



**Ministry of Higher Education and Scientific Research  
University of Babylon College of Science for Women  
Department of Chemistry**

**STUDY THE IMPLEMENTATION OF  
SAFETY AND SECURITY MEASURES IN THE  
LABORATORIES OF THE COLLEGE OF  
SCIENCE FOR WOMEN**

**for the student Hajar Hassan Abd Harab  
and under the supervision of Dr. Muhammad Hamid**

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## بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿ يرفع الله الذين امنوا منكم والذين اوتوا العلم درجات والله بما تعلمون خبير ﴾

صدق الله العظيم

سورة المجادلة (اية ١١)

### الشكر والتقدير

الحمد لله حبا وامتنانا كان اللسان عاجزا عن بلوغ ادنى شكره

يسرني تقديم هذا الشكر لوالدي ووالدتي وكل من كان معي طيلة هذه الرحلة

واشكر كل من علمني او ساهم في تعليمي من اساتذة

واخص بالشكر والتقدير والامتنان استاذي الفاضل الدكتور (محمد حامد)

على امرشاده لي بالنصح والتصحيح وعلى اختيار العنوان والموضوع المناسب

والشكر لنفسي التي خولت لي الوقوف في مكاني اليوم

## الاهداء

بسم الله الرحمن الرحيم

﴿ قل اعملوا فسيرى الله عملكم ورسوله والمؤمنون ﴾

صدق الله العظيم

الى من افضلها على نفسي ولم اقلد ضحت من اجلي

ولم تدخر جهدا في سبيل اسعادي على الدوام

حبيبي وصدیقي (امي الغالية)

نسير في دروب الحياة ويبقى من يسيطر على اذهاننا في كل مسلك نسلكه

صاحب الوجه الطيب والافعال الحسنة فلم يبخل علي طيلة حياته

(والدي العزيز)

الى اصدقائي وجميع من وقفوا بجوامري وساعدوني بكل ما يملكون وفي اصعدة كثيرة

الى من علموني كل ما اعرفه طيلة سنوات الدراسة الجامعية

(اساتذتي الافاضل)

الابوين والاهل والاصدقاء والاساتذة المبجلين..... اهدىكم بحث تخرجي

## ABSTRACT

In this study, the applications of chemical and biological safety and security in the biological unit laboratories in a hospital located in Babylon was measured. The questionnaire was designed by researchers using their expertise in the field of safety and security. It was also presented to four experts in the field of safety and security and the design of the questionnaires, where the questionnaire dealt with the following item: the provides health and safety equipment, Personal safety, Chemicals handling controls, Laboratory arrangement and safety, treatment and sterilization, Safety in emergencies and Safety documentation in the laboratory. The sample of study consisted of (15 of people they are work in the biological unit laboratories). The results obtained showed positive indicators in all points, with some weaknesses that the Department of biology require attention to and treatment.

## INTRODUCTION

Laboratories are spaces where scientists and researchers conduct experiments in pursuit of scientific knowledge. However, laboratories can also be dangerous places if proper safety measures are not taken. Safety and security are of utmost importance in laboratories to prevent accidents and ensure the well-being of employees. Laboratory safety can also protect the environment and help avoid costly lawsuits. Safety measures should be taken seriously by all laboratory workers to ensure a safe and secure environment for everyone. In a laboratory, safety and security are of the utmost importance. There are many potential hazards in a laboratory, such as chemicals, biological agents, and equipment that can cause physical harm. Proper safety protocols and training for laboratory personnel are necessary to prevent accidents and ensure the safe handling of these hazards. In addition, security measures should also be in place to prevent unauthorized access to the laboratory and theft of valuable equipment or materials. Overall, ensuring the safety and security of a laboratory is crucial for protecting both the researchers and the environment they work in.

