

# Effect of An Educational Intervention About Occupational Safety on Knowledge and Practices of Male Students in Technical Mechanical Secondary Schools in El-Behira Governorate

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## Abstract

**Background.** Occupational health and safety is one of the most important aspects of human concern. **The Aim of this study** is to evaluate the effect of educational intervention about occupational safety on knowledge and practice of male students in technical mechanical secondary schools in El-Behira governorate. **Hypothesis:** Technical Mechanical secondary school male students who engage in occupational safety intervention will demonstrate higher level of knowledge and practice than those who are not. **Material and Methods:** Quasi-experimental pre/post-test research design. **Settings:** the study was conducted in four technical mechanical secondary schools in El-Behira governorate. **Subjects:** the study was carried on 280 students (140 were cases and 140 were control). **Data collection tools:** data were collected using three tools: structured self-administered questionnaire, Students' knowledge regarding occupational safety and observation check list regarding safety measures practices in the training workshops. **Results:** conveyed that less than half (46.4%, 47.9%) of both the study and the control group respectively were aged between 16 to less than 17 years. All the study group and the control one had poor knowledge regarding occupational health and safety before conduction of the educational intervention, whereas after implementation of the educational intervention, more than three quarters of the study group (85.7%) had good knowledge whereas the vast majority of the control group (99.3%) still had poor knowledge. There was a statistically significant relation between the department and the total knowledge score of the study group ( $X^2= 14.150$ ,  $P=0.007^*$ ). **Conclusion:** The educational program is successful in attaining its aim of positively improving knowledge, and practice of the study group about Occupational Health and Safety. **Recommendations:** this study recommend the necessity of provision of personal protective equipment to the students in the school workshops and integrating occupational safety topics in their curriculum. **Keywords:** Educational intervention, occupational health, Knowledge, Technical secondary schools.

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## 1. Introduction

Young people spend an expansive extent of their day in school or seeking after school-related exercises. Whereas, the essential reason of school is the scholastic advancement of students, its impacts on youths are distant broader. Moreover, enveloping their physical and mental wellbeing, security, civic engagement, and social <sup>(1)</sup>.development (WHO 2018). A secure environment is a prerequisite for successful learning, so there must be school programs in place to diminish levels of injuries as part of its wider plan to improve academic performance <sup>(2)</sup>.

Technical education is the cornerstone for all advancement efforts at any society. It plays a critical part in pushing up the advancement wheel and in accomplishing its maximum rates <sup>(3)</sup>. Whatever the improvement plans quality is, they couldn't accomplish their goals and their targeted rates without the existence of scientifically and technically qualified human cadres in all production fields <sup>(4)</sup>.

Vocational Secondary School is one of the branches in which the students will acquire the potential of technical talent from the technical field. To produce the potential of this professional future, specialized training is essential. In producing students who are exceedingly talented, they ordinarily utilize the practical training workshop more frequent for their technical practices. This is to reinforce the knowledge gained by students before they enter the real working environment <sup>(5)</sup>.

A secure school is one where the entire school environment enables students, teachers, administrators, and staff to communicate in a favorable, non-threatening way that reflects the educational mission of school while fostering positive relationship and personal development <sup>(6)</sup>. Safety at school includes identifying and implementing suitable policies and programs to ensure the health of students and staff <sup>(7)</sup>.

Creating a healthy school environment requires the inclusion of virtually everyone in the school students, administrators, teachers, guardians, school counselors, and nurses. Hence safe and supportive schools refers to

the provision of an environment that protects the emotional, psychological and physical prosperity of students<sup>(8)</sup>. Students in technical school face risks at their work stations in schools and furthermore at their work such as physical, chemical and psychosocial hazards. Since the scheme of the technological and vocational education is career oriented, the mentality of the students usually emphasizes specialized subjects and overlooks the overall curricula<sup>(9)</sup>.

Occupational health and safety (OHS) training is a principal component in work environment risk control programs. Various safety and health standards for hazard control contain requirements for training pointed at diminishing risk factors for injury, disease or death. Combined with management responsibility, which is fundamental, training is a vital portion of a comprehensive risk control program. Improving the effectiveness of OHS training efforts and other interventions is vital particularly as workplaces and workforces change<sup>(10)</sup>.

Unintentional injuries are harmful acts that occurred without any intention of causing damage to oneself or others. Unintentional accidents amongst teenagers and young adults age 21 and younger, an already susceptible, vulnerable subpopulation, are ongoing public health issue<sup>(11)</sup>. Nearly 18.1 million young workers under age 24 comprised about 13% of the workforce in the U.S. in 2013. In 2017, 375 young U.S. workers died from work-related injuries. Several researches published that there have been high occurrence of injuries amongst young people due to knowledge deficit about occupational fitness and safety and also lack of training about occupational dangers<sup>(12)</sup>.

Occupational health and protection is the concern of human wellbeing. Nowadays industrialization and service giving sectors development is accelerating resulting in enormous occupational health problems. Occupational safety and health hazards currently regarded as a driving force toward finding solutions how to prevent it from the manufacturing industries worker bad consequence<sup>(13)</sup>. In latest years, the quality, health, knowledge and protection necessities in several countries have been greater stringent than was the case seen before. Several studies concluded that pressures from communities have led to the enactment of a range of safety legislations and safety standards in different regions for several industries<sup>(14)</sup>.

A study carried out in United States (2018) revealed that extra than half (57%) of the study group of students had experienced injury during training in the mechanical workshops. The most commonly injured body parts had been hands, fingers, and legs. The most commonly reported injury kind was cuts/lacerations. Moreover, the study revealed that these injuries have been due to lack of knowledge about occupational fitness and safety<sup>(15)</sup>.

A study conducted in USA 2018 illustrated that more than three quarters (77%) of technical education students have poor knowledge about occupational fitness. More over the study illustrated that the majority of the students didn't wear personal protective equipment's during training in the workshop and therefore about 30 % of them had experienced injuries during training<sup>(16)</sup>.

The Occupational health nurse (OHN) performs an important role in assisting to defend the fitness of workers. The role of OHN is to authorize workers to make informed health decisions while also overseeing the fitness dangers and costs linked with the employment relations between employees and the enterprise<sup>(17)</sup>. The main functions of the occupational health nurse are to keep employees healthy, prevent illness and ensuring a safe working environment. The occupational health nurse is in an ideal situation to provide guidance, counseling, and coaching for employees who choose to enhance their health<sup>(18)</sup>.

### **Significance of the study**

Students in technical school face risks at their work stations in schools and furthermore at their work such as physical, chemical and psychosocial hazards. Since the scheme of the technological and vocational education is career oriented, the mentality of the students usually emphasizes specialized subjects and overlooks the overall curricula<sup>(9)</sup>.

A study conducted in Ethiopia (2019) revealed that more than two-thirds (48.1%) of the welders never heard about occupational hazards. With respect to fire hazards more than half (56%) of the study subjects didn't have knowledge about fire hazards, whereas more than three fourth (78%) of the respondents didn't have knowledge about electrical hazards. However, less than one third (28%) of the study subjects didn't have knowledge about accident prevention<sup>(19)</sup>.

A study conducted in Sweden (2014) concluded that vocational education pupils had poor knowledge regarding occupational risks and protective measures. Post program implementation about occupational safety, the majority (95%) of the students had good knowledge concerning occupational health and personal protective equipment<sup>(20)</sup>.

Although some studies are done on the prevalence of injuries among technical education students, information on occupational health and safety among technical mechanical secondary school students is still minimal. Furthermore, there are limited studies that specifically determine effect of educational intervention about occupational safety on knowledge and practice of male students in technical mechanical secondary schools. Therefore, the intent of the present study was to evaluate the effect of an educational intervention about

occupational safety on knowledge and practice of male students in technical mechanical secondary schools in El-Behira Governorate in order to improve their knowledge, practice toward occupational safety, hence improve their health.

### Aim of the study

#### Aim of the study is to:

- Evaluate the effect of educational intervention about occupational safety on knowledge and practice of male students in technical mechanical secondary schools in El-Behira governorate

#### Research hypothesis

- Technical Mechanical secondary school male students who engage in occupational safety intervention will demonstrate higher level of knowledge and practice than those who are not

## 2. Material and Methods

### 2.1. Material:

#### 2.1.1 Research design :

Quasi experimental (pre-posttest) study design was carried out to demeanor this study.

#### 2.1.2 Study setting :

The study was conducted in Four schools out of 13 schools (around one quarter) harvesting the highest numbers of students at the second level namely; Damnhour Technical Mechanical Secondary School, Kafr-El-Dawar Technical Mechanical Secondary School, Abo Homos Technical Mechanical Secondary School, and Hosh Eisa Technical Mechanical Secondary School .

