

## Effect of Educational Program on Nurses Role Regarding First Aid for Patients having Toxic Aluminium Phosphate Suicide

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### Abstract

**Background:** Aluminium phosphate (AP) can be fatal if used for suicidal purposes. The phosphine gas, which is released as a result of aluminium phosphate intake, has highly level of toxic. It causes hypoxia at the cellular level and disrupts oxidative phosphorylation. Intoxication from aluminium phosphate can result in acid-base disorder, heart rhythm abnormalities, acute respiratory distress, and circulatory collapse. Ingesting large amounts can lead to death within hours. **Purpose:** To assess the effect of educational program on role of nurses in first aid for patients having toxic aluminium phosphate suicide. **Design:** This study utilized a quasi-experimental research design. **Setting:** the study was performed at the general and university hospitals in Beni-Suef University. **Subjects:** The study included 100 emergency nurses. **Instruments:** Three instruments were employed: (Nurses 'knowledge assessment Interview Questionnaire, a checklist for evaluating nurses' practices and nurses' attitudes checklist). **Results:** Illuminate that majority of study group (85%, 82%) and over half of them (55%) respectively had poor knowledge, practice, and attitude levels Pre-program, while almost three-fifths (54%, 64%) and almost of study group(86%) had good knowledge, skill, and attitude level following the implementation of educational program ( $P > 0.01^*$ ). There were a statistically marked difference in the overall scores for knowledge, practice, and attitude levels pre and post-test after application nursing educational program ( $P > 0.01^*$ ). **Conclusion:** Nursing educational program had favorable effect in improving nurses' knowledge, practice, and attitude regarding first aid emergency response to toxic aluminium phosphate tablet related suicide cases. **Recommendations:** Replicating this study with a larger sample of nurses across various hospitals is required.

**Keywords:** Toxic Aluminium Phosphate

### Introduction

Aluminium Phosphate (ALP) is a widely utilized agricultural pesticide known for being cost-effective, efficient, and readily accessible. Aluminium Phosphide is specifically employed as a rodenticide, insect infestations in stored grain silos. (Nadeem et al., 2019).

Aluminium phosphate (ALP) poisoning is a significant contributor to suicides. The toxicity from ALP arises from the release of phosphine gas, which swiftly induces cellular hypoxia by disrupting oxidative phosphorylation, ultimately resulting in circulatory failure. (Agrawa et al., 2015).

For decades, aluminium phosphate has been a low-cost and exceedingly efficient grain fumigant in less developed countries, with phosphine (PH<sub>3</sub>) gas as its key component. The most predominant form is in tablets, typically weighing 3 grams. Because of the flammable properties of PH<sub>3</sub> gas, it is often conjoined with Inorganic ammonium salt. Sudden Intoxication can happen from Swallowing or in a roundabout way through Inhaling of PH<sub>3</sub> gas in the surrounding environment. (Farahani et al., 2016).

The deadly form of aluminium phosphate poisoning has no particular antidote and has a fatality rate as high as 45 to 100%. In spite of a majority of patients may persist symptom-free or have little symptoms of nausea and vomiting on

Incipient presentation, there is expeditious degradation in clinical condition mainly because of cardiac and respiratory failure (Sharma et al., 2018).

Patients exposed to even small amounts of phosphine gas often have trouble breathing. Other potential symptoms comprise lightheadedness, lethargy, thoracic tightness, headaches, watery stools, ataxia, tingling, paresthesia, tremors, muscular debility, vision disturbances, and jaundiced state. Inhalation of large volumes can lead to severe complications such as acute respiratory distress syndrome, cardiac failure, heart rhythm disturbances, seizures, and unconsciousness, along with delayed signs of liver toxicity and renal toxicity. Cardiotoxic effect and circulatory collapse are the primary reasons of dying in ALP poisoning, ultimately leading to the death of cardiomyocytes. (Karimani et al., 2018).

Extracorporeal Membrane Oxygenation is a remedial approach that assists heart and lung function, allowing the body sufficient time to detoxify and improve organ performance. Thus, employing ECMO in these patients is crucial for effective management and significantly enhances their chances of survival. (Daliri et al., 2020).

Death results from the speedy emanate of phosphine gas, which induces cellular and mitochondrial poisonousness, ultimately resulting in cardiovascular collapse and multiple organ failure. (Priya et al., 2017).