The chemical laboratory has become the center for obtaining knowledge and developing new materials to be used in the future, as well as observation and control of these materials, which are used in thousands of commercial operations. Many of these compounds are useful, but many of them may also cause harm to human health as well as to the environment. How to deal security with it. Until recently, the risks that the workers in these laboratories are exposed to were not taken into account, but now, societal pressure has forced institutions that have laboratories to be responsible for providing safety and a safe environment for those who work in them, and to take care when transporting chemicals as well as disposing of chemical waste. The days of negligent treatment of laboratory security are over, and laboratories are now completely safe places to work in[1]

As for Biosafety is the prevention of loss of biological health, with an emphasis on both the environment and human health. These prevention mechanisms include regular biosafety reviews within laboratory settings as well as strict guidelines that must be followed using safety Biological Hazards to Protect Against Harmful Incidents Many laboratories that deal with biohazards use a continuous biosafety management assessment and implementation process. Failure to follow these protocols can increase the risk of exposure to biohazards or pathogens. Human error and poor technology contribute to unnecessary exposure to these hazards and weakening the preventive measures taken to protect against danger. Safety procedures within the chemical laboratory are based on international rules and foundations that must be followed by everyone who works in this field in order to protect himself, those working with him, and the external environment.[2]

## **SPECIFICATIONS AND SAFETY RULES IN LABORATORIES**

- (1) The laboratory space should be suitable for the number of researchers and students
- (2) There must be two doors in the laboratory hall for entry and exit.
- (3) Windows shall be provided with fire-resistant curtains and movable protection bars.
- (4) Equipping laboratories with means of natural and artificial lighting and ventilation, and following up the periodic maintenance of such equipment.
- (5) Laboratory floors, basins, and tables must be of types that are resistant to chemicals and fire.
- (6) A gas cabinet must be provided to be used when preparing or using volatile substances or hazardous or foul-smelling gases.
- (7) The laboratory should be equipped with comfortable, easy-to-move chairs that can be controlled in height.
- (8) Laboratories should be equipped with a sufficient number of electrical points with covers.
- (9) Laboratories should be equipped with a gas and electricity system, and a control switch should be placed in a visible place that can be easily accessed in case of emergency.
- 10) Each laboratory shall be provided with a room for storing tools and devices.
- (11) Each laboratory shall be provided with a movable transport cart to transport equipment and tools from the preparation room to the laboratory and vice versa.
- (12) Primary safety means such as fire extinguishers, first aid box, emergency shower and alarm devices must be provided and kept in a conspicuous place and periodic maintenance should be done to ensure their validity.

## **RISKS IN LABORATORIES CAN BE DIVIDED INTO:**

- 1- The dangers of chemicals
- 2- The dangers of glassware
- 3- Electrical hazards
- 4- Vital hazards. [3]

## **EXPERIMENT PROCEDURES**

- 1-The form related to the safety and security items was designed.
- 2- We presented it to the experts specialized in this field in order to verify the validity of the items.
- 3- We distributed it to 15 workers in the biological unit laboratory in the hospital.
- 4-We collected the results and then emptied the data.
- 5- We drew the results in an Excel program to discuss the reasons

## **DISCUSSION :-**

In this study, we have studied the following topics related to chemical and biological safety and security in chemical and biological laboratories:

- Safety equipment
- Personal health and safety
- Control of chemicals
- Laboratory arrangement and safety
- Processing and sterilization
- Emergency Safety
- Documenting safety in the laboratory

The sample consisted of 15 workers in the biological unit laboratories

In the first topic of safety equipment It was found through the questionnaire that we conducted for the biological unit, the percentage of availability of health and safety equipment in general was 54%, it was yes for the workers, and 35% of them did not have equipment, but 11% of them did not know about its existence, and from those percentages it was found that it is a reliable percentage, which is 46% of the associates between no They have health equipment and those who are not aware of its existence, which leads to their exposure to danger during their work, and this means that there is a lack of equipment and follow-up, including administrative reasons from the institutions responsible for the equipment, as through the questionnaire it was found that the unit requests equipment and they cannot obtain it, and the percentage of 11% who They do not know whether they are available or not due to a lack of training. Among the low percentages that we found is the lack of proper use of signs, as it was found that there are no signs indicating the locations of showers and eye washbasins, and to a lesser extent it is difficult to access showers and eye wash basins, as well as the showers are not checked regularly, and the necessary equipment is not Good Condition