#### 2.1.3 Subjects:

The target population of this study was the male students in the technical mechanical secondary schools who meet the following inclusion criteria:

- Enrolled in the second academic year
- Free from chronic disease
- Free from disability

#### 2.1.4 Sampling technique:

By using multi stage sampling technique, the following steps were done:

- El-Behira governorate was classified into 18 educational directorates. only 13 directorate have technical mechanical secondary schools
- Four schools (constituted 25%) having the highest numbers of students were purposively selected .
- From each school, the students enrolled in the second academic year were included in the study using systematic random sampling technique to select the required sample size of 280 students.
- The study sample was randomly assigned (lottery) to one of two groups, either the experimental group (n=140 students) or control group (n= 140) students .The experimental group received the occupational safety program, while the control group received the routine instructions from their teachers.

#### 2.1.5 Sample size:

The sample size was calculated by using EPI info7software based on the total population of 1104 and an expected frequency of 50% of hazards with margin error of 5% and confidence interval of 95%. This resulted in minimum required sample size of 280 students. 140 students were selected as an experimental group and 140 students were randomly selected as control group from each of the previously selected settings according to the following table.

#### Number of Students Selected From Different Departments

School	Department						Total
	Welding		Lathing		Foundry		
	Cases	Control	Cases	Control	Cases	Control	
<b>Damnhour Technical Mechanical Secondary School</b>	13	13	13	13	12	12	<b>76</b>
<b>Abo Homos Technical Mechanical Secondary School</b>			34	35			<b>69</b>
<b>Kafr-El-Dawar Technical Mechanical Secondary School</b>	19	19	19	19			<b>76</b>
<b>Hosh Eisa Technical Mechanical Secondary School</b>	10	10	10	10	10	9	<b>59</b>

#### 2.1.6 Tools for data collection:

Data were collected using the following three tools.

### **Tool (I): structured self-administered questionnaire:**

It was developed by the researcher and is composed of three parts. **The first part** is developed to collect data related to socio-demographic characteristics of the students: such as age, Academic department, residence, crowding index, family income, father & mother education and occupation. **The second part** included assessment of student's general health status like presence of health problems in the last 6 months, medication used, lab investigation done before, and presence of vision or hearing problems. **The third part** involved questions related to lifestyle of the students as physical exercises, sleeping patterns, eating habits, risk taking behaviors such as smoking, alcohol consumption, and drug abuse.

### **Tool (II): Students' knowledge regarding occupational safety**

**It was concerned with the following items:**

- Occupational safety in schools (definition, occupational safety committee in schools, activities of occupational safety committee )
- Possible environmental hazards present in school from their point of view
- Accidents hazards and their prevention
- Safety measures needed and adopted to overcome these hazards
- Personal protective equipment, and importance of using it
- First aid measures
- Fire hazards and their prevention

### **Scoring system:**

The students' knowledge about safety measures were calculated for each item. It consists of 62 items. A score of (2) will be given to the complete and correct answer, a score of (1) for correct but incomplete answer and a score of (0) for the wrong or missed answer. The total knowledge score was calculated and ranged from (0-124) which further categorized into three levels as follows:

Classification	Score
Good	75%-100% (93-124 points )
Fair	< 75%-50% (62- < 93 points)
Poor	< 50% (< 62 points )

### **Tool (III): Observation check list regarding safety measures practices in the training workshops**

An observational checklist was developed by the researcher after reading the recent literature in order to assess safety measures utilized in the mechanical workshops. It included the following parts:

#### **Part I: Workshops Environmental safety measures**

This part included data as: housekeeping, ventilation, noise control, lighting system, fire protection, electrical safety and workshop design

#### **Part II: Work process safety measures**

This part included safety measures adopted in various departments like Welding, lathing, and foundry.

#### **Part III: Protective devices used by students:**

This part included different personal protective equipment utilized by students in different departments of workshops such as safety glasses, mask, ear plug, gloves, apron, safety shoes...etc

### **Scoring system:**

Safety measures adopted in training workshops composed of 75 items and was calculated for each one. Every item was scored (1) if present and (zero) if not present. The total observational score was calculated and ranged between 0-100 and categorized into two levels as follows:

- 75% or more items of safety measures was considered as having complete safety measures (  $\geq 75$ -100 points ) .
- Less than 75% items of safety measures was considered as having incomplete safety measures. (< 75 points) .

### **Tool Content Validity and Reliability:**

Tools of the study were examined for content validity by a jury of five experts in the field of community health nursing from the Faculty of Nursing (Damnhour and Alexandria university) and the necessary modifications were done based on their recommendations . The reliability was assured by utilizing test-retest, and the result was 0.9.

## **2.2 Methods:**

- Permission to conduct the study in the selected setting was obtained after explanation of the aim of the study
- Tool I structured self-administered questionnaire: It was developed by the researcher after reviewing of the recent literatures to assess socio-demographic characteristics and life style of the students. Tool II Students' knowledge regarding occupational safety. It was developed by the researcher after reviewing the recent

literature to assess students' knowledge regarding occupational safety. Tool III Observation check list regarding safety measures practices in the training workshops. Was constructed by the researcher after reviewing the recent literature so as to assess safety measures used in the mechanical workshops. Tools validity, all the study tools (I,II,III) were examined for content validity by a jury of five experts in the field of community health nursing from the Faculty of Nursing (Damnhour and Alexandria university) and the necessary modifications were done based on their recommendations. Tool reliability, the reliability of tool III was conducted using test-retest and the result was 0.9 and the tool seems to be reliable.

- **Pilot study:** Twenty-eight (10% of the estimated sample) were piloted to ascertain the clarity, applicability and feasibility of the tools and to detect the obstacles that might impede the data collection process (not included in the original sample) consequently, all needed modifications were done.
- **Data collection phase:** The overall data collection process took about seven months (from September 2019 to March 2020).

- **Educational intervention:**

The study was implemented through the following three phases: Preparation of the educational intervention, implementation of the educational intervention and evaluation of the educational intervention. Collection of the data covered a period of six months from September 2019 to February 2020.

**First Phase: preparation of the educational intervention:**

**I. Assessment phase**

- The researcher visit the study setting and explain the questionnaire to both the study and control group.
- Pre intervention assessment for the students' knowledge and practice about occupational safety was done by the researcher after distributed tool II to be completed by both groups as pretest and to detect their learning needs in the first week before starting the program in each school.
- The observational assessment was calculated by the researcher for both study and control groups to assess safety measures practices in the training workshops by using tool III.

**II. Planning phase**

The intervention of occupational safety was developed by the researcher for the study group according to student's needs assessment and review of literature as to the following steps:

**a)Setting the program objectives**

➤ **General objective**

To improve the knowledge and practices of male students regarding occupational safety

➤ **Specific objectives**

**By the end of the educational intervention, the students were able to:**

- Define occupational safety
- List activities of occupational safety
- Mention the possible environmental hazards present in their schools
- Mention prevention of accidents and hazards
- Apply safety measures needed to overcome the occupational hazards
- Apply personal protective equipment and mention its importance
- List first aid measures
- Apply prevention of fire hazards

**b)Preparation of the content**

- The content of the educational intervention of occupational safety was designed to by the researcher to cover all the predetermined objectives .it was developed based on review of relevant recent literature, results of pre-assessment as well as characteristics of students.
- The content was comprised and formulated as regard to numbers of sessions and teaching methods
- Different educational strategies were utilized as lectures, brain storming, group discussion, and role play
- Different teaching aids were used to facilitate and illustrate teaching such as posters, handout, slide data show and videos.

**Second Phase: Implementation of the Educational Intervention**

- 1)This phase included the implementation of the planned educational intervention.
- 2)The students were divided into groups at each school, each group was contain around (15-20) students.
- 3)At the beginning of the first session, students were oriented to the aim of the study, phases and the educational intervention sessions (time, duration, and contents).The researcher focused on the importance of continuous attendance and active participation. In each session students questions were answered, then handout were distributed to them.
- 4)Timetable of the educational intervention regarding occupational health and safety