Case reports have highlighted the beneficial effects of coconut oil in managing acute Aluminium Phosphate (AIP) poisoning. Coconut oil reduces the absorption of phosphine, which is produced following AIP ingestion, and has been shown to be effective even six hours after acute exposure. The prognosis for patients with AIP poisoning is generally poor, with mortality rates reaching up to 70%. The presence of ECG abnormalities and the requirement for mechanical ventilation are indicators that suggest a negative outcome. (Ghazi., 2013).

There is limited knowledge regarding emergency nurses' readiness to handle suicidal individuals. Many propose that enhancing nurses' knowledge can improve their dispositions

and peril estimation skills, thereby boosting interventive strategies to mitigate suicidal behavior. (Briggs.,2018).

### Significance of the Study

Aluminum phosphide is a toxic substance utilized for fumigating kept cereals. Despite its high Venomousness, there exists no antidote available, and treatment primarily involves supportive care. ALP poisoning has become a common method of suicide in several less derdeveloped countries, including North India, Iran, and Egypt. In Egypt, the occurrence of aluminum phosphide intoxication is on the up, leading to an increase in cases reported to poison control centers. (Abd-Allah et al., 2022). This study will provide educational program for nurses about first aid emergency response to toxic aluminium phosphide tablet related suicide cases where the nurse plays a vital role in surviving patients had toxicity with Aluminum phosphide tablet.

#### Purpose:

To evaluate the effect of educational program on nurse's role regarding first aid for patients having toxic aluminium phosphate suicide.

#### The main goals of this research are:

- 1.To assess the extent of knowledge amongst nurses concerning first aid emergency response to toxic aluminum phosphate suicide cases.
- 2.To assess the level of practical competence displayed by nurses in first aid emergency response to toxic aluminium phosphate suicide cases.
3. To assess attitude displayed by nurses regarding first aid for patients having toxic aluminium phosphate suicide
- 4.Develop, implement, and appraise the effect of educational program on nurses role regarding first aid for clients having toxic aluminium phosphate suicide.

#### Research hypothesis:

- 1.Nurses who receive the educational program are expected to have higher level of knowledge about first aid emergency response to

toxic aluminium phosphate tablet related suicide cases on post-test than pre-test.

2. Nurses who receive the educational program are expected to have higher level of practice about first aid emergency response to toxic aluminium phosphate tablet related suicide cases on post-test than pre-test.

3. Nurses who receive the educational program are expected to have positive attitude about first aid emergency response to toxic aluminium phosphate tablet related suicide cases on post-test than pre-test.

4. The educational program will enrich nurses' attitude about first aid emergency response to toxic aluminium phosphate tablet related suicide cases.

## Methods

### Design

A quasi-experimental design was used (pre-intervention and post-intervention evaluations).

### Setting:

The study was performed in the Emergency Units at Beni-Suef General and University hospitals.

### Sampling:

A convenience sample that includes 100 nurses working in emergency units at the general and university Hospitals in Beni-Suef.

The specimen size was calculated according to the ensuing equation:

$$n = \frac{Np(1-p)}{(N-1)(d^2/z^2) + p(1-p)}$$

N= Population (2597)

Z= confidence level 95% (1.96)

P= probability (50%)

d= margin of error (0.05)

So, specimen size (n) = 100

### Instruments

To accomplish the reason of research three instruments were applied for data assemblage:

### Instrument one: Nurses 'knowledge arranged Interview form

It was developed by the researcher based on recent national and international literature and is divided into two parts:

#### Part 1: Demographic data patient sheet:

It contains age, relationship state, sex, vocation, qualification, income level and course about toxic aluminum phosphate).

**Part 2: Nurse Knowledge:** It includes 41 items about toxic aluminium phosphate tablet such as definition of aluminium phosphate gas, effect of aluminium phosphate gas on human body, manifestation of aluminium phosphate tablet toxicity, complications, treatment, prevention and nursing intervention.

### Scoring system

Scoring system for each item was one for correct and zero for incorrect. Total scoring system was inadequate knowledge if the level was <75% and adequate if level of knowledge was ≥75.

### Instrument two: Nurses practices checklist

It was created by the researcher later scrutinizing a literature to evaluate nurses' practices of toxic aluminum phosphate tablet in emergency units. It consisted of 39 steps in 2 parts of checklist (before, and after as following:

#### Scoring System:

Scoring system for each item was one for correct and zero for incorrect. Total scoring system was inadequate practice if the level was <75% and adequate if level of practice was ≥75.

### Instrument three: Nurses attitudes Likert Scale

This instrument was created by the researcher after check-up of literature. It was developed to determine nurse' attitude and the potency of nursing educational program on attitude It contained 8 items on 5-Likert scale.

