

## Effect of Educational program on Nurses' Performance Regarding Prevention of Infection among Children Receiving Total Parenteral Nutrition

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### Abstract

**Background:** Total parenteral nutrition is vital for children who unable to consume their food through gastrointestinal system, there are a lot of complications; the most common and serious is blood infection. **The study was aimed to** evaluate the effect of educational program on nurses' performance about prevention of infection among children receiving total parenteral nutrition. **Subjects and method: Subjects:** A convenience sampling of thirty five nurses from Tanta University Hospital and fifteen nurses from Al-Mabra Hospital. Fifty children at Intensive Care Units that were received total parenteral nutrition. **Setting:** The study conducted at Pediatric Intensive Care Unit of Tanta Main University Hospital and Al Mabra Tanta Hospital. **Four tools were used to collect data: Tool I;** structured interview schedule to collect sociodemographic data of nurses and assess nurses, knowledge, **Tool II;** assess nurses performance using observational check lists, **Tool III;** laboratory investigation related to infection of children receiving total parenteral nutrition: (ESR, CRP, WBCs, Blood culture), **Tool IV;** physiological and physical measurement of children **Results:** revealed that educational program have positive effect on both knowledge and practice of nurses regarding prevention of infection and significance improvement in condition of children receiving total parenteral nutrition. **Conclusion:** Educational program have positive effect on performance of nurses, physiological and physical condition of children and prevention of infection occur with total parenteral nutrition. **Recommendation:** implementation of educational and training programs should be encouraged and repeated for pediatric intensive care unit children who received total parenteral nutrition to prevent infection.

**Keywords:** Children, Infection, Educational Program, Nurses' performance, Total parenteral nutrition.

### Introduction

Total parenteral nutrition is used to maintain good nutritional status, suitable weight, and positive intravenous nitrogen balance. Always we use internal nutrition when possible and use total parenteral nutrition only when persons unable to meet nutritional requirements via GI tract

and in cases with bowel dysfunction for 5 days, and when a child is not able to get their food via the GI system (Braunschweig et al., 2019).

Total Parenteral nutrition (TPN) still has some complications, even though numerous improvements made in the last fifty years to make it safer and more

effective. Administering and monitoring parenteral nutrition dosages requires careful preparation and execution, it is critical to prevent infection, metabolic abnormalities, associated with early and prolonged TPN (Sanchez et al., 2019).

Infection associated with central line is common and serious complication related to catheter use. The incidence of catheter infection is between 2 and 29% in children receiving total parenteral nutrition, and Children are more likely than adults to experience it. This is a dangerous, potentially fatal side effect of intravenous feeding. Staphylococcus aureus, followed by Enterococcus species, Escherichia coli, Klebsiella species, others enteric Gram-negative microbes, coagulase-resistant staphylococci, and strains of Candida, are linked to the majority of infections (Lissauer et al., 2022).

Most common symptom of bacterial infection is a fever, although it is not always present. Fever and tremors that start after flushing the catheter line are a symptom that increases the specificity of infection related to catheter. Additionally, local signs of infection (redness, painful, swelling), more helpful diagnostic indicators (O'Grady et al., 2018).

Using a sterilized insertion approach is essential to keeping infection rates low. The following scientifically supported methods were used in a large multicenter cohort research study to reduce infection: rinsing the hands with detergent and water, conducting sterilized insertions with full barrier measures (head cover, face mask, clean clothes, disposable gloves, and a

complete uncontaminated wrap), using 2% chlorhexidine solution and drying it before insertion, minimizing the femoral site for the central line, and eliminating unnecessary catheters (Ormsby et al., 2020).

Insertion of catheter should be carried out under sterile conditions using sterile instruments and suitable hand hygiene, avoid leaving the site exposed, central line or catheter care and dressing changes should be carried out aseptically and without delay, regular dressing changes, and inspections are part of the maintenance of a central line free from contamination. (Chopra et al., 2023).

Numerous safety measures have been placed over the years, including established policies for long-term access in some hospitals and the capacity for a professional team composed of qualified nurses to monitor children during insertion the catheter and deliver total parenteral nutrition (Aloush & Al saraiah 2018). Femoral catheters have higher rates of infection than internal jugular and subclavian sites, it is best to avoid using it. When compared to other access, femoral catheters are also linked to increase incidence of vein thrombosis. (Wright et al., 2018).