Days	Contents	Teaching methods	Media	Time	Evaluation
<b>First day Session 1</b>	<ul style="list-style-type: none"> <li>➤ Orientation of the participants</li> <li>➤ Explain the purpose and nature of the study for them</li> <li>➤ Introduction (Technical education in Egypt and its importance)</li> <li>➤ Overview about school safety ( definition of school safety ,type of hazards in school, safety precautions in school , the role of school safety committee )</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion</li> <li>• Lecture</li> <li>• Brain storming</li> </ul>	<ul style="list-style-type: none"> <li>• Brochure</li> <li>• Data show</li> </ul>	1 hour	<ul style="list-style-type: none"> <li>➤ Pretest</li> <li>➤ Post test</li> </ul>
<b>Second day Session 2</b>	<ul style="list-style-type: none"> <li>➤ Occupational health (definition of occupational health, objectives of occupational health , occupational hazard meaning , various sorts of occupational risks )</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion</li> <li>• Lecture</li> <li>• Brain storming</li> </ul>	<ul style="list-style-type: none"> <li>• Data show</li> <li>• Brochure</li> <li>• Poster</li> </ul>	1 hour	<ul style="list-style-type: none"> <li>➤ Pretest</li> <li>➤ Post test</li> </ul>
<b>Third day Session 3</b>	<ul style="list-style-type: none"> <li>➤ Safety precautions in mechanical workshops (occupational hazards and protective measures in welding ,lathing and foundry workshops , identification of safety precautions that must be taken during working in the workshop )</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion</li> <li>• Lecture</li> <li>• Brain storming</li> </ul>	<ul style="list-style-type: none"> <li>• Data show</li> <li>• Brochure</li> <li>• Video about occupational hazards</li> </ul>	1 hour	<ul style="list-style-type: none"> <li>➤ Pretest</li> <li>➤ Post test</li> </ul>
<b>Fourth day Session 4</b>	<ul style="list-style-type: none"> <li>➤ Personal protective equipment ( definition, importance and different types of personal protective equipment)</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion</li> <li>• Lecture</li> <li>• Brain storming</li> </ul>	<ul style="list-style-type: none"> <li>• Data show</li> <li>• Brochure</li> <li>• Video about personal protective equipment</li> </ul>	1 hour	<ul style="list-style-type: none"> <li>➤ Pretest</li> <li>➤ Post test</li> </ul>
<b>Fifth day Session 5</b>	<ul style="list-style-type: none"> <li>➤ First aid ( definition, first aid box contents , principles of first aid , priorities of first aid , first aid survey</li> <li>➤ Heart attack first aid measures</li> <li>➤ ( definition, signs and symptoms , application of first aid )</li> <li>➤ Burn ( definition, causes of burn , degrees of burn, application of first aid)</li> </ul>	<ul style="list-style-type: none"> <li>• Group discussion</li> <li>• Lecture</li> <li>• Brain storming</li> <li>• Role play</li> <li>• Demonstration and re-demonstration</li> </ul>	<ul style="list-style-type: none"> <li>• Data show</li> <li>• Brochure</li> <li>• Video about heart attack first aid</li> <li>• Video about burn first aid</li> </ul>	1 hour	<ul style="list-style-type: none"> <li>➤ Pretest</li> <li>➤ Post test</li> </ul>

Days	Contents	Teaching methods	Media	Time	Evaluation
<b>Sixth day Session 6</b>	<ul style="list-style-type: none"> <li>➤ Wounds (definition, types of wounds , application of first aid )</li> <li>➤ Bleeding ( definition, causes, types, complications, application of first aid</li> <li>➤ Fractures ( types, application of first aid )</li> <li>➤ Convulsion ( definition, signs and symptoms , application of first aid )</li> <li>➤ Poisoning ( definition, signs and symptoms, application of first aid )</li> <li>➤ Bites and stings ( definition, different types of bites and stings</li> <li>➤ Eye injuries ( definition, application of first aid)</li> <li>➤ Amputation ( definition, application of first aid )</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion</li> <li>• Lecture</li> <li>• Brain storming</li> <li>• Role play</li> <li>• Demonstration and re-demonstration</li> </ul>	<ul style="list-style-type: none"> <li>• Data show</li> <li>• Brochure</li> <li>• Video about wound first aid</li> <li>• Video about bleeding first aid</li> <li>• Video about fracture first aid</li> <li>• Video about Convulsion first aid</li> <li>• Video about eye injuries first aid</li> <li>• Video about poisoning first aid</li> </ul>	2hours	<ul style="list-style-type: none"> <li>➤ Pretest</li> <li>➤ Post test</li> </ul>
<b>Seventh day Session 7</b>	<ul style="list-style-type: none"> <li>➤ Emergency evacuation drill ( definition, objectives, duties of emergency team, measures that must be available in school , duties of firefighting teams in schools , evacuation exercises in school )</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion</li> <li>• Lecture</li> <li>• Brain storming</li> <li>• Role play</li> <li>• Demonstration And re-demonstration</li> </ul>	<ul style="list-style-type: none"> <li>• Data show</li> <li>• Brochure</li> <li>• Video about emergency evacuation drill for fire</li> </ul>	1hour	<ul style="list-style-type: none"> <li>➤ Pretest</li> <li>➤ Post test</li> </ul>
<b>Eighth day Session 8</b>	<ul style="list-style-type: none"> <li>➤ Types of common accidents in mechanical workshops and protective measures (definition of accident, different types of accidents inside the mechanical workshops, causes of accidents, and protective measures .</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion</li> <li>• Lecture</li> <li>• Brain storming</li> <li>• Role play</li> <li>• Demonstration and re-demonstration</li> </ul>	<ul style="list-style-type: none"> <li>• Data show</li> <li>• Brochure</li> <li>• Poster</li> </ul>	1hour	<ul style="list-style-type: none"> <li>➤ Pretest</li> <li>➤ Post test</li> </ul>
<b>Ninth day Session 9</b>	<ul style="list-style-type: none"> <li>➤ Principles of proper nutrition (benefits of proper nutrition, food groups, factors affecting food group's requirements, well balanced diet).</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion</li> <li>• Lecture</li> <li>• Brain storming</li> <li>• Role play</li> <li>• Demonstration and re-demonstration</li> </ul>	<ul style="list-style-type: none"> <li>• Data show</li> <li>• Real objects</li> <li>• Brochure</li> </ul>	1 hour	<ul style="list-style-type: none"> <li>➤ Pretest</li> <li>➤ Post test</li> </ul>
<b>Tenth day Session 10</b>	<ul style="list-style-type: none"> <li>➤ Health maintenance importance ( definition, factors affecting health , ways of health maintenance, benefits of health maintenance )</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion</li> <li>• Lecture</li> <li>• Brain storming</li> <li>• Role play</li> <li>• Demonstration and re-demonstration</li> </ul>	<ul style="list-style-type: none"> <li>• Data show</li> <li>• Brochure</li> </ul>	1hour	<ul style="list-style-type: none"> <li>➤ Pretest</li> <li>➤ Post test</li> </ul>

### Third Phase: Evaluation of the Educational Intervention

- Evaluation of the intervention was done two times: immediately and after 3 months of the completion of the intervention for the study group and the control one through posttest structured questionnaire using tool II.

#### Statistical analysis

Data were coded and transferred into specially designed formats to be suitable for computer feeding. Following data entry, checking and verifying process were carried out to avoid any errors during data entry. Frequency analysis, cross tabulation and manual revision were all used to detect any errors.

- Data was analyzed using PC with statistical package for social science (SPSS) version 20.
- The level of significance selected for this study was p equal or less than 0.05.

The next statistical procedures were employed:

1. Descriptive: count, percentage, arithmetic mean, standard deviation.
2. Inferential: the mean change in the overall score of the studied variables was employed for comparison at baseline and follow-up after the educational intervention based on the total maxing allowable score for each variables using: Chi-square test, Fisher's Exact or Monte Carlo correction, Student t-test, ANOVA with repeated measures, Pearson coefficient.

#### Ethical Considerations:

- Permission was obtained from ethical committee in the Faculty of Nursing Damnhour University
- Permission was obtained to collect the data from the selected settings.
- Written consent was obtained from every student participated in the study after explanation of the aim of the study and participants were assured that collected data will be used only for the study purpose.

### 3. Results

**Table (I) displays distribution of the studied sample according to their personal and socio demographic characteristics.** The total number included in the study was 280 (140 cases and 140 control. concerning age, it ranged from 15-18 years with a mean age of  $16.39 \pm 0.71$  among the study group whereas among the control group  $16.21 \pm 0.71$ . Regarding the place of residence, less than two thirds (63.6%) of the study group were living in urban areas compared to two thirds (66.4%) of the control group. Also, it was evident that the vast majority of both groups (90%) had not enough income to meet the demands of their lives.