### Scoring System

Scoring system for each item was 1=Totally Disagree, 2= Disagree, 3=Neither Disagree nor Agree, 4=Agree, and 5=Totally Agree. Total attitudes were considered negative if the result was  $\leq 75\%$  of the maximum score and positive if the score was  $>75\%$  of the maximum score.

### Validity:

The content validity of the study instruments was evaluated by three expert academics in nursing and two in medicine. They assessed the instruments for perspicuity, pertinence, comprehensiveness, comprehension, applicability, and usability. Based on their feedback, negligible adjustments were made, resulting in the development of the definitive version of the instruments.

### Reliability:

Reliability was assessed using Cronbach's alpha, with the knowledge questionnaire scoring 0.85. The reliability of the practice checklist was 0.91, and the nurses' attitude measure also had a reliability of 0.91.

### A pilot study

A pilot study was executed in December (2023) to determine the viability and practicability of the study instruments. Ten nurses, representing 10% of the sample size, were enrolled in the pilot study to estimate the time required to fulfil the instruments.

### Ethical considerations:

A formal written approval was obtained from each nurse regarding their acceptance to share in the study. Nurses were told about the reason of the study, means of data compilation. Prior to the study's commencement, they were assured of the privacy of the study and that they could retract at any point in time and there will not be subjected for any risk. They were assured of the confidentiality of their information.

### Procedure:

A letter from boss of the college of Nursing at Beni-Suef University was submitted to the chief of Beni-Suef General and University

Hospitals. The letter contained the goal of the research and methods of data collection. After obtaining permission for data collection, the researcher presented himself to the head nurses and nurses working in emergency units. An explanation of the research 'aims and specimen aggregation ways. Data assemblage was continued from December 2023 to May 2024.

On the basis of the findings, educational program was planned. A review of the literature for the ongoing study was conducted, incorporating both domestic and cosmopolitan sources, including textbooks, writings, and scientific journals. Booklets were developed. Educational program was planned. The program aims to appraise the role of nurses in first aid emergency response to toxic aluminium phosphate tablet related suicide cases. The program designed will be presented in Arabic language. It will be conducted in eight sessions. Nurses were split into five groups. Each group made up of 20 nurses. Each group received 2 sessions for assessment, 4 educational sessions and 2 sessions for follow up. Each nurse in the study sample received a copy of the designed nursing educational program booklet which included first aids activities. The researchers teach each subgroup in the same manner using the same teaching methods and materials including posters, pictures and educational videos. At the beginning of each session, an orientation to the session objective took place. Teaching aids included posters, pictures and educational videos.

Introductory session before the implementation of the program will be done. This session aimed to clarify the aim of the program. The first 2 sessions included the objectives of the meeting and orientate nurses concerning the educational program. The third and fourth sessions included: Introduction, simple note on the definition of aluminium phosphate tablet toxicity, causes, signs and symptoms, treatment, prevention, nursing intervention and complications. The fifth and sixth session included: nurse practices such as first aid intervention, medication administration, and safety precautions. The seventh and eighth session included consciousness assessment, closure and revision on how to reach all the knowledge and practices learned.

Evaluating the effectiveness of the education program will be done using knowledge practices, and attitude questionnaire after implementation of the program. All over the time of sessions application consolidation of the program was done directly to assess to which extent the participants remember the knowledge, attitude and apply the follow up and management practices with the target nurses.

After completing the nursing educational program, Researcher redistributed the same tools to each nurse for completion to appraise the effectiveness of the nursing educational program and ensure their understanding. Post test was carried out one month later applying the same data collection instruments.

### Statistical analysis

The collected data from the sample was reviewed, modernized, coded, and inputted into a proprietary computer. The Statistical Package for Social Sciences (SPSS version 25.0), developed by IBM in Illinois, Chicago, was utilized for data analysis and tabulation. Descriptive statistics were employed to present the attributes of the research participants and variables, with mean scores calculated for numerical values. A p-value of  $\leq 0.001$  was considered, and the significance level was set at  $p < 0.05$ . Chi-Square Test ( $X^2$  Test of Independence), Chi-Square ( $X^2$ ) test was applied to compare the distribution of participants' knowledge, attitudes, and practice levels before and after the intervention, and paired t-test was employed to compare the mean scores of knowledge, practice, and attitude prior to and subsequent to intervention. Pearson's correlation was applied to analyze bivariate correlations between the study variables.