### **Significance of study:**

Children with intestinal impairment need total parenteral nutrition for their nourishment and survival because it can save their lives by promoting healthy development and growth without harmful complications. This study confirms that

administration of parenteral nutrition may be accompanied with complications such as: infection, venous thrombosis, pulmonary embolism, and other metabolic complications. (Mirtallo et al., 2020). When pediatric patient with intestinal disorders are completely dependent on parenteral nutrition, blood infection are a major cause of mortality as well as morbidity. In order to enhance nurses' knowledge and practice and to help children receive high quality care that prevent complications from occurring, it is crucial to provide educational programs about prevention of bacterial infection related to total parenteral infection (Cernat & Puntis 2020).

#### **Research Hypothesis:**

Nurses' knowledge and practice about prevention of bacterial infection for children receiving total parenteral nutrition is expected to be enhanced after educational program, also physical and physiological measurements of children is expected to be improved.

#### **Subjects and method**

##### **Research design:**

A quasi experimental research design was used in the present study.

##### **Setting:**

The present study was conducted at: 1- Pediatric Intensive Care Unit of Tanta Main University Hospital, which is affiliated to Ministry of Higher Education and Scientific Research

2-Al Mabra Tanta Hospital which is Affiliated to Health Insurance

##### **Subjects:**

A Convenience sampling of nurses working at the previously mentioned settings was assigned in the study. Thirty five nurses from Tanta University Hospital

and fifteen nurse from Al-Mabra Hospital. A Convenience sampling of fifty children at Intensive Care Units that was received total parenteral nutrition, at the previously mentioned settings.

##### **Inclusion criteria of selected children:**

- Both sexes
- Children aged from 1 to 4 years

**Tools of data collection:** Four tools were used in this study, as follow: **Tool I: Nurses knowledge structured interview schedule:** It was developed by the researcher to assess nurses' knowledge before, immediately and after one month of implementation of educational program. It consisted of parts: **Part one: (a) Sociodemographic characteristics of studied nurses** such as; age, educational level, years of experience at Pediatric ward, and attendance of related training courses.

**(b): children characteristics** as: Age, sex, birth weight and diagnosis.

**Part two: Nurses knowledge about total parenteral nutrition:** definition, indication, uses, sites of insertion, and types of solutions.

**Part three: Nurses' knowledge about bacterial infection:** include: definition, causes, predisposing factors, complications, prevention, and nursing intervention.

**Part four: Nurses' knowledge about complications of total parenteral nutrition, it include;** Infection, nutritional, metabolic problems, and mechanical problems: thrombosis and occlusion.

**Total score of nurses' knowledge was classified as follow:**

- Less than 60% was considered poor knowledge.

- From 60- <80% was considered fair knowledge.

- From 80-100 % was considered good knowledge.

**Tool II: part one: Nurses practice by using observational checklist;** it was developed by the researcher to assess nurses' practices among children receiving total parenteral nutrition regarding central line care.

**Part two: Nurses observational checklist:** it was developed by the researcher to assess nurses' practices regarding administration of total parenteral nutrition.

**Total score of nurses' practice was classified as follow:**

-Less than 80 % were considered unsatisfactory.

-From 80-100 % were considered satisfactory.

**Tool III: laboratory investigations related to infection in children receive total parenteral nutrition:** performed for 25 children who receiving total parenteral nutrition before educational intervention and for 25 children after program as; Blood culture, C reactive protein, Erythrocyte sedimentation rate and White blood count rate.

**Tool (IV) Physiological and physical measurement of children: include:**

-**Physical measurement** as weight and height.

-**Physiological measurement** as temperature, heart rate, respiratory rate and blood pressure.

**Ethical and legal considerations:** Ethical approval to conduct the study was taken from scientific research ethical committee at the Faculty of Nursing. The nature of the study didn't cause any harm or pain to the entire sample. Confidentiality and

privacy regarding the data collection were taken into consideration. Nurses, consent to participate in study was obtained after explaining of the aim of the study, and the participants had the right to withdrawn from the study at any time.

**Phases of the study:** The current study conducted on four phases:

**1-Assessment Phase:** The researcher collected baseline data for each study participant and used Tool (I, II) to evaluate nurses' knowledge and skills regarding TPN and care giving to children prior to the implementation of intervention.

**2- Planning Phase:** The researcher prepared the program and the sessions' content in addition to establishing the program's goals for the educational intervention, setting up appropriate media, such as lectures, videos, and power points.