The solutions lie in the periodic monitoring, which may be every week or every month, of the necessary equipment in order to function properly, as well as following up the signs that indicate the locations of showers and eye washbasins, so that they are clearly visible and for all associates, and in more than one place, and provide easy passages to reach the washbasins, or set up washroom units in more than one place From a place and be close to the laboratories, as well as holding scientific educational seminars or training courses within a periodic schedule to educate the percentage that said I do not know

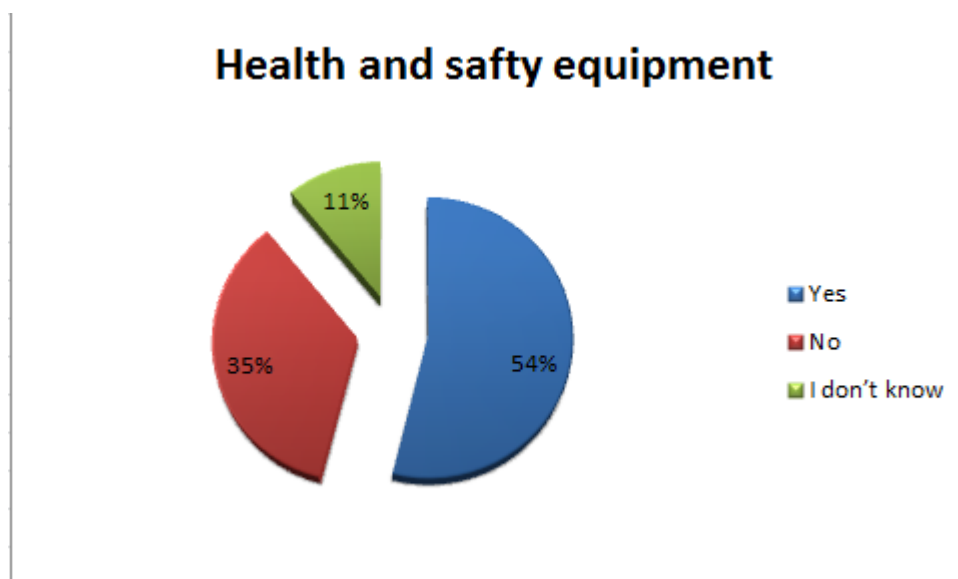


Figure (1): Availability of safety equipment

2It was found through the questionnaire for the personal health and safety paragraph that 87% of them answered yes, which is almost high, 9% of them answered no, and 4% of them do not know that the total estimate indicates the presence of personal health and safety equipment such as washing hands before Leaving and undressing before leaving the laboratory Wearing masks and cleaning the laboratory after completing the laboratory, but it was found that there are not enough controls to prevent food and drink inside the laboratory

The reason for the availability of personal health and safety equipment may be due to the laboratory workers purchasing tools such as masks and laboratory uniforms themselves due to a lack of equipping

them with them, as mentioned above.

The solutions lie in equipping laboratories with health and safety equipment for laboratory workers as well as increasing control

