

Evaluation the Level of Awareness on Sterilization Methods in a Research Center

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Abstract

Observing the correct principles of sterilization is one of the most important strategies to prevent infection transmission and, also, to reduce the time and the cost of research projects in biological sciences. The aim of this study is to evaluate the awareness of employees in a research laboratory in an institute of medical sciences. In this cross-sectional study, a questionnaire was designed, which contained important items of sterilization, such as autoclave performance and its quality control, conditions of sterilization by oven, and the principles of surface disinfection, and distributed among the staff. Forty-four filled questionnaires were collected and the results were analyzed using SPSS version 17. There was a significant correlation between the level of education and the level of researchers' knowledge about the principles of sterilization ($P < 0.05$), in a way that the individuals with PhD degree had a higher percentage of correct answered questions. There was a significant relationship between the duration of activity in the laboratory and the level of knowledge on the principles of sterilization. Level of the staffs' knowledge about sterilization procedures is not desirable and there is a need for researchers training.

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Introduction

Research laboratories require distinct safety measures compared to other laboratories, with regards to the nature, methods and materials used in it. For example, the activities such as cultivation and isolation of microorganisms from various sources, cloning and expression of recombinant proteins, detection of pathogens, different cell lines culture, and molecular methods are some processes requiring special skill to prevent contamination or damages to researchers and other laboratory personals [1].

Use of chemical substances, protection against radiation, disinfection and sterilization methods, waste disposal, and individual protection are items recommended for complete observing biosafety in laboratory and any of the staff is required to learn these principles and apply them in all steps of the work. Among the items listed, the sterilization involves special importance, because on one hand, it ensures the integrity of the testing process and on the other hand, it prevents the personnel contamination with pathogens [2]. Lack of proper sterilization method during a process would lead to increased costs and unreliable results [3]. Most importantly, personnel contamination with pathogens is an expected outcome of the inappropriate sterilization which sometimes is associated with irreversible damages [4]. To select an appropriate method for disinfection process, some factors should be considered, such as the nature of equipments, the number of microorganisms, the resistance of microorganism to disinfectants, the amount of pollution and the concentration of disinfectants [4-6].

So, learning and applying these principles are of the basic requirements before entering to a research laboratory. The awareness on safety in the laboratory during the activity should be measured by standard methods and, if necessary, training needs to be repeated or updated [7]. The aim of this study was to assess the awareness of employees working in the research laboratories of a university of medical science on basic principles of sterilization.

Methods

In this cross-sectional study, a questionnaire was designed consisted of 20 questions about the principles of sterilization, including the types of autoclave, sterilization methods used for a variety of culture media and devices, the principles of surface disinfection, quality control methods for autoclave performance, etc.. The questionnaire was distributed among 44 researchers working in research laboratories in August 2014. The participation of the respondents was voluntary. In the following, the responses were collected and the results were analyzed using SPSS version 17.

Results

The relationship between the level of knowledge and experience in the laboratory

Qualitative ordinal test of Kendall's tau-b was used to compare the studied groups and their correlation with the answers to the questions. The results of the test performed both in general and pair wise showed that the groups in a comprehensive analysis have no significance differences in the response level. But in a more detailed comparison,



response level in Group 1 (with less than one-year experience in the laboratory) and Group 3 (with more than three years experience in the laboratory) showed a statistically significant difference ($P = 0.025$). The level of responses to questions in none of the individuals with more than

three years experience was not weak, while the level of responses in more than 82% of those with less than one year experience was poor or moderate (Fig. 1 & Table 1).

Table 1. The relationship between the level of knowledge and experience in the laboratory.

Time spent in the lab	The level of response				Kendall's tau-b Exact Sig.
	Weak	Moderate	Good	Total	
Less than 1 year	2	8	2	12	0.025
More than 3 years	0	2	5	7	
Total	2	10	7	19	