### Results

**Table 1** demonstrates that 87% of their studied sample age were between 18 and 29, 53% of them were married and about half of nurses (56%) had enough income level.

**Table 2** reveals that nurses had more adequate knowledge, more positive attitude and satisfactory practices on post-test than pre-test. Consequently, there were very highly statistical differences in nurses' knowledge, attitudes and practices between the pre and post-tests.

**Figure 1:** displays that 85% of the research nurses had inadequate entire knowledge before intervention, while after the execution of the educational program 54% of them had adequate total knowledge. 55% of studied patients had negative attitude before intervention, while after implementation of educational program 86% of them had positive attitude. Furthermore, 82% of the study group had an not good enough practice level before the intervention, which improved to 64% achieving a satisfactory practice level after the program was implemented.

**Table 3:** clarifies that, there was statistically substantial difference in the mean and SD distribution of nurses' knowledge, skills, and attitudes before and next carrying out the program.

**Table 4:** indicates a advantageous correlation amongst nurses' knowledge and practice, while showing no statistically significant divergence between attitude and practice pre- and post-program application.

**Table 5:** shows that, there was positive correlation amongst nurses' income and their knowledge, skills, and attitudes before and after the program implementation.

**Fig. 2:** illustrates that there was good difference in linear correlation amongst nurses' knowledge and practice regarding toxic aluminum phosphate before and after the program implementation.

**Fig. 3:** clarifies that, there was positive difference in mean score of nurses' knowledge, practice, and attitude throughout the program stages.

Table 1: characteristics of studied nurses

Characteristics		No	%
Age	18-	87	87.0
	30+	13	13.0
Marital status	Single	39	39.0
	Married	53	53.0
	Divorced	8	8.0
Qualification	Diploma	2	2.0
	Tech. institute	44	44.0
	Bachelor	41	41.0
	Post. Graduate	13	13.0
Income	Enough	56	56.0
	Not-enough	44	44.0
Having a course about Toxic Aluminum Phosphate	Yes	17	17.0
	No	67	67.0
	Yes, but need more	16	16.0
<b>Total</b>		100	100.0

Data are expressed as numbers (No), percentage (%)

Table 2: Allocation of nurses pursuant to their knowledge, skills, and attitude on pre and post-tests (n=100)

		Pre-intervention		Post-intervention		X <sup>2</sup>	p-value
		No	%	No	%		
knowledge	In-adequate	85	85.0	46	46.0	33.654	0.000**
	Adequate	15	15.0	54	54.0		
Attitude	Negative	55	55.0	14	14.0	37.194	0.000**
	Positive	45	45.0	86	86.0		
Practice	Un-satisfactory	82	82.0	36	36.0	43.737	0.000**
	Satisfactory	18	18.0	64	64.0		

Data are expressed as numbers (No), percentage (%), X<sup>2</sup>: Pearson Chi-square, (\*\*) statistically important at p-value > 0.01