**Table (1):Distribution of The Studied Sample According to Their Socio Demographic Characteristics**

Socio-demographic characteristics	Study group (n = 140)		Control group (n = 140)		Test of Significance
	No.	%	No.	%	
<b>Age in years</b>					
15 < 16	13	9.3	24	17.1	$\chi^2=4.974$ $_{MC}p=0.174$
16 < 17	65	46.4	67	47.9	
17 < 18	57	40.7	44	31.4	
18 < 19	5	3.6	5	3.6	
Min. – Max.	15.0 – 18.0		15.0 – 18.0		$t=1.948$ $_{MC}p=0.052$
Mean $\pm$ SD.	$16.39 \pm 0.71$		$16.21 \pm 0.71$		
<b>Residence</b>					
Urban	89	63.6	93	66.4	$\chi^2=0.251$ $_{MC}p=0.616$
Rural	51	36.4	47	33.6	
<b>Family income</b>					
Enough	14	10.0	14	10.0	$\chi^2=0.000$ $_{MC}p=1.000$
Not enough	126	90.0	126	90.0	
<b>Crowding index</b>					
< 2	10	7.1	5	3.6	$\chi^2=11.497^*$ $_{MC}p=0.001^*$
2- < 4	30	21.4	40	28.6	
$\geq 4$	100	71.5	95	67.8	
Min. – Max.	1 -10		1-5		$t=3.627^*$ $p<0.001^*$
Mean $\pm$ SD.	$2.4 \pm 0.9$		$2.1 \pm 0.6$		



Socio-demographic characteristics	Study group (n = 140)		Control group (n = 140)		Test of Significance
	No.	%	No.	%	
<b>Mother Level of education</b>					
Illiterate	13	9.3	14	10.0	$\chi^2=4.225$ MC p=0.524
Read and write	3	2.1	3	2.1	
Primary school	5	3.6	3	2.1	
Preparatory school	10	7.1	12	8.6	
Secondary school	69	49.3	55	39.3	
University education	40	28.6	53	37.9	

$\chi^2$ : Chi square test                      MC: Monte Carlo                      t: Student t-test  
 p: p value for comparing between Experimental and Control  
 \*: Statistically significant at  $p \leq 0.05$

**Table (I): (CONT.) :**

Socio-demographic characteristics	Study group (n = 140)		Control group (n = 140)		Test of Significance
	No.	%	No.	%	
<b>Father level of education</b>					
Illiterate	5	3.6	5	3.6	$\chi^2=5.839$ MC p=0.304
Read and write	1	0.7	0	0.0	
Primary school	1	0.7	4	2.9	
Preparatory school	15	10.7	12	8.5	
Secondary school	46	32.9	34	24.3	
University education	72	51.4	85	60.7	
<b>Mother's occupation</b>					
House wife	74	52.9	57	40.7	$\chi^2=23.635^*$ MC p<0.001*
Unskilled manual worker	3	2.1	0	0.0	
Farmer	5	3.5	0	0.0	
Trades/business	27	19.3	23	16.5	
Semiprofessional /clerk	6	4.3	3	2.1	
Professional	25	17.9	57	40.7	
<b>Father's occupation</b>					
Non-working/retired	2	1.5	13	9.3	$\chi^2=17.581^*$ MC p<0.001*
Unskilled manual worker	5	3.6	4	2.9	
Skilled manual worker/farmer	5	3.6	0	0.0	
Trades/business	45	32.1	29	20.7	
Semiprofessional / clerk	3	2.1	4	2.9	
Professional	80	57.1	90	64.2	

$\chi^2$ : Chi square test                      MC: Monte Carlo  
 p: p value for comparing between Experimental and Control  
 \*: Statistically significant at  $p \leq 0.05$

**Table (II) Illustrates distribution of the studied sample according to their life style pattern.** Concerning the dietary pattern, around two thirds of the study group (61.4%) reported that they had three meals per day compared to more than two thirds (69.3%) of the control group. The table also portrays that nearly two fifths (41.4%) of the study group always had breakfast daily compared to more than half (52.9%) of the control group. Additionally, it was found that half of the study group ( 50%) reported always intake of fast food compared to less than two third (63.6%) of the control group. Moreover, it was apparent that the vast majority of the study group were consuming beverages.

Concerning exercise, it was evident that, less than two thirds (60.7%) of the study group didn't practice any type of exercise compared to more than three quarters (83.6%) of the control group, whereas the rest of both groups were practicing exercises.

With respect to risk-taking behaviors, the table depicts that more than one third (37.1) of the study group reported that they were smokers compared to about one fifth (20.7%) of the control group.

**Table (II): Distribution of the Studied Sample According to their life style pattern**

Life style pattern	Study group (n = 140)		Control group (n = 140)		Test of Significance
	No.	%	No.	%	
<b>A. Eating habits</b>					
<b>Number of meals per day</b>					
One meal	0	0.0	0	0.0	$\chi^2=4.893$ MC p=0.070
Two meals	4	2.9	0	0.0	
Three meals	86	61.4	97	69.3	
More than three	50	35.7	43	30.7	
<b>Intake of breakfast meal</b>					
Always	58	41.4	74	52.9	$\chi^2=13.576^*$ MC p =0.001*
Sometimes	63	45.0	63	45.0	
Never	19	13.6	3	2.1	
<b>Fast food intake</b>					
Always	70	50.0	89	63.6	$\chi^2=14.269^*$ MC p =0.001*
Sometimes	53	37.9	49	35.0	
Never	17	12.1	2	1.4	
<b>Number of water glasses per day</b>					
< 8 cups/ day	58	41.4	80	57.1	$\chi^2=12.267^*$ MC p =0.002*
8 cups/ day	61	43.6	54	38.6	
> 8 cups/ day	21	15.0	6	4.3	
Mean $\pm$ SD	9.86 $\pm$ 3.07		10.56 $\pm$ 3.07		t=3.627* MC p <0.001*
<b>Beverages intake</b>					
No	14	10.0	0	0.0	$\chi^2=14.737^*$ MC p <0.001
Yes	126	90.0	140	100.0	
<b>Beverages intake frequency</b>					
	n=(126)		n=(140)		$\chi^2=12.267^*$ MC p=0.002*
Three times per day	54	42.9	65	46.4	
Two times per day	55	43.6	64	45.7	
More than three times per day	17	13.5	11	7.9	

$\chi^2$ : Chi square test                      MC: Monte Carlo  
 p: p value for comparing between the studied groups  
 \*: Statistically significant at  $p \leq 0.05$

**Table (II): (CONT.) :**

Life style pattern	Study group (n = 140)		Control group (n = 140)		Test Significance
	No.	%	No.	%	
<b>B. Exercise</b>					
<b>Practicing exercise</b>					
No	85	60.7	117	83.6	$\chi^2=18.198^*$ MC p <0.001*
Yes	55	39.3	23	16.4	
<b>Frequency of practicing exercise per week</b>					
	(n=55)		(n=23)		$\chi^2=26.039^*$ MC p <0.001*
Once	51	92.7	15	65.2	
Twice	4	7.3	8	34.8	
More than twice	0	0.0	0	0.0	
<b>Causes of not practicing exercise</b>					
Lack of time	50	90.9	19	82.6	$\chi^2=16.014^*$ MC p <0.001*
Sickness reasons	5	9.1	4	17.4	



majority of both groups (97.1%, 98.6%) had poor knowledge, and the rest of both groups (2.9%, 1.4%) had fair knowledge, with a statistically significant difference between both groups ( $X^2= 6.272$ ,  $^{FE}p=0.684$ ). By contrast, after the educational intervention, more than one third (41.4%) of the study group had good knowledge compared to only 0.7% of the control one. Additionally, less than half (47.9%) of the study group had fair knowledge compared to just 2.1% of the control group. Moreover, around one tenth (10.7%) of the study group had poor knowledge, whereas the vast majority of the control group still had poor knowledge, with a statistically significant difference between both groups ( $X^2= 210.542$ ,  $^{MC}p = <0.001$ ).

In relation to school accidents, the table conveys that before the educational intervention the vast majority (92.9%, 97.1%) of the study group and the control one respectively scored poorly and the minority of both groups (2.9%) had good knowledge, with a statistically significant difference between both groups ( $X^2= 6.272$ ,  $^{MC}p = 0.047$ ). Otherwise, after the educational intervention, two-fifth (40%) of the study group had correct knowledge compared to a minority (2.9%) of the control group. In addition, more than one third (37.9%) of the study group had fair knowledge compared to only 2.9% of the control one. As well as that, less than one quarter (22.1%) of the study group had poor knowledge, whilst the vast majority (94.2%) of the control group still had poor knowledge, with a statistically significant difference between both groups ( $X^2=149.77$ ,  $^{MC}p = <0.001$ ).

The table also represented that before the educational intervention all the study group and the control one had poor knowledge regarding safety measures that must be available in the workshop. Nevertheless, after the educational intervention, more than two thirds (68.5%) of the study group had good knowledge, whilst more than one fifth (23.6%) of them had fair knowledge and the rest of them (7.9%) had poor knowledge. Furthermore, all the control group still had poor knowledge, with a statistically significant difference between both groups ( $X^2= 239.205$ ,  $^{MC}p = <0.001$ ).

The table also depicts that all the study group and the vast majority (98.6%) of the control one had poor knowledge regarding first aids before the educational intervention, with no statistically significant difference between both groups ( $X^2= 2.014$ ,  $^{FE}p=0.498$ ). Unlike, after the educational intervention, less than two thirds (63.6%) of the study group had good knowledge, whereas less than two fifth (15.7%) had fair knowledge and the rest of them (20.7%) had poor knowledge. Along with, the vast majority (98.6%) of the control group and only 1.4% of them had fair knowledge. A statistically significant difference was found between both groups ( $X^2= 176.320$ ,  $^{MC}p = <0.001$ ).