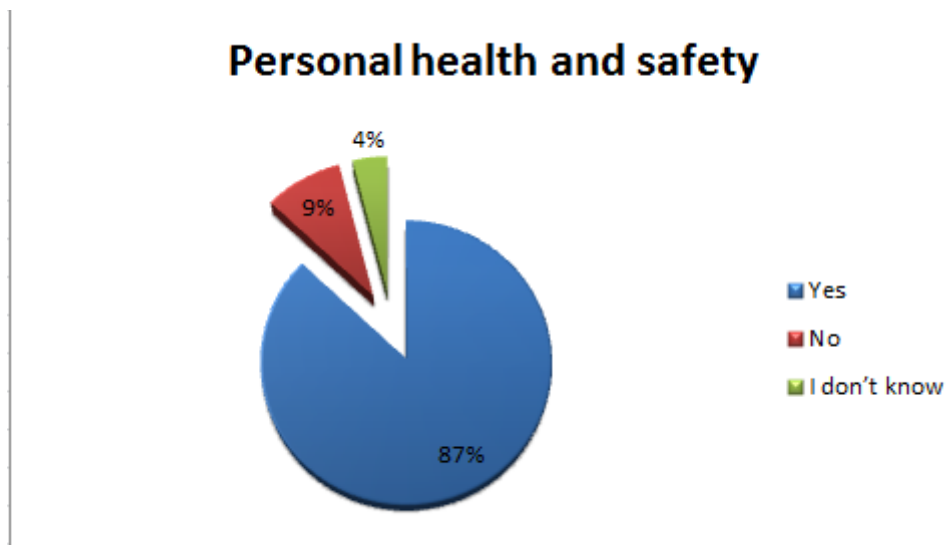


Figure 2 shows the monitoring of the availability of personal safety equipment

With regard to controlling chemicals, through the questionnaire it was found that 72% of them answered yes, 10% no, and 18% did not know. Environment both

It was found through the questionnaire in this paragraph that a large percentage of them indicated that there was no first aid box and fire blankets and that there was no chemical spillage kit. Hazardous and non-hazardous chemical waste banks, and there is a large percentage of them who do not know the chemical controls, not most of the paragraphs

With regard to solutions, it is necessary to deal well and disciplined with these materials due to their danger, as the necessary materials for first aid must be available in areas close to the work and be easily accessible. Also, attention must be paid to the mechanism for disposing of hazardous and non-hazardous waste, and defining banks to collect them for disposal. As we mentioned above, the problem of lack of awareness of workers The importance of laboratory health and safety is almost repeated in all paragraphs of the questionnaire. It is necessary to hold educational seminars, and this is the responsibility of the people who run the laboratory in cooperation with the hospital administration so that the workers are familiar with all these necessary details for their protection.

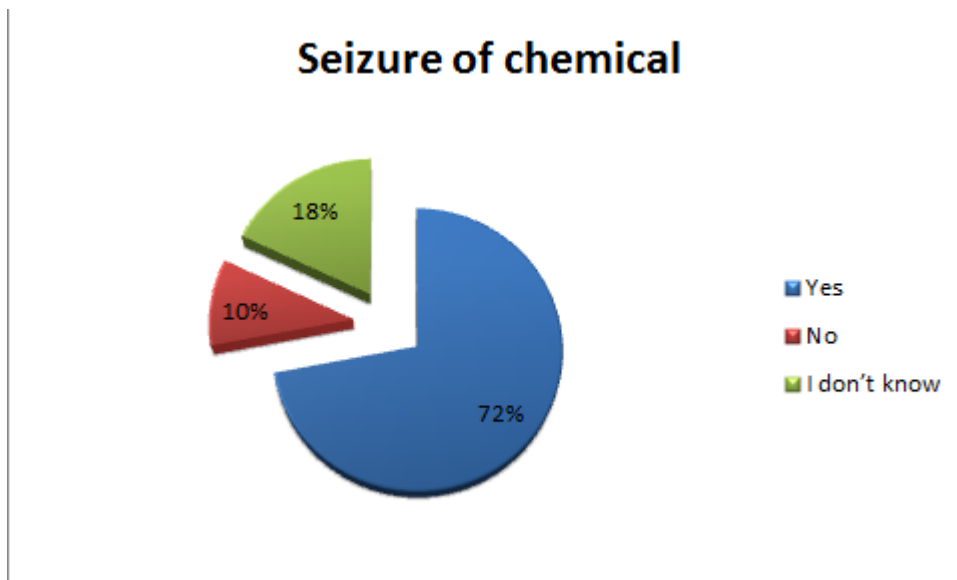


Figure 3: show the control of chemical

With regard to the arrangement and safety of the laboratory, 70% of them answered yes, 8% answered no, and 22% did not know. They don't even know it exists. There are also some shortcomings in laboratory techniques