**3) Implementation Phase:** Before implementing of the intervention program, the researcher made assessment for each group, by using Tool (I) and Tool (II).

- Ten subgroups of studied nurses, seven from Main Tanta Pediatric University Hospital and three from Al Mabra Hospital, each group comprised five nurses.

- Every session began with a conclusion of the previous discussion topics and comments regarding the previous educational session's content.

- Six sessions, two per week, were planned for the educational intervention, each session lasted nearly 30 to 45 minutes.

- The knowledge is given to nurses via lecture, power point presentations and discussions of related concepts, and demonstration.

**The content of sessions included:**

**The first session:** Focused on definition, uses, contraindication, routes of administration, types and components of parenteral solutions, site of insertion.

**The second session:** Focused on complications related to total parenteral nutrition: liver damage, catheter occlusion, thrombosis, and the methods used to prevent this complication.

**The third session:** Focused on definition of catheter associated infection, and appropriate infection control measures, safe manipulation, and care of the central line to prevent infection.

**The fourth session:** Antibiotic used as preventive treatment from blood stream infection, and side effects that may happened.

**The fifth session:** Role of nurse during total parenteral nutrition administration, physiological, physical measurements and other items should be monitored to ensure that child growth is normal.

**The sixth session:** Nursing role in the discharge plan for children with total parenteral nutrition at home, and health education needed by their parents.

**4) Evaluation Phase:** The same research tools were used to assess how educational intervention program affected performance of nurses. Every nurse was assessed immediately after educational program, and then again after one month, with the results of both assessments being compared to the data from the pretest.

**Statistical analysis:** The collected data were organized, tabulated and statistically analyzed using SPSS software program for descriptive statistics in the form of frequencies and percentage for categorical variables. Means and standard deviations

were used for continuous variables. Pearson correlation coefficient was used for measuring the correlation between study variables. Regression analysis was used for predicting the relationships between study variables. Chi square tests were used for correlating categorical variables. Significance was adopted at  $p < 0.05$  for interpretation of results of tests of significance (Beth et al., 2016).

### Results

**Table (1):** Illustrated that nearly half percentage 46.0% of studied nurses, age ranged between 25 <30 years, with mean age  $28.3 \pm 5.1$ , regarding educational level, it was clear that, about 46.0% of the studied nurses had bachelor's degree. According to work experience found that, the mean years of experience were  $11.4 \pm 5.4$ , according to their marital status found that nearly half of nurses 52% married, 30% divorced and widow and 18% single, regarding the gender of nurses it was clear that, nearly two third of them were female 66%.

**Table (2):** Show total knowledge level, it was noticed that, about 62.0% and 24.0% of nurses had poor level and fair level of total knowledge respectively before the educational program. Most studied nurses 82.0% and 74.0% of them had good level of total knowledge immediately and one month after program respectively as illustrated in **figure (1)**.

**Table (3):** Illustrated that total score of nurses practice among children receiving total parenteral nutrition was unsatisfactory before educational program 78% compared respectively to 88%, 78% satisfactory immediately and one month after program, with high statically significance difference before and

immediately after program with mean SD  $18.2 \pm 8.1$ ,  $31.3 \pm 6.1$ , where ( $t=9.135$ ,  $P<0.001$ ), ( $t=7.044$ ,  $P<0.001$ ). There was no significant difference between immediately and one month later with mean SD  $28.8 \pm 6.9$ , where ( $t=1.919$ ,  $P=0.057$ ) as illustrated in **figure (2)**.

**Table (4):** Illustrate laboratory investigations in children receiving total parenteral nutrition before, and immediate educational program. It was obvious that there were high statically significance regarding all laboratory investigations before and immediately after educational program where ( $X^2=19.485$ ,  $X^2=23.077$ ,  $X^2=19.485$ ,  $X^2=27.750$ ) & ( $P<0.001$ ).

**Tables (5):** Reflect physiological measurements for children receiving total parenteral nutrition. Regarding temperature mean  $\pm$ SD  $38.2 \pm 1.1$ ,  $37.5 \pm 1.0$ ,  $37.4 \pm 0.9$  before, immediate and one month after educational program. There was no statically significance difference regarding respiratory rate before, immediate and after month with mean SD  $32.4 \pm 9.5$ ,  $29.0 \pm 7.8$ ,  $29.3 \pm 7.8$  where  $P=0.053$ ,  $P=0.077$ ,  $P=0.847$ . Regarding heart rate mean SD was  $122.8 \pm 29.1$ ,  $107.8 \pm 24.1$ ,  $109.4 \pm 24.5$ , there was statically significance difference before and immediately, before and after month where  $P=0.006$ ,  $P=0.014$ . Regarding blood pressure, it was noticed that 70% was abnormal before educational program while 72%, 66% was normal immediately and after month of educational program.