**Table (III): Distribution of the Studied Sample According To Their Total Knowledge Score before and After Program**

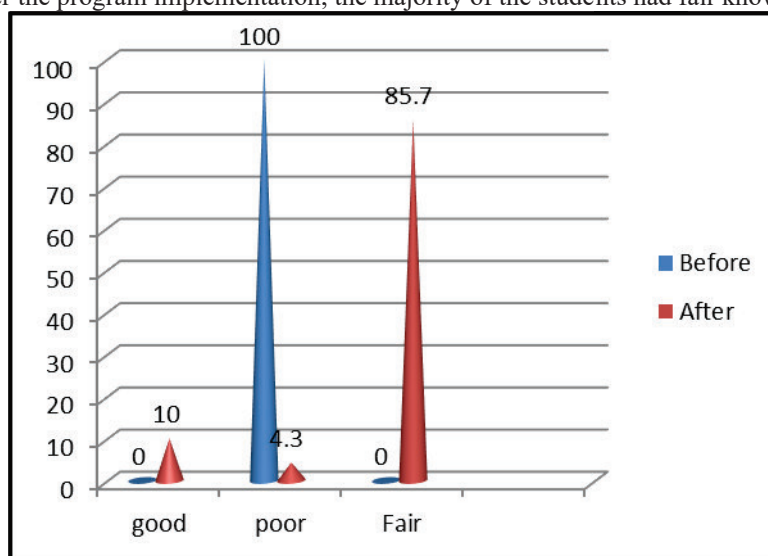
Knowledge Level	Before				After			
	Study group (n = 140)		Control group (n = 140)		Study group (n = 140)		Control group (n = 140)	
	No.	%	No.	%	No.	%	No.	%
<b>Occupational health and safety in the school</b>								
Poor	140	100.0	140	100.0	47	33.6	140	100.0
Fair	0	0.0	0	0.0	19	13.6	0	0.0
Good	0	0.0	0	0.0	74	52.8	0	0.0
$\chi^2$ (p)					- 139.251* ( <b>&lt;0.001*</b> )			
<b>Occupational hazards</b>								
Poor	136	97.1	138	98.6	15	10.7	136	97.2
Fair	4	2.9	2	1.4	67	47.9	3	2.1
Good	0	0.0	0	0.0	58	41.4	1	0.7
$\chi^2$ (p)					0.681 ( $^{FE}p=0.684$ ) 210.542* ( <b>&lt;0.001*</b> )			
<b>School accidents</b>								
Poor	130	92.9	136	97.1	31	22.1	132	94.2
Fair	6	4.2	0	0.0	53	37.9	4	2.9
Good	4	2.9	4	2.9	56	40.0	4	2.9
$\chi^2$ (p)					6.272 ( $^{MC}p=0.047^*$ ) 149.772* ( <b>&lt;0.001*</b> )			
<b>Safety measures that must be available in the workshop</b>								
Poor	140	100.0	140	100.0	11	7.9	140	100.0
Fair	0	0.0	0	0.0	33	23.6	0	0.0
Good	0	0.0	0	0.0	96	68.5	0	0.0
$\chi^2$ (p)					- 239.205* ( <b>&lt;0.001*</b> )			

Knowledge Level	Before				After			
	Study group (n = 140)		Control group (n = 140)		Study group (n = 140)		Control group (n = 140)	
	No.	%	No.	%	No.	%	No.	%
<b>First aids</b>								
Poor	140	100.0	138	98.6	29	20.7	138	98.6
Fair	0	0.0	2	1.4	22	15.7	2	1.4
Good	0	0.0	0	0.0	89	63.6	0	0.0
$\chi^2$ (p)	2.014 (FE p=0.498)				176.320* (<0.001*)			

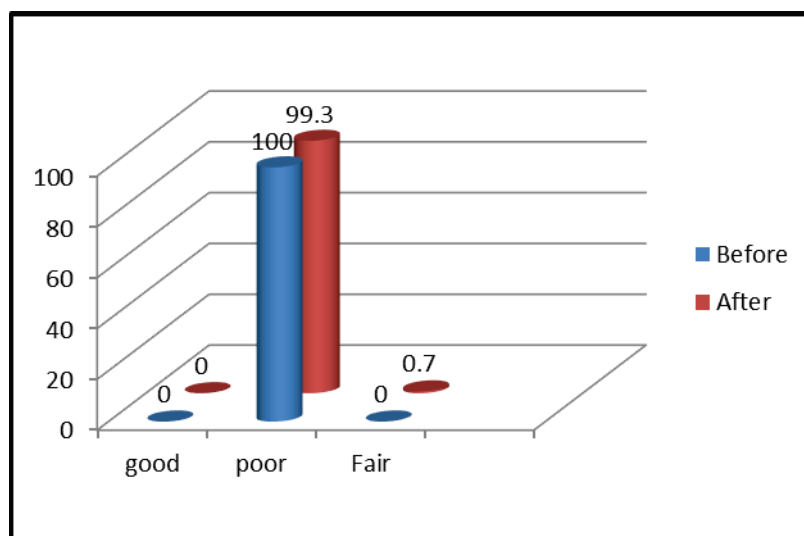
$\chi^2$ : Chi square test MC: Monte Carlo FE: Fisher Exact p: p value for comparing between Experimental and Control \*: Statistically significant at  $p \leq 0.05$

**Figure (I): Study group overall knowledge scores before and after program implementation.**

It is clear from the figure that before conduction of the educational intervention, all the study group had poor knowledge, while after the program implementation, the majority of the students had fair knowledge.

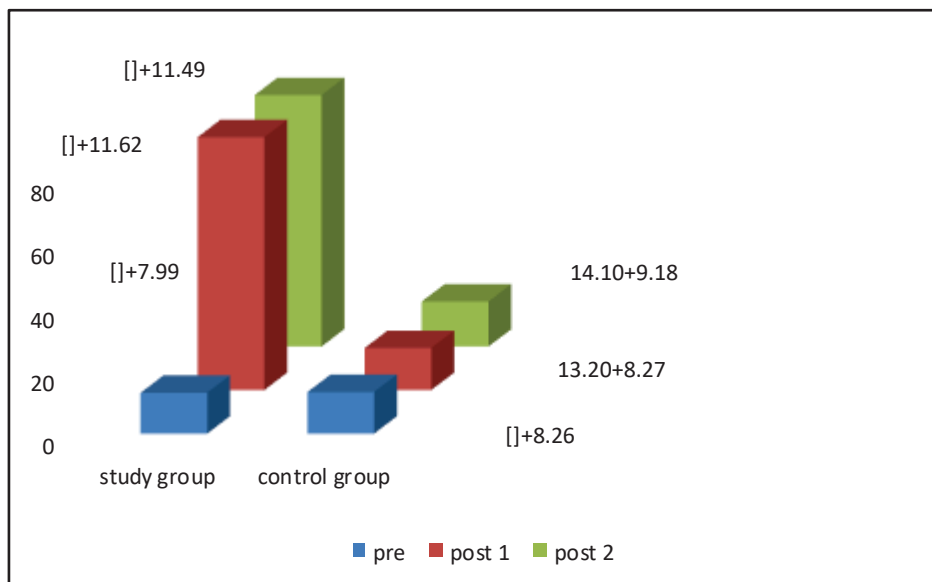


**Figure (II): Control group overall knowledge scores before and after program implementation.** The figure conveys that the control group had poor knowledge before and after implementation of the educational intervention.



**Figure (III) Portrays Distribution Of The Studied Sample According To Their Overall Total Mean Score.**

It is apparent from this figure that the overall mean score for the study group before the educational intervention was  $(12.79 \pm 7.99)$ , whereas the control group was  $(13.03 \pm 8.26)$ , with no statistically significant difference between both groups ( $t\text{-test} = 0.243, P = 0.808$ ). On the contrary, after the educational intervention, the mean score for the study group rose to  $(79.24 \pm 11.62)$ , whereas the control group remained the same  $(13.20 \pm 8.27)$ , with a statistically significant difference between both groups ( $t\text{-test} = 54.792, P < 0.001$ ). Additionally, three months after the educational intervention, the mean score for the study group was  $(78.79 \pm 11.49)$ , whereas the control group was  $(14.10 \pm 9.18)$ , with a statically significant difference between both groups ( $t\text{-test} = 52.037, P < 0.001$ ).