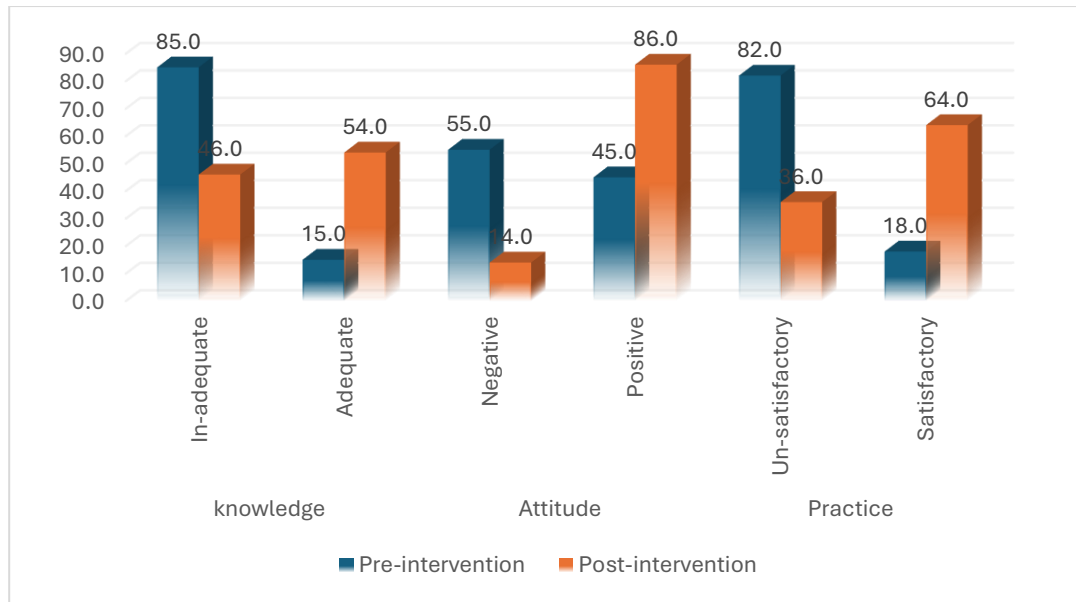


Fig.1

Table 3: Mean and Standard deviation of nurses' knowledge, skills, and attitude at pre and post-tests (n=100)

	Pre	Post	T	p-value
	<b>Mean (SD)</b>	<b>Mean (SD)</b>		
<b>Knowledge</b>	20.18(2.89)	23.52(4.28)	6.47	0.000**
<b>Practice</b>	15.32(2.80)	21.95(7.22)	8.56	0.000**
<b>Attitude</b>	23.07(3.99)	43.82(13.90)	14.35	0.000**

Data are stated as mean and, SD: Standard Deviation, (\*\*) statistically significant at p-value> 0.01

Table 4: Correlation among nurses' knowledge, attitudes and Practices

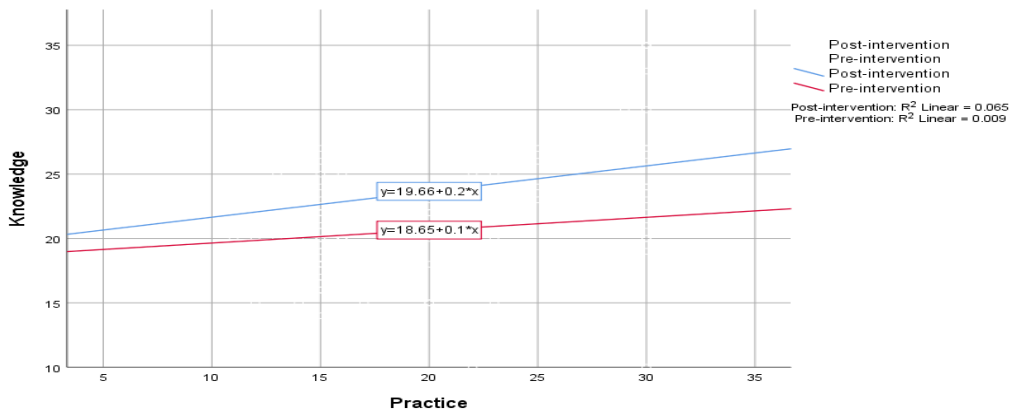
Study variables		Nurses' practice	
		Pre	Post
<b>Knowledge</b>	r	.097	.255*
	P-value	.339	.010
<b>Attitude</b>	r	.169	-.072
	P-value	.092	.477

(\*)Correlation is significant at the 0.05 level (2-tailed).

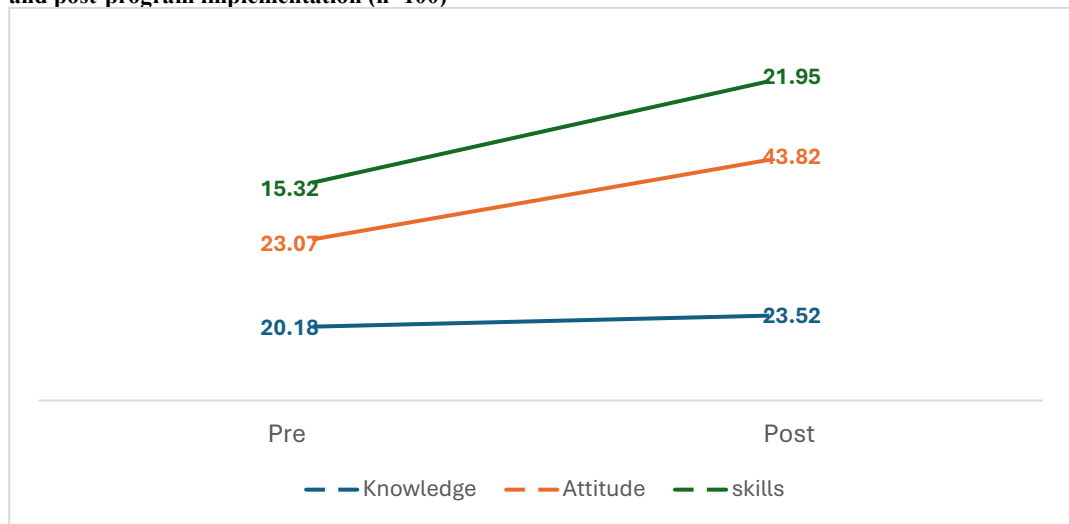
**Table5: Correlation between study variables and nurses’ demographic characteristics pre and post-program implementation (n=100)**