**Table (6):** Regarding children weight there was no statically significance difference between before and immediate, before and one month, and between immediate and after one month where ( $t=1.955$ ,  $P=0.053$ ), ( $t=1.783$ ,  $P=0.077$ ), ( $t=0.192$ ,  $P=0.847$ ).

Regarding children height there was statically significance difference between before and immediate post, before and one month later where ( $P=0.006$ ,  $P=0.014$ ), ( $t=4.562$ ,  $t=4.595$ ).

**Figure (3, 4, 5):** Shows relation between total nurses' knowledge and total practice scores before, immediate and after one month of program. There was no significant relation before educational program where ( $r=0.070$ ,  $p=0.600$ ), while there was positive significant relation immediately after program where total score ( $r=0.598$ ,  $p<0.001$ ), and there was positive significant relation between knowledge of studied nurses and total practice scores after one month of program where total score ( $r=0.403$ ,  $p=0.004$ ).

**Table (7):** Shows relation between physical (weight) and physiological measurements. It revealed that there were no significant relation between weight and blood pressure before program where ( $t=0.643$ ,  $P=0.523$ ), while there were significant relation immediate post program where ( $t=3.978$ ,  $P<0.001$ ), there were significant relation after month of educational program where ( $t=3.196$ ,  $P=0.003$ ).

Regarding respiratory rate, heart rate and temperature before educational program there were no significant relation with children weight where ( $r=0.202$ ,  $p=0.159$ ), ( $r=0.218$ ,  $P=0.128$ ), ( $r=0.225$ ,  $P=0.116$ ) respectively, while there were positive significant relation immediately after program regarding all items where ( $p<0.001$ ), ( $r=0.746$ ,  $0.883$ ,  $0.851$ ) and there were significant relation after one month of educational program where ( $r=0.376$ ,  $p=0.008$ ), ( $r=0.416$ ,  $P=0.003$ ), ( $r=0.332$ ,  $P=0.020$ ) respectively.

**Table (8):** Shows relation between physical (height) and physiological measurements. It showed that there were no significant relation between height and blood pressure before program where ( $t=0.382$ ,  $P=0.704$ ), while there were significant relation immediate, and post program where ( $t=2.735$ ,  $P=0.008$ ), ( $t=2.346$ ,  $P=0.023$ ).

Regarding respiratory rate, heart rate and temperature before educational program there were no significant relation with children height where ( $r= 0.395$ ,  $P=0.123$ ), ( $r=0.114$ ,  $p=0.432$ ), ( $r= 0.106$ ,  $P=0.463$ ) respectively, while there were positive significant relation immediately after program regarding all items where ( $p <0.001$ ), ( $r= 0.608$ ,  $0.765$ ,  $0.734$ ) and there were significant relation after one month of educational program where ( $r= 0.427$ ,  $P=0.002$ ), ( $r=0.330$ ,  $P=0.019$ ), ( $r=0.283$ ,  $P=0.046$ ).