**Table (IV): Puzzles out the Relation between the students’ knowledge level and their socio-demographic characteristics.** It was apparent from the table that there was significant correlation between age, department and level of knowledge. ( $X^2 = 15.929, P = 0.014^*$ ), ( $X^2 = 14.150, P = 0.007^*$ ). Nevertheless, It can also be observed from the table that factors such as place of residence, family income, crowding index, Mother’s level of education, Mother’s occupation, Father’s level of education, and Father’s occupation of the studied sample had an insignificant effect on their knowledge score. ( $X^2 = 1.897, P = 0.387, X^2 = 2.593, P = 0.274, X^2 = 0.809, P = 0.667, X^2 = 9.028, P = 0.529, X^2 = 5.503, P = 0.064, X^2 = 4.377, P = 0.929, X^2 = 0.338, P = 0.844$ ).

**Table (V): Relation between the students’ knowledge level and their socio demographic characteristics**

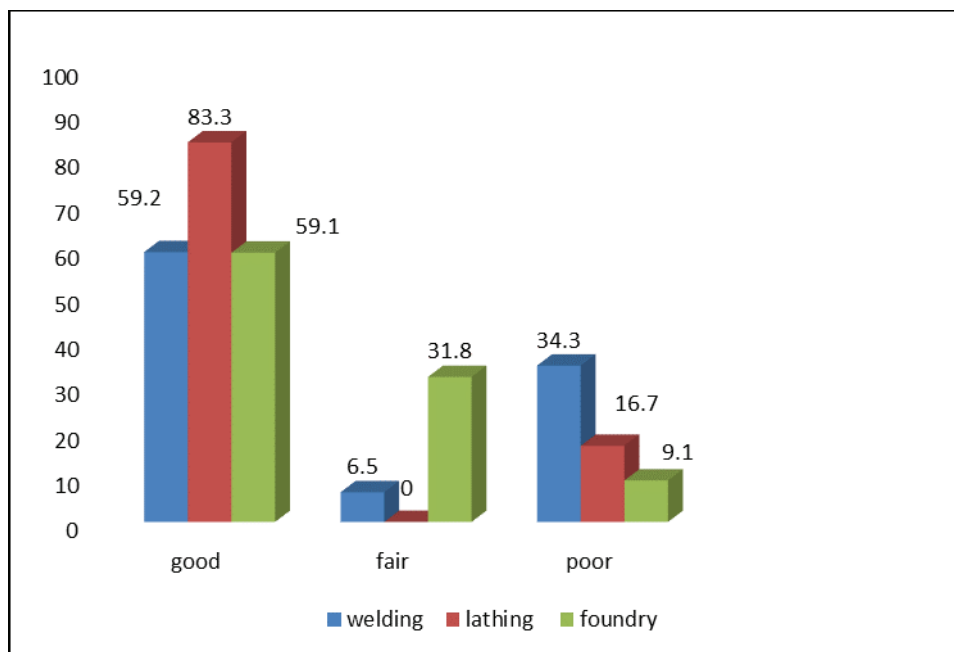
Item	Knowledge level						Total n=140		Test of significance
	Poor (n=6)		Fair (n=120)		Good (n=14)				
	No.	%	No.	%	No.	%			
<b>Age</b>									
- 15-	1	7.7	8	61.5	4	30.8	13	9.3	$X^2 = 15.929$ $P = 0.014^*$
- 16-	1	1.5	59	90.8	5	7.7	65	46.4	
- 17-	4	7.0	50	87.7	3	5.3	57	40.7	
- 18-<19	0	0.0	3	60.0	2	40.0	5	3.6	
<b>Department</b>									
- Welding	1	1.3	63	82.9	12	15.8	76	54.3	$X^2 = 14.150$ $P = 0.007^*$
- Lathing	5	11.9	36	85.7	1	2.4	42	30.0	
- Foundry	0	0.0	21	95.5	1	4.5	22	15.7	
<b>Place of residence</b>									
- Urban	3	3.4	75	84.3	11	12.4	89	63.6	$X^2 = 1.897$ $P = 0.387$
- Rural	3	5.9	45	88.2	3	5.9	51	36.4	

Item	Knowledge level						Total n=140		Test of significance
	Poor (n=6)		Fair (n=120)		Good (n=14)				
	No.	%	No.	%	No.	%			
<b>Family income</b>									
- Enough	0	0.0	14	100.0	0	0.0	14	10.0	X <sup>2</sup> = 2.593 P=0.274
- Not enough	6	4.8	106	84.1	14	11.1	126	90.0	
<b>Crowding index</b>									
- < 1.5	2	3.6	46	83.6	7	12.7	55	39.3	X <sup>2</sup> = 0.809 P=0.667
- ≥ 1.5	4	4.7	74	87.1	7	8.2	85	60.7	
<b>Mother's level of education</b>									
- Illiterate	0	0.0	11	84.6	2	15.4	13	9.3	X <sup>2</sup> = 9.028 P=0.529
- Read & write	0	0.0	2	66.7	1	33.3	3	2.1	
- Primary education	0	0.0	4	80.0	1	20.0	5	3.6	
- Preparatory education	0	0.0	9	90.0	1	10.0	10	7.1	
- Secondary education	5	7.2	61	88.4	3	4.3	69	49.3	
- University education	1	2.5	33	82.5	6	15.0	40	28.6	
<b>Mother's occupation</b>									
- Working	5	7.6	52	78.8	9	13.6	66	47.1	X <sup>2</sup> = 5.503 P=0.064
- Not working	1	1.4	68	91.9	5	6.8	74	52.9	
<b>Father's level of education</b>									
- Illiterate	0	0.0	4	80.0	1	20.0	5	3.6	X <sup>2</sup> = 4.377 P=0.929
- Read & write	0	0.0	1	100.0	0	0.0	1	0.7	
- Primary education	0	0.0	1	100.0	0	0.0	1	0.7	
- Preparatory education	0	0.0	12	80.0	3	20.0	15	10.7	
- Secondary education	3	6.5	40	87.0	3	6.5	46	32.9	
- University education	3	4.2	62	86.1	7	9.7	72	51.4	
<b>Father's occupation</b>									
- Working	6	4.3	118	85.5	14	10.1	138	91.4	X <sup>2</sup> = 0.338 P=0.844
- Not working	0	0.0	2	100.0	0	0.0	2	8.6	

X<sup>2</sup> Chi square test \* statistically significant at ≤ 0.05

**Figure (V): Conveys Distribution of the Study Group according To Overall Score of Knowledge by Department after the Educational Intervention.**

It can be observed from the figure that more than half (59.2%) of the study group in the welding department had good knowledge, whereas more than one third (34.3%) of them had poor knowledge and only 6.5% of them had fair knowledge. Pertaining to lathing department, more than three quarters (83.3%) of the students had good knowledge and more than one tenth (16.7%) had poor knowledge. Also it can be noticed that more than half (59.1%) of the students in foundry department had good knowledge, whereas more than one quarter (31.8%) of them had fair knowledge and the minority (9.1%) had poor knowledge.



**Table (VI): Available environmental safety measures in different mechanical workshops according to the scoring used in this study.**

It was apparent that all observed workshops had incomplete safety measures in terms of housekeeping, ventilation, noise, lighting, machine safe working, manual tool, electricity, fire protection, first aid facility, and communication facility.

**Table (VII): Available Environmental Safety Measures In Different Mechanical Workshops**

Items	Pre program						Post program					
	Welding (n = 3)		Lathing (n = 4)		Foundry (n = 2)		Welding (n = 3)		Lathing (n = 4)		Foundry (n = 2)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<b>House keeping</b>												
Incomplete	3	100.0	4	100.0	2	100.0	1	33.3	1	25	0	0.0
Complete	0	0.0	0	0.0	0	0.0	2	66.7	3	75	2	100
<b>Ventilation</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100	4	100	2	100
Complete	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0
<b>Noise</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100.0	4	100.0	2	100.0
Complete	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
<b>Lighting</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100.0	3	75.0	2	100.0
Complete	0	0.0	0	0.0	0	0.0	0	0.0	1	25.0	0	0.0
<b>Machine safe working</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100.0	4	100.0	2	100.0
Complete	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
<b>Manual tool</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100	4	100	2	100
Complete	0	0.0	0	0.0	0	0.0	0	0	0	0	0	0
<b>Electricity</b>												
Incomplete	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Complete	3	100.0	4	100.0	2	100.0	3	100.0	4	100.0	2	100.0
<b>Fire protection</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100.0	4	100.0	2	100.0
Complete	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
<b>First aid facility</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100.0	4	100.0	2	100.0
Complete	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0



Items	Pre program						Post program					
	Welding (n = 3)		Lathing (n = 4)		Foundry (n = 2)		Welding (n = 3)		Lathing (n = 4)		Foundry (n = 2)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<b>Communication facility</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100.0	4	100.0	2	100.0
Complete	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

**Table (IX): Safety Measures Adopted In Different Workshops During Work Process.** It can be observed from the table that none of the welding workshops adopted complete safety measures during working process neither before nor after the educational intervention. On the contrary, complete safety measures were adopted in both lathing and foundry workshops in the pretest and posttest phases.