Nurses’ characteristics	Attitude	Knowledge	skills
Age	-.042	.093	-.048
Marital status	-.113	.023	.053
Qualification	.086	.112	.004
Income	-.206**	-.047	.019
Having a course about Toxic Aluminum Phosphate	.075	.132	-.005

(\*\*)Correlation is significant at the 0.01 level (2-tailed).



**Fig.2: Linear correlation among nurses’ knowledge and skill regarding toxic aluminum phosphate at pre and post-program implementation (n=100)**



**Fig.3: Mean score of nurses’ knowledge, practice, and attitude through program stages (n=100)**

**Discussion**

Owing to aluminum phosphide’ easy accessibility, quick and intense poisonousness, and lack of a particular antidote, it has become a mortal venom frequently associated with suicidal

intent in rural societies. Regardless of advancements in medical science, the toxicity of this compound remains poorly understood, resulting in elevated case mortality rate and limited treatment options (Anbalagan et al., 2021). This study planned to evaluate the effect



of educational Program on nurses role regarding first aid for patients having toxic aluminium phosphate suicide.

Concerning nurses' knowledge, practice and attitude about first aids emergency response to toxic aluminum phosphide tablet related suicide cases, majority of them exhibited inadequate knowledge, negative attitude, and unsatisfactory practice prior carrying out educational program; this may be as a result of unavailability of educational program for nurses about first aids emergency response to aluminum phosphide poisoning, These findings align with those of (Mohamed et al., 2020), which noted that approximately three- fourths of the nurses studied had unsatisfactory knowledge concerning the care of clients with sharp organophosphate poisoning. Additionally, in excess of three-fourths of the nurses demonstrated negative attitudes toward caring for these patients, while over half exhibited a competent level of practice in managing acute organophosphate poisoning.

Concerning patients' knowledge about first aids emergency response to toxic aluminum phosphide tablet related suicide cases; Almost of them (85%) had insufficient knowledge prior carrying out educational program, These conclusions are further reinforced by (Kumari et al.,2023), who noted that a significant portion of participants (43.8%) had an unsatisfactory level of knowledge. In contrast, 42.4% of the study participants demonstrated an admissible level of knowledge, while only 13.6% exhibited good knowledge.

The results of the present study indicated that a significant majority of nurses (82%) exhibited an unsatisfactory level of practice prior putting into action the educational program. In contrast, this finding contradicts the assertions made by (Lekei et al., 2017), who claimed that most nurses demonstrate adequate practices and possess sufficient knowledge regarding first aid care and therapy in poisoning cases.

In this study, the findings demonstrated that fewer than half of the nurses (45%) exhibited a positive attitude toward first aids emergency response to toxic aluminum phosphide tablet related suicide cases implementation of the educational program for nurses supported by

findings from (Adal et al., 2017), who discovered that around 243 nurses (57.6%) had a positive attitude toward the initial management of patients affected by poisoning..

However, following the implementation of the educational program, there was amelioration in the studied nurses' knowledge, practice and attitude related aluminum phosphide poisoning with statistically significant variance observed among the prior to and subsequent to the educational program application. this was in agreement with that of (Khatun & Jeganathan., 2022) who stated that nursing professionals carries an essential role in their professional practices which has been seen in several stages of toxicological care which include initial assessment and the treatment of both acute and chronic cases

## Conclusion

The study findings indicated that the educational program beneficial impacts on enhancing the roles of nurses toward first aid for patients having toxic aluminium phosphate suicide. The nurses who received the educational program had better level of knowledge, skill and attitude than before implementing of educational program.

## Recommendations

on the basis of the results of the recent study, the following recommendations are proposed:

- 1- The study should be replicated in different areas to achieve generalization.
- 2- Nurses should attend regular in-service training courses and workshops focusing on first aid for patients having toxic aluminium phosphate suicide. This will improve their knowledge, practice, and attitude ultimately leading to better patient outcomes.
- 3- Additional studies to identify obstacles facing nurses' provision of first aid for patients having toxic aluminium phosphate suicide.

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