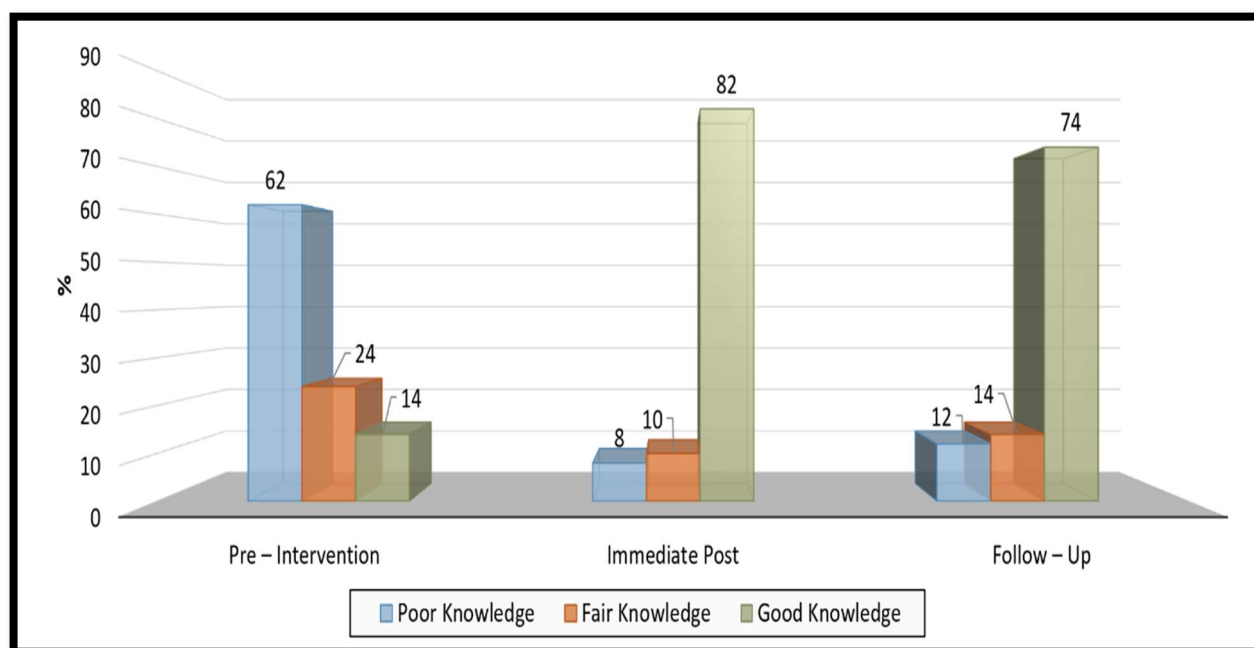
**Table (1): Percentage distribution of studied nurses regarding sociodemographic characteristics (n=50)**

	No	%
<b>Age (Years)</b>		
20 < 25	10	20.0
25 < 30	23	46.0
30 < 35	10	20.0
35 < 40	7	14.0
<b>Mean ±SD</b>	28.3 ±5.1	
<b>Gender</b>		
Male	17	34.0
Female	33	66.0
<b>Marital status</b>		
Single	9	18.0
Married	26	52.0
Divorced / Widow	15	30.0
<b>Educational level</b>		
Diploma	14	28.0
Bachelor's degree	23	46.0
Master's degree	13	26.0
<b>Work experience (Years)</b>		
Less than 5	12	24.0
5 < 10	13	26.0
10 < 15	15	30.0
15 or More	10	20.0
<b>Mean ±SD</b>	11.4 ±5.4	
<b>attended training courses</b>		
Yes	18	36.0
No	32	64.0



**Table (2): Percentage distribution of total nurses knowledge about children received total parental nutrition**

							Chi – Square / Fisher’s exact test		
	before Intervention		Immediate Post		One month after		I	II	III
	No	%	No	%	No	%	X <sup>2</sup> , P	X <sup>2</sup> , P	X <sup>2</sup> , P
<b>Total parenteral nutrition</b>									
Poor Knowledge	29	58.0	5	10.0	7	14.0	49.925 <0.001**	38.611 <0.001**	1.358 0.506
Fair Knowledge	16	32.0	5	10.0	8	16.0			
Good Knowledge	5	10.0	40	80.0	35	70.0			
<b>Mean ±SD</b>	<b>6.2 ±2.7</b>		<b>10.6 ±2.1</b>		<b>9.8 ±3.4</b>		<b>t=9.095, P&lt;0.001**</b>	<b>t=5.863, P&lt;0.001**</b>	<b>t=1.415, P=0.160</b>
<b>Bacterial infection</b>									
Poor Knowledge	32	64.0	4	8.0	7	14.0	50.723 <0.001**	38.770 <0.001**	1.476 0.478
Fair Knowledge	12	24.0	5	10.0	7	14.0			
Good Knowledge	6	12.0	41	82.0	36	72.0			
<b>Mean ±SD</b>	<b>6.2 ±2.5</b>		<b>10.8 ±1.9</b>		<b>10.2 ±2.7</b>		<b>t=10.358, P&lt;0.001**</b>	<b>t=7.686, P&lt;0.001**</b>	<b>t=1.285, P=0.201</b>
<b>complications of children receiving TPN</b>									
Poor Knowledge	34	68.0	4	8.0	6	12.0	45.303 <0.001**	39.450 <0.001**	0.451 0.798
Fair Knowledge	8	16.0	6	12.0	6	12.0			
Good Knowledge	8	16.0	40	80.0	38	76.0			
<b>Mean ±SD</b>	<b>3.4 ±1.6</b>		<b>6.9 ±1.7</b>		<b>6.7 ±1.8</b>		<b>t=10.601, P&lt;0.001**</b>	<b>t=9.689, P&lt;0.001**</b>	<b>t=0.571, P=0.569</b>
<b>Total Knowledge Level</b>									
Poor Knowledge	31	62.0	4	8.0	6	12.0	47.794 <0.001**	38.662 <0.001**	0.938 0.625
Fair Knowledge	12	24.0	5	10.0	7	14.0			
Good Knowledge	7	14.0	41	82.0	37	74.0			
<b>Mean ±SD</b>	<b>15.8 ±5.6</b>		<b>28.3 ±3.8</b>		<b>26.7 ±5.0</b>		<b>t=13.060, P&lt;0.001**</b>	<b>t=10.266, P&lt;0.001**</b>	<b>t=1.801, P=0.074</b>



