pockets 14,14%, 6,45% and sleeves front of 4,71%. The results of this study show the viability of *Staphylococcus aureus*, especially involving multi-resistant samples coats of health professionals. The data reflect a serious problem for public health, where health caregivers are involved in cross-transmission of pathogens [11]. Thus, it is clear that the medical and nursing staff, because they have much contact with patients, is likely to have their PPE contaminated.

In a qualitative study investigated the perceptions through dental graduates interview on the biosafety guidelines. Respondents revealed that they knew of the existence of biosecurity protocols; however the daily routine they are impractical and stressed the need for such measures be continually taught. Some of them show ignorance about the high risk of contagion and others have shown indifference to the subject as something believed to be possible to have control through adherence to standard precautions. The study shows the need to improve educational strategies, so as to motivate the faithful adherence to biosafety standards, essential in treating dental patients. It was noticed that although the biosafety content is taught in theoretical and practical classes for graduation, students feel there is estrangement between learned knowledge and clinical practice [12].

In another study that aimed to evaluate the bacterial contamination in coats of nursing students immediately after use in health care practices. For this the coats of academics were collected, washed and passed in a standard way and used for four hours in clinical activities. It was evident that there was bacterial growth of *Staphylococcus aureus* and *Staphylococcus epidermidis* in 50% of the samples, where the first were resistant to vancomycin antibiotics, chloramphenicol and sulfonamides. The study shows that even after the use for short periods coats are contaminated with antibiotic-resistant strains and vectors can be infection. This same study applied questionnaires to participants and when asked about the use of the bathroom using the coat, 54.5% said yes; 40.9% and 4.6% rarely not. The use of the jacket in social settings, such as supermarkets, public transportation, among others, 100% of respondents do not have this habit. About the way carrying the coats; 36.4% answered that the carry in their hands; 27.2% in personal bags and 36.4% in plastic bags [13].

It was also verified a considerable contamination index of the coats of the students in the area of the sleeves of the dress code. The courses studied in this research, the Pharmacy course is the only one that has its own discipline on Biosafety, and however, we found a higher prevalence of microbial contamination in the coats of the students of this course. It is believed that this result may be related to as many of Pharmacy Course students in research conducted or large laboratory workload involving these students.

In a paper that evaluated how the coats are used by health professionals during their activities and how they are stored it was found that the handle was the most contaminated site, followed by pockets. The study reinforces the idea that no use proper hand hygiene is the professional clothing is contaminated [14].

Studies show that during clinical, uniforms and white coats calls become progressively contaminated and that contamination reaches a saturation level to stabilize at a plateau. The time it takes to reach this level of saturation certainly depends on the amount of microbial colonization of the patient, frequency and type of clinical activity. The recommended is that coats are stored in plastic bags and cleaned more than once per week [5].

The sleeves of the coats are places of high contamination because they are exposed sites in the practical activities performed by students in clinical, dental care in handling secretions and biological samples and in proximity to contaminated countertops. Such activities lead to the possibility of bacterial transfer from the patients or hands to dress and vice versa. It is then essential to conduct sanitize your hands frequently [5].

Another thing to be encouraged students of health courses is the washing of coats often. This procedure can help to remove or kill microorganisms, although there is evidence to establish the efficiency of the decontamination of industrial or household laundering processes [5].

The sites of greatest contamination in coats of medical students are the sleeves and the pocket.<sup>[10]</sup> In this scenario, it is observed that during supervised internships students often examine patients and the sleeve becomes the place that most frequently comes into contact with patients, with the possibility of contamination of bacteria acquired from it. The assumption that the uniforms and lab coats can be a vehicle for transmission of infection still causes some resistance, despite some evidence [5].

In a study we sought to identify the microorganisms present in coats of dentists before and after a day of service to so determine the risk of microbiological contamination of professionals and patients. Swab samples were collected that were previously rubbed in collars, pockets and cuffs. Participants said sanitize coats every five days of use. After microbiological analysis identified microorganisms were *Klebsiella sp.*, *Staphylococcus saprophyticus*, *Enterobacter sp.*, *Staphylococcus epidermidis* and *Staphylococcus aureus*. There was a predominance growth of *Staphylococcus aureus* (50%) and *Staphylococcus epidermidis* (40%), especially in gowns analyzed at the end of day [15].

Studies evaluating the sanitary conditions of coats of health professionals who attend the university cafeteria of a hospital through the determination of *Escherichia coli* and total coliforms showed unsatisfactory results in 38.1% of the total of 40 samples, however, the same was not found in any of the samples analyzed growth of *Escherichia coli*. In this survey, 80% of samples were unsatisfactory, with 62.35% in group of Gram negative bacteria, suggesting total coliforms [8].

It was found at work the superiority of samples that could not perform the counting colony forming units and are classified as countless. This result was similar to that observed in previous studies, which received 41% of countless samples, making finding an important factor in the severity of biological risk [10].

The recommendation is that the coats must be removed after use, transported in plastic bags and washed in a no more than a week frequency, or whenever they present some dirt. Thus ensuring simple biosecurity rules in infection control [5].

### CONCLUSION

The results of this study indicate that coats can be a potential agent for transmission of microorganisms can link them to possible microbial infections, because 85% of them had some degree of contamination.

The high level of contamination found in the survey contains elements that support the exclusion of coats in areas other than hospitals or laboratories, such as restaurants, coffee shops, living spaces and others. Suggesting also conduct a continuous update of students in biosafety and its variations, in order to inform them and make them aware of the risks that can occur with improper use of coats.

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