**Table (IX): Safety Measures Adopted In Different Workshops during Work Process**

Items	Pre program						Post program					
	Welding (n = 3)		Lathing (n = 4)		Foundry (n = 2)		Welding (n = 3)		Lathing (n = 4)		Foundry (n = 2)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<b>Welding safety</b>												
Incomplete	3	100.0	-	-	-	-	3	100.0	-	-	-	-
Complete	0	0.0	-	-	-	-	0	0.0	-	-	-	-
<b>Lathing safety</b>												
Incomplete	-	-	0	0.0	-	-	-	-	0	0.0	-	-
Complete	-	-	4	100.0	-	-	-	-	4	100.0	-	-
<b>Foundry safety</b>												
Incomplete	-	-	-	-	0	0.0	-	-	-	-	0	0.0
Complete	-	-	-	-	2	100.0	-	-	-	-	2	100.0

**Table (X): Protective Devices in Different Mechanical Workshops.** The table pointed out that body protection, feet protection, ear protection; hand protection, eye and face protection devices were not adopted in the all observed workshops before and after the educational intervention.

**Table (X): Protective Devices in Different Mechanical Workshops**

Items	Pre program						Post program					
	Welding (n = 3)		Lathing (n = 4)		Foundry (n = 2)		Welding (n = 3)		Lathing (n = 4)		Foundry (n = 2)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<b>Body protection</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100.0	4	100.0	2	100.0
Complete	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
<b>Feet protection</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100.0	4	100.0	2	100.0
Complete	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
<b>Ear protection</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100.0	4	100.0	2	100.0
Complete	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
<b>Hand protection</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100.0	4	100.0	2	100.0
Complete	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
<b>Eye and face protection</b>												
Incomplete	3	100.0	4	100.0	2	100.0	3	100.0	4	100.0	2	100.0
Complete	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

## Discussion

Adolescent population and their health are a very special issue and focus of attention globally for various reasons, as it is a period of rapid physical growth and emotional and psychological change. Health and quality of life during adulthood depend on health during adolescence <sup>(21)</sup>.

Safe work and workplace, for increased production and higher productivity, are necessary and hence promotion and protection of safe work and workplace are the complementary aspects of industrial development <sup>(22)</sup>.

In technical schools, students have the highest injury rates, as they not only exposed to hazards from school

environment, but also from workshops. Moreover, they spend nearly half of their time in workshop training, facing different types of actual and potential hazards <sup>(23)</sup>.

If students have to participate in activities to promote their health, they must be aware of the risks at work. Young workers (15–24 years old) have a disproportionately high rate of injuries in the workplace and many are employed on a casual, temporary or intermittent basis, in jobs that require low technical skill. One approach to reduce the burden of young worker injury is through improvements in the provision and effectiveness of safety training, initially at school and then in the workplace <sup>(24)</sup>.

The primary aim of any occupational health and safety program is the prevention of accidents and illness, which employs knowledge as the principal tool. Only accurate knowledge of the risks and adequate training in handling them can enable the worker to adopt appropriate behavior in a hazardous working environment <sup>(25)</sup>.

Previous studies concluded that technical education students had a limited knowledge of how to prevent health risks at work and lacked a systematic way to approach hazard control. Therefore, the aim of this study was to evaluate the effect of educational intervention about occupational safety on knowledge and practice of male students in technical mechanical secondary schools in El-Behira Governorate.

The current findings illustrated that less than half (46.4%, 47.9%) of both the study and the control group respectively were aged between 16 to less than 17 years. While, a minority (3.6%) of both groups were aged from 18 to less than 19 years. With a mean age of  $16.39 \pm 0.71$  among the study group whereas among the control group  $16.21 \pm 0.71$ . Furthermore, less than two thirds (63.6%) of the study group were living in urban areas compared to two thirds (66.4%) of the control group.

Concerning the family income, the current study demonstrated that the vast majority of both groups (90%) had not enough income to meet the demands of their lives, and the minority of both groups (10%) had enough income. As regards to the crowding index, the present study demonstrated that the crowding index ranged from 1 to 10 persons/bed room among the study group and from 1-5 among the control group with a mean of  $(2.4+0.9)$  and  $(2.1+0.6)$  respectively.

With respect to the relation between socioeconomic characteristics and level of knowledge, the present study illustrated that there was significant association between age of the students and their level of knowledge. On the other hand, no significant association was found between the level of knowledge and place of residence, crowding index, family income, parent's level of education and occupation.

Adolescents are considered to be a nutritionally vulnerable segment of the population. Due to enhanced growth during adolescence, the requirement of some minerals is of paramount important. A rapid growth rate combined with a marginal nutrient intake increases the risk of nutritional deficiencies in this population. Micronutrients such as iron and zinc are essential trace elements involved in the high growth rates of adolescents <sup>(26)</sup>.

The nutritional status of adolescents contributes significantly to the health status of the community in which they reside. One of the major global health problems faced by developing countries today is under nutrition <sup>(27)</sup>. The present study revealed that around two thirds of the study group (61.4%) reported that they had three meals per day compared to more than two thirds (69.3%) of the control group. This was consistent with the study conducted by **Al-Isa A (2018)** who found that nearly two thirds (66%) of the studied sample had three meals daily <sup>(28)</sup>. Moreover, nearly two fifths (41.4%) of the study group always had breakfast daily compared to more than half (52.9%) of the control group. Furthermore, half of the study group (50%) reported always intake of fast food compared to less than two third (63.6%) of the control group.

Physical activity habits during adolescence and youth are likely to be important influences on habitual physical activity throughout adult life <sup>(28)</sup>. Opportunities for physical activity are largely determined by social, economic, and cultural factors as well as physical environments that influence access, availability and utilization <sup>(29)</sup>. The present findings illustrated that less than two thirds (60.7%) of the study group didn't practice any type of exercise compared to more than three quarters (83.6%) of the control group.

Sleep disorders in adolescents are common problems in families and can affect the social, emotional and educational performance <sup>(30)</sup>. The present study illustrated that the mean duration of nocturnal sleep was  $5.75 \pm 1.68$  for the study group and  $5.59 \pm 1.40$  for the control group. This was contradicted with the study conducted by Reisi et al (2017) as the mean duration of nocturnal sleep was  $8.38 \pm 1.17$  <sup>(31)</sup>. Moreover, the current findings revealed that nearly one tenth (10.7%) of the study group had sleeping problems compared to less than half of the control group (48.6%). These findings also lend credence to the research findings of **Marques A et al (2019)** <sup>(32)</sup>.

Male students were significantly more likely than female students to engage in risk behavior in school <sup>(33)</sup>. Such behavior involving substance abuse, un-safe sex and irresponsible driving, may be seen as ways to prove their manliness <sup>(34)</sup>.

The results of the present study illustrated that more than one third (37.1) of the study group reported that they were smokers compared to about one fifth (20.7%) of the control group. However, different picture was reported by **(Nabil MM et al 2018)** who indicated that more than one fourth (26.5%) of the studied group were

smokers<sup>(35)</sup>. Furthermore, the current findings demonstrated that neither of the study nor the control group was addicted to any drug. These results disagreed with the study conducted by **(Boini S, et al 2017)** who indicated that more than three quarters (78.8%) of the studied sample were alcoholic and less than one tenth (9.7%) were cannabis user<sup>(36)</sup>.

Occupational safety and health should be the subject of education, as it prepares students for their future occupation, and further adult education, including retraining. Nowadays, as society supports technical education via dual learning, this issue is becoming particularly necessary. Schools ensure students' safety and health in education, training and other related activities as well as in the provision of school services<sup>(37)</sup>.

The present study portrayed that, before the implementation of the educational intervention, all the study group and the control one had poor knowledge regarding occupational health and safety in the school. This may be due to the limited access of information and there were no regular and periodic educational sessions about occupational hazards and occupational health and safety offered to them. In addition, there was a remarkable lack of clear policy, lack of investment and interest in occupational health and safety issues and a shortage of preventive strategies, implemented by the school managers and occupational health and safety supervisors which probably resulted in that significant decline in knowledge, before implementation of the program.

This finding is supported by **(Tetemke et al 2014)** who reported that the practice towards safety information is inadequate<sup>(38)</sup>. In addition, found that the workers have less knowledge level compared to other studies. Moreover, **(Nasab et al 2009)** depicted that knowledge, attitude and safe behaviors of the workers are unacceptable, so they suggested and concluded that managers should design and implement educational interventions to promote knowledge of workers<sup>(39)</sup>.

Although after the implementation of the educational intervention more than half (52.8%) of the study group had good level of knowledge concerning occupational safety, whilst the entire control group had poor level of knowledge. There was highly significant impact of education on study's group's knowledge throughout the study. This remarkable and obvious improvement could be attributed to the effect of the implemented program. These findings strongly support the hypotheses that the level of workers' knowledge will be improved after implementation of the educational intervention.