With regard to solutions, keeping the laboratory tidy and safe should be a priority for the workers in the laboratory and its supervisors. Whenever the laboratory is clean, tidy, and safe, they can work comfortably, and the percentage of errors that may occur during laboratory experiments will also decrease. As we mentioned above, equipment and tools should be available. Necessary in the laboratory for safety and awareness of laboratory health and safety rules

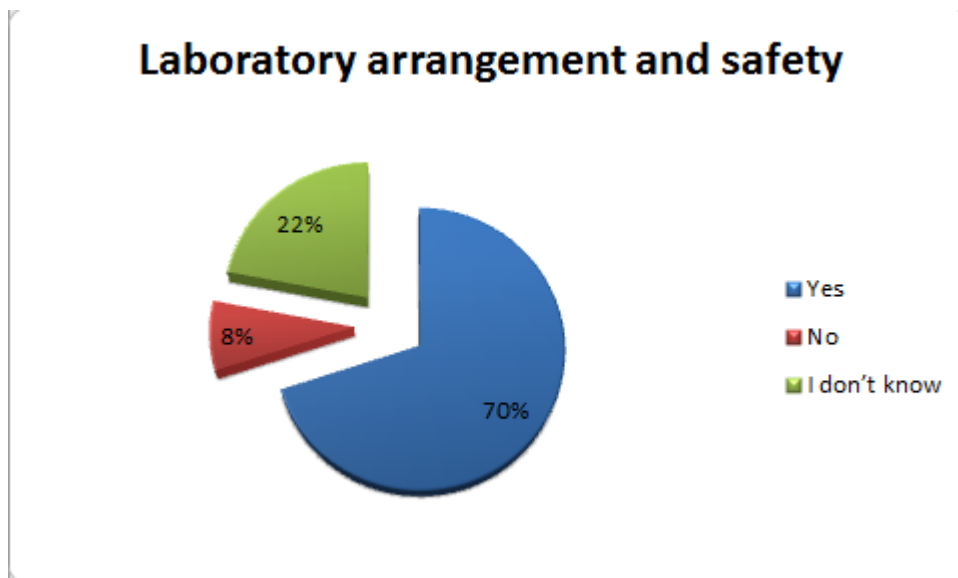


Figure 4: show the laboratory arrangement and safety

As for treatment and sterilization, 72% answered yes, 15% answered no, and 13% did not know. As for 72%, it is good because treatment and sterilization exist in their laboratories, as it is known in biological laboratories that they deal with blood samples and types of tiny bacterial and parasitic organisms that may lead to Any laboratory or technical error leads to the spread of the virus and may infect workers, causing harm. Therefore, sterilization and treatment are of great importance in removing or killing these microbes that may remain from experiments. However, 28% of those who confirmed that sterilization equipment is not available, as well as those who do not know about their existence, percentage It cannot be ignored, as the availability of safety equipment must be available to all workers without exception, since the lives and



health of workers must be at the forefront of the priorities of supervisors and managers. It was noticed through the questionnaire that there are some deficiencies in sterilization devices, as well as the lack of proper handling of contaminated metal sharps.

Solutions are at the forefront of solutions. The necessary materials and devices for sterilization must be available, as well as the need to apply the correct methods and with caution in dealing with contaminated tools after the completion of each experiment, as in biological laboratories, any simple error can cause the spread of a specific virus, or if conditions are met, it will have a mutation. Certain cases are more dangerous, and we have monitored some cases recorded in the hospital's risk register