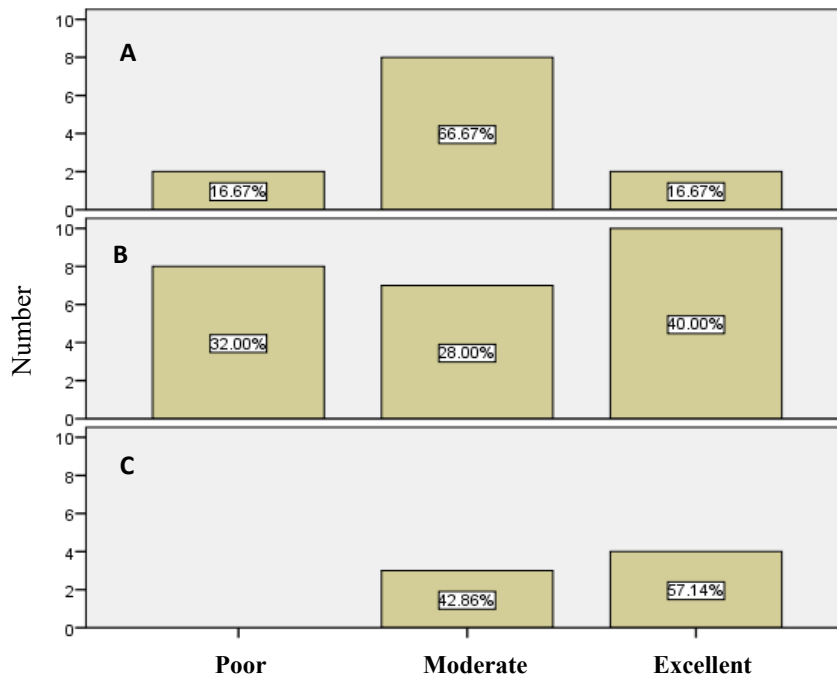


Figure 1. The comparison of the level of respond to questions in employees with different backgrounds. A: less than 1 year, B: between 1 to 3 years, C: more than 3 years.

The relationship between the level of education and knowledge on sterilization methods

Qualitative ordinal test of Kendall's tau-b was used to compare the education level of participants in the study (Masters and PhD) and the level of responses to the questions. The results showed a statistically significant difference ($P < 0.001$) in the level of education in responding to the questions, so that the individuals with PhD degree had more correct answer than the individuals with Master degree (Table 2).

The relationship between the type of membership and the level of awareness on sterilization methods

The results obtained from data analysis using Fisher's test showed although the percentage of researchers who have answered the questions correctly is more than other groups, there is no statistically significant difference among the type of membership (student, research assistant and researcher) and the level of response to the questions (Table 3).

Table 2. The relationship between the level of education and the level of responses.

Level of education	The level of response				Kendall's tau-b Exact Sig.
	Weak	Moderate	Good	Total	
Maser	10	14	6	30	0.000
PhD	0	4	10	14	
Total	10	18	16	44	

Table 3. Table 3: The relationship between the type of membership and the level of awareness on sterilization methods.

Membership	The level of response				Fisher's Exact Test Sig.
	Weak	Moderate	Good	Total	
Student	7	11	11	29	0.425
Research assistant	3	6	2	11	
Researcher	0	1	3	4	
Total	10	18	16	44	

Discussion

Working safely with microorganisms is one of the basic requirements in research laboratories. Because, on the one hand, the processes performed in these laboratories are vary various, and on the other hand, the personnel working in these laboratories are not at the same level of experience and training, meaning that in these laboratories there are both students with no previous experience on working with microorganisms and professors engaged with research in various laboratories for years. Thus, paying attention to the training and retraining of working with microorganisms and sterilization is critical in research laboratories. However, the standard guidelines for working with infectious agents have been compiled and are accessible to everyone [5, 8, 9]. But some factors such as the authorities' negligence in personals training, the nonchalance of staff in applying methods and the lack of funds to provide needed equipments and materials have led to the consequence that microbial contamination still imposes financial costs and sometimes is life- threatening. Therefore, recognition of the knowledge level of employees in each research laboratory is the basic of future planning to prevent such damages.

The results of this study showed that work experience in research laboratories and appropriate training are two important factors in increasing the level of awareness on the principles of sterilization. There was a direct relationship between the duration of working in the laboratory and the level of awareness on principles of sterilization.

It also showed that training has an essential role in improving staff's awareness. By comparing the educational level of employees, it was found that the employees with PhD degrees, who have gained more education, were more familiar with safety rules. Since there is not a comprehensive study about the knowledge level of staff in academic-research laboratories in the country, the results obtained in this study are not comparable with others, but the results from similar studies on observing the standards of sterilization in the hospitals in the country revealed the defect in biosafety measures in most cases [2, 10].

Although the failure in sterilization devices is so important, however, the low awareness on personal and workplace hygiene is known as the main reason for non-compliance of the standard [11]. The lack of comprehensive data about the principles of sterilization, especially in the less experienced staff, is announced as a major issue in hospitals in the other countries [12, 13].

Conclusion

Since the staffs working in academic research laboratories are usually not stable and the processes used in these laboratories are also diverse, it is therefore necessary that laboratory manager takes special measures to train each person, depending on type of tasks they work on. These trainings should be repeated at regular intervals or be updated. The periodic evaluation of staff's knowledge on the principles of safety in the laboratory may help to prevent probable contamination and damage to life and properties.

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