**Figure (1): Total nurses knowledge level**

**Table (3): Total score of nurse's practice**

							Chi – Square / Fisher's exact test		
	before Intervention		Immediate Post		One month after		I X <sup>2</sup> , P	II X <sup>2</sup> , P	III X <sup>2</sup> , P
	No	%	No	%	No	%			
<b>Central venous catheter care</b>									
Unsatisfactory Practice	41	82.0	6	12.0	13	26.0	49.177 <0.001**	38.455 <0.001**	3.183 0.074
Satisfactory Practice	9	18.0	44	88.0	37	74.0			
<b>Mean ±SD</b>	<b>7.2 ±2.7</b>		<b>13.1 ±3.4</b>		<b>12.1 ±3.7</b>		<b>t=9.609, P&lt;0.001**</b>	<b>t=7.564, P&lt;0.001**</b>	<b>t=1.407, P=0.162</b>
<b>Administration for parenteral nutrition</b>									
Unsatisfactory Practice	36	72.0	7	14.0	12	24.0	34.312 <0.001**	23.076 <0.001**	1.624 0.202
Satisfactory Practice	14	28.0	43	86.0	38	76.0			
<b>Mean ±SD</b>	<b>11.0 ±4.3</b>		<b>18.2 ±4.6</b>		<b>16.7 ±5.8</b>		<b>t=8.085, P&lt;0.001**</b>	<b>t=5.582, P&lt;0.001**</b>	<b>t=1.432, P=0.155</b>
<b>Total Checklist Level</b>									
Unsatisfactory Practice	39	78.0	6	12.0	11	22.0	44.000 <0.001**	31.360 <0.001**	1.772 0.183
Satisfactory Practice	11	22.0	44	88.0	39	78.0			

Practice						
<b>Mean ±SD</b>	18.2 ±8.1	31.3 ±6.1	28.8 ±6.9	t=9.135, P<0.001**	t=7.044, P<0.001**	t=1.919, P=0.057