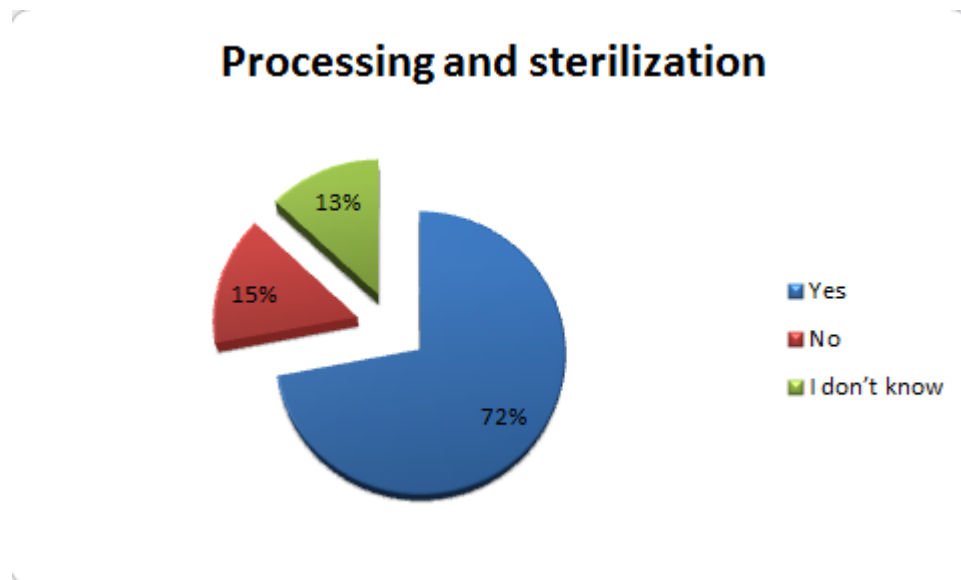


Figure 5 : show the processing and sterilization

Safety and emergency: 40% answered yes, 30% said no, and 30% did not know. By observing the percentages, the percentage of those who do not know and those who answered no combined is 60%, which is a percentage that most of the paragraphs consider for safety in the event of an emergency. Their percentages were low, meaning that they should be A real treatment of this issue as it is unreasonable that there is no emergency plan in cases of accidents, fire or environmental disasters

As we mentioned above, most of these paragraphs have low percentages for that, as a solid plan must be available in the first place in order to evacuate and deal with the situation in the event of accidents of all kinds. There must be actual monitoring of the progress of this process and care to train employees for such situations so that they can deal with them correctly when it occurs, and this plan includes various situations, i.e. a period before work, during work, and the lunch period. The plan also includes people with special needs, such as the disabled and the blind.

Provide alarm devices and emergency numbers to inform the responsible authorities as soon as possible, and that these devices are close to the work site, and open emergency exits must be provided and first aid must be provided for assembly areas in emergency cases

### Emergency safety

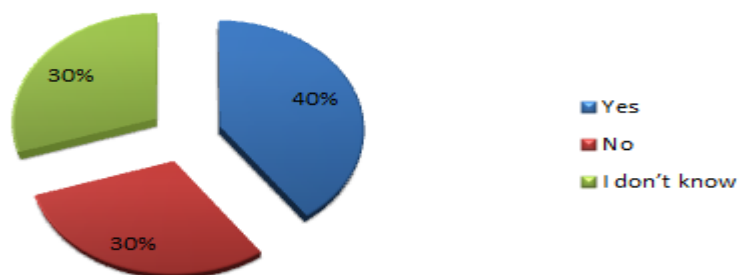


Figure 6: show the emergency safety

As for documenting safety in the laboratory, 45% answered yes, 45% said no, and 10% did not know. By observing percentages, we find that there is an actual lack of documenting the practical tests that take place in the hospital in a special record, as well as a lack of training in first aid and the lack of posters. Including names and emergency contact numbers

Upon observing most of the paragraphs, most of the workers have no knowledge of some of the laboratory safety and security paragraphs, so it is necessary to organize scientific programs to educate them on the importance of following the security and safety rules for their safety.

Likewise, there is a shortage of the supervisory factor, as sometimes the necessary equipment is available, but there is a defect in monitoring, which leads to not using it properly and providing training programs for evacuation and first aid in emergency cases.