Throughout the globe, most adults and many adolescents spend a great deal of their waking hours at work. The work provides a number of economic benefits. At the same time, people at work face a variety of hazards owing to chemicals, biological factors, physical agents, adverse ergonomic conditions, allergens, a complex network of safety hazards, and diversified psychosocial agents<sup>(40)</sup>.

The current findings depicted that the vast majority of the study and the control group had poor knowledge regarding occupational hazards before implementation of the educational intervention. This could be due to lack of periodic health education sessions about occupational hazards. These findings are congruent with other studies conducted by **Shafik S 2016** and **Gebrezgiabher et al 2019**<sup>(41,42)</sup>. However, these findings were contradicted with **Adebola et al 2014** who stressed that the education and advice concerning specific work hazards are essential<sup>(43)</sup>.

While after the educational intervention, the results of the study revealed that, around two-fifths of the study group expressed higher total knowledge score compared to the control group. There was highly significant impact of education on study group knowledge throughout the study. This remarkable and obvious improvement could be attributed to the effect of the implemented program. This finding correspond with the results of **(Padmini et al 2013)** and **(Sayapathi B 2014)**<sup>(44,45)</sup>.

Every year, International Labor Organization (ILO) reports that, job related accidents and diseases claim estimated 2.34 million lives of men and women giving daily loss of 6,300 lives due to work related causes. Moreover, 160 million occupational diseases are reported each year **(ILO 2013)**<sup>(46)</sup>.

The current study elaborated that the vast majority of both the study and the control group had poor knowledge regarding school accidents before the implementation of the educational intervention. This finding may be explained by the lack of training programs. These findings are congruent with **(Esaiyas et al 2018)** and **(Deebom et al 2019)**<sup>(47,48)</sup>.

In point of fact, after implementation of the educational intervention, the study group showed significant improvement in their knowledge compared with the control group as less than half (40%) of the study group had good knowledge regarding school accidents compared to only 2.9% of the control group. There was highly significant impact of education on study's group's knowledge across the three stages. This is in the same line with the results of other studies by **(Saleh DA 2009)**<sup>(49)</sup>.

Safety is the prime requisite in all the work places. Workplace safety affects everyone in school workshop environment, including staff, students, and visitors. A safe and healthy working atmosphere is a basic necessity and has to be ensured in the technical education workshop without fail **(Moksen 2013)**<sup>(50)</sup>.

The current findings demonstrated that before the educational intervention, the entire study group and the control one had poor knowledge about safety measures that must be available in the workshop. This may be due to the limited access of information and there were no regular and periodic educational sessions about safety

measures. These findings were in agreement with other studies conducted by **(Andersson et al 2014)** and **(Balanay et al 2014)** <sup>(20,51)</sup>.

However, after the educational intervention, the current findings portrayed that the study group expressed higher total knowledge score compared to the control group as more than two thirds (68.5%) of the study group had good level of knowledge concerning safety measures that must be available in the workshops whereas the entire control group still had poor level of knowledge . There was highly significant impact of education on study's group's knowledge throughout the study.

This remarkable and obvious improvement could be attributed to the effect of the implemented program, which included all information and skills required for the study group to help them to understand the necessity of safety measures that will help them to avoid the occurrence of higher levels of occupational hazards at the workplace and to the fact that it was custom-tailored to workers' needs. These findings strongly support the hypotheses "that the level of students' knowledge and practice will be improved after implementation of the educational intervention. These findings were comparable with other study conducted by **(Gyekye et al 2015)** <sup>(52)</sup>.

In the general, school students have poor knowledge about safe working conditions during injuries, so most of them must be motivated to learn about first aid and basic life support which are components of chain survival for a person experiencing a life threatening injuries **(Altintas 2015)** <sup>(53)</sup>.

The present study demonstrated that all the study group and the vast majority of the control one (98.6%) had poor level of knowledge regarding first aids before administration of the educational intervention. This finding may be explained by lack of training and health education sessions about first aid. These results were in agreement with **(Dasgupta, et al 2014)** and **(Behairy et al 2015)** <sup>(54,55)</sup> .

However, the current findings revealed that after implementation of the educational intervention less than two thirds (63.6%) of the study group had good level of knowledge concerning first aids, whereas the vast majority of the control group still had poor level of knowledge .There was highly significant impact of education on the study group's knowledge throughout the study. These findings were matching with the other studies conducted by **(Al-Robaiaay 2013)** and **(Abd El-Hay et al 2015)** <sup>(56,57)</sup>.

Students in industrial schools spend majority of the schooling day in the workshops for training. Hence, workshop environment must be taken into consideration to create a comfortable environment for students or teachers. Ventilation such as opened windows and adequate lighting is to be a great concern to ensure that the work is being carried out properly. Teachers also need to ensure adequate space for students to work in accordance with the number of students there. Safety means a condition resulting from a change in human behavior or the physical environment to reduce the likelihood of further hazards and reduce accidents. A large part of the safety compliance is the responsibility of all, acceptance of roles and awareness of the rules will be able to determine safe or otherwise of such an activity in order to ensure effective safety at the workshop teachers will need to identify to which extend the teachers and students practice safety management <sup>(58)</sup>.

The present study illustrated that all the observed workshops had incomplete environmental safety measures as regards to housekeeping, ventilation, noise, lighting, electricity, fire protection, manual tools, machine safe working, first aid facility and communication facility. This may be due to low financial resources allowed to technical mechanical secondary school workshops. Similar findings were reported by **(Shafik S et al 2016)** and **(Deebom et al 2018)** <sup>(48,59)</sup>. The study conducted by Shafik S et al (2016) illustrated that that half (50) of factories environment having good applicable of sanitation, ventilation and lighting while 100.0% had poor applicable for presence of safety measure and precaution sign. Deebom et al (2018) et al revealed that the workshops environment were restricted , had poor housekeeping , poor ventilation, poor illumination, the power tools were not properly grounded and insulated , had defective tools and equipment .

It was noticed in the present study that none of the welding workshops adopted complete safety measures during working process neither before nor after the educational intervention. These findings were in agreement with **(Olagbegi et al 2013)** and **(Yekinni et al 2016)** <sup>(60,61)</sup>. The study carried out by Olagbegi et al (2013) portrayed that there were inadequate fire extinguisher in the laboratory; poor ventilation including hot shop and machine shop, faulty and old door locks, especially in the thermo fluid laboratory; little or no use of personal protective equipment, no working fire alarm, uncovered electrical panels and fuse boxes are related to causes of accidents in thermo fluid laboratory. Also, these findings corroborates with that of Yekinni (2016) who submitted that there were defective conditions of equipment; lack of signals and barricades; improper use of mechanical aid; power tools not properly grounded and insulated; floors, and inside passageway not kept clean.

Personal protective equipment are very effective in minimizing occupational injuries, accidents and other hazards which otherwise result in substantial human sufferings and financial losses. Personal Protective Equipments (PPEs) plays a prominent role in ensuring overall health and safety on the training workshops in industrial schools. As the students spend majority of the schooling day in the training workshop where they exposed to numerous physical, chemical and accidental hazards. Personal protective equipment includes face shields, safety glasses, hard hats, safety shoes, coveralls, gloves, ear protection, and respirators. Active cooperation and compliance of the workers are necessary for maximum benefits to be derived from PPE

utilization <sup>(62)</sup>.

The current findings demonstrated that different means of personal protective equipment were not available in the different observed workshops. This might be due to financial resources shortage in these workshops and lack of awareness of the authorized persons about the necessity of personal protective equipment utilization. Otherwise, the current study is contradicted with the study conducted by (Sabitu K. et al 2009) who found that around one third (34.2%) of the welders used one or more types of protective devices against workplace hazards with eye goggles (60.9%), hand gloves(50.3%) and boots (34.5%) being more frequently used <sup>(63)</sup>.

### Conclusion

Based upon the results of the present study, it could be concluded that:

Almost the entire study group had poor total knowledge, as well as poor total practice regarding occupational health and safety before application of the educational intervention. After implementation of the educational program a remarkable improvement was detected with highly statistical significant differences during pre-, post- and follow-up phases. Therefore, the educational program was successful in attaining its aim of positively changing knowledge, attitude and practice practices and of the studied group regarding occupational health and safety.

### Recommendation

- Provision of personal protective equipment's for technical mechanical students in their training workshops.
- Conducting periodic health education sessions about the necessity of personal protective equipment utilization.
- It is necessary that first aid and basic life support courses must be a part of the curricula in industrial secondary school.
- The ministry of education should monitor technical mechanical workshops periodically.
- Conducting health education sessions about dangers of risk taking behaviors among male students in secondary schools.
- First aid and basic life support guidelines should be available to all students at school in order to decrease the early morbidity and mortality of accidents and emergencies
- It is recommended to carry out a regular health education session for the students to raise their knowledge in the occupational health and safety aspects.

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