### Laboratory safety documentation

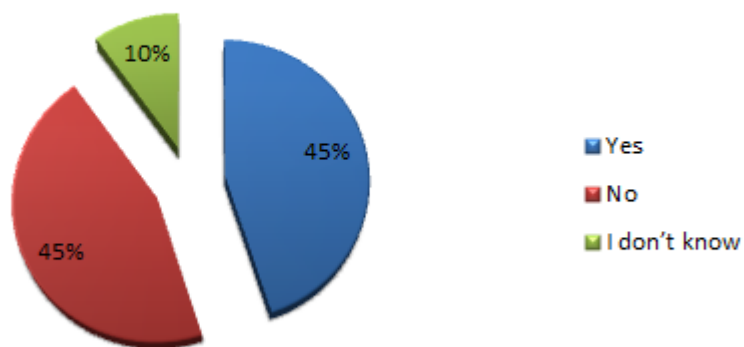


Figure7: show the laboratory safety documentation

### CONCLUSION

Through the research that we have done, we found that there is an urgent need to establish scientific educational courses within a periodic schedule to educate the workers in the laboratory about the rules and importance of security and safety, as well as the need to provide health and safety equipment and increase control, in addition to that there is a shortage of materials necessary for first aid and the need for their availability as well as important points that We noticed that there is a shortcoming in dealing with it, which is the mechanism for disposing of hazardous and non-hazardous waste alike. There must be a well-established evacuation plan that takes into account all categories in the event of any unexpected accident or fire

Table No. (1) shows the answers of the fourth students of chemistry sciences

Description	Yes	No	I do not know	No answer
<b>1- Safety equipment</b>				
-All necessary equipment is available, in good condition and used properly	6	6	3	0
- PPE, staff and students are monitored and their superiors are informed	10	3	2	0
Staff and students are trained in the correct use of personal protective equipment	9	4	2	0
- Personal protective equipment has been selected based on the hazards and manufacturer's recommendations.	10	3	2	0
<b>2- Personal health and safety</b>				
- Food and drink are prohibited in the laboratory	10	4	0	1
- Keep hands away from the face while working in the laboratory, and prevent the use of cosmetics, taking medicines and touching the eyes, nose or mouth.	14	0	1	0
- Using protective means (gags, for example) to protect the respiratory system, according to experiences, and taking into account the health conditions of students.	14	1	0	0
-Make sure to clean the laboratory immediately after completing each laboratory session and before using it again.	13	1	1	0
<b>3- Control of chemicals</b>				
-Instructions labeled on all chemical containers and packages are clear and intact.	15	0	0	0
-Do not store chemicals on laboratory benches	14	1	0	0
- A guide on how to handle chemicals safely (MSDS) and an inventory of chemical laboratory materials is available when needed	12	0	3	0

- Special signs are to be placed in dangerous places or in the cabinet for the extraction of gases and fumes	13	1	2	0
- First aid kit, fire blankets and spill kit provided.	7	8	0	0
-Chemical waste storage areas are clearly labeled.	7	4	3	1
4- Laboratory arrangement and safety				
- Damaged equipment or wiring is checked and repaired or replaced.	11	0	4	0
-Broken materials are safely disposed of	12	1	2	0
5- Processing and sterilization				
-- There is a record of the devices and tools used in sterilization, including: date, time, inspection time, pressure and temperature for periodic follow-up	12	3	0	0
-- Sterilization materials are documented in their own record.	11	2	2	0
6- Emergency Safety				
-An emergency evacuation plan has been developed in the department.	7	3	5	0
-- Students and staff were trained on the emergency evacuation plan in the department.	6	7	2	0
7- Documenting safety in the laboratory				
-- Laboratory personnel have been trained in first aid operations and the evacuation system	7	7	1	0
-The professor who conducts the experiment is qualified, and makes sure that the steps and materials are safe.	7	6	2	0
-Practical experience is evaluated to identify risks	6	6	3	0
-Hazardous waste management training is documented	8	5	2	0

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