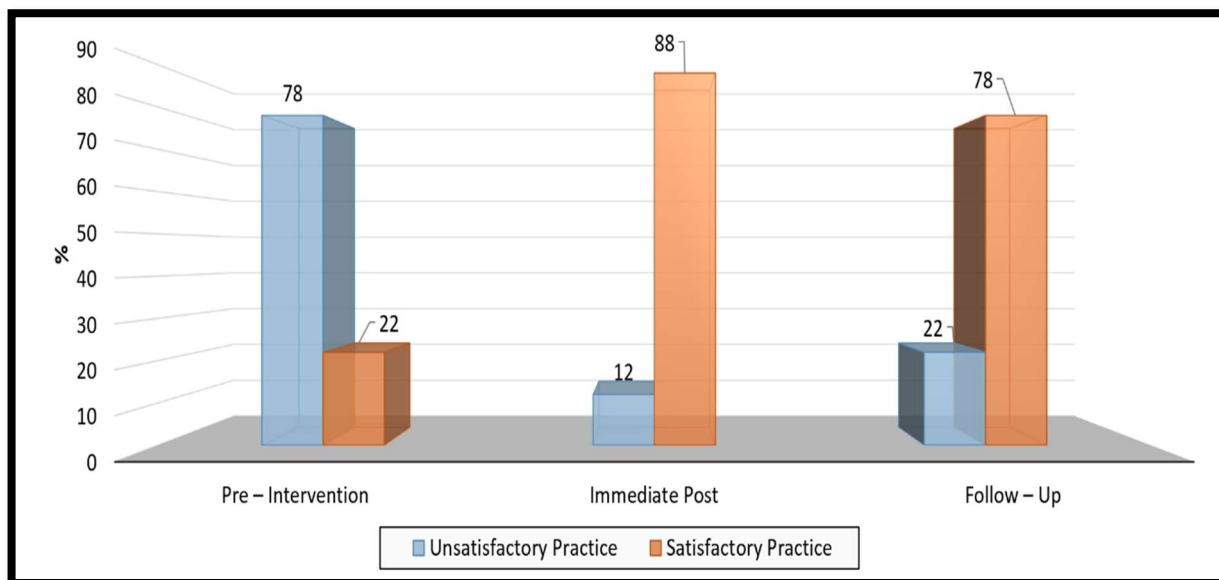


Figure (2): Total score of nurses, practice

Table (4): Percentage distribution of laboratory investigation of children receiving total parenteral nutrition

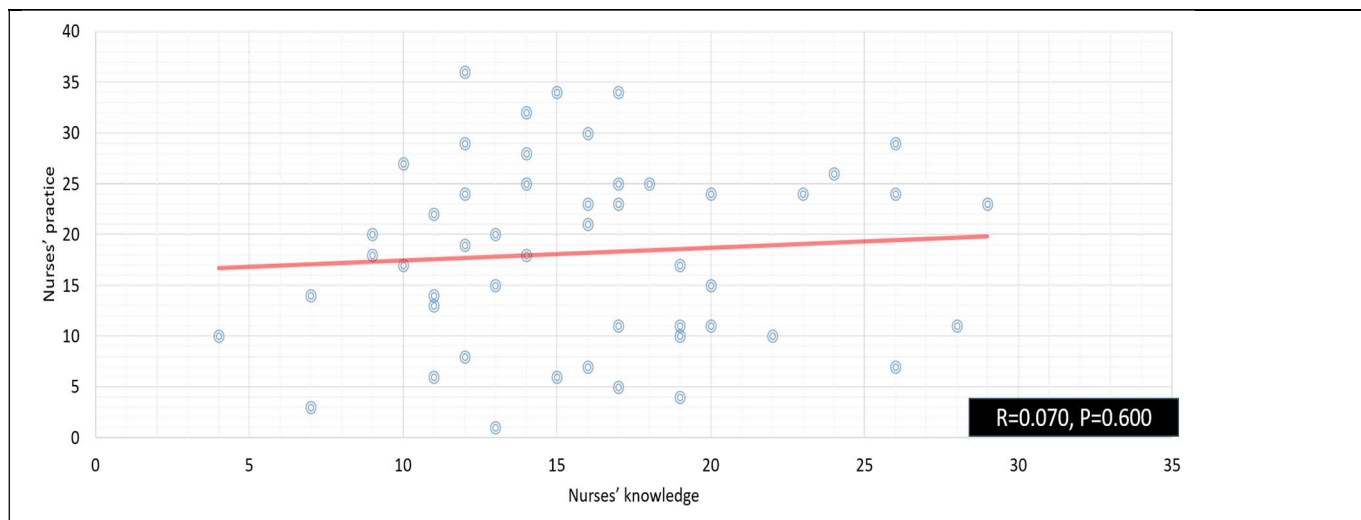
					Significance test
	before Intervention		Immediate Post		I
<b>Blood Culture</b>					
Positive	34	68.0	12	24.0	X <sup>2</sup> =19.485, P<0.001**
Negative	16	32.0	38	76.0	
<b>C reactive protein (CRP) (mg/L)</b>					
Normal (<10 mg/L)	14	28.0	38	76.0	X <sup>2</sup> =23.077, P<0.001**
Abnormal (≥10 mg/L)	36	72.0	12	24.0	
<b>Erythromycin sedimentation rate (mm/hr)</b>					
Normal (≤10 mm/hr)	16	32.0	38	76.0	X <sup>2</sup> =19.485, P<0.001**
Abnormal (>10 mm/hr)	34	68.0	12	24.0	
<b>White blood cells count (WBC)</b>					
Normal	16	32.0	42	84.0	X <sup>2</sup> =27.750, P<0.001**
Abnormal	34	68.0	8	16.0	

**Table (5): Percentage distribution of children related to physiological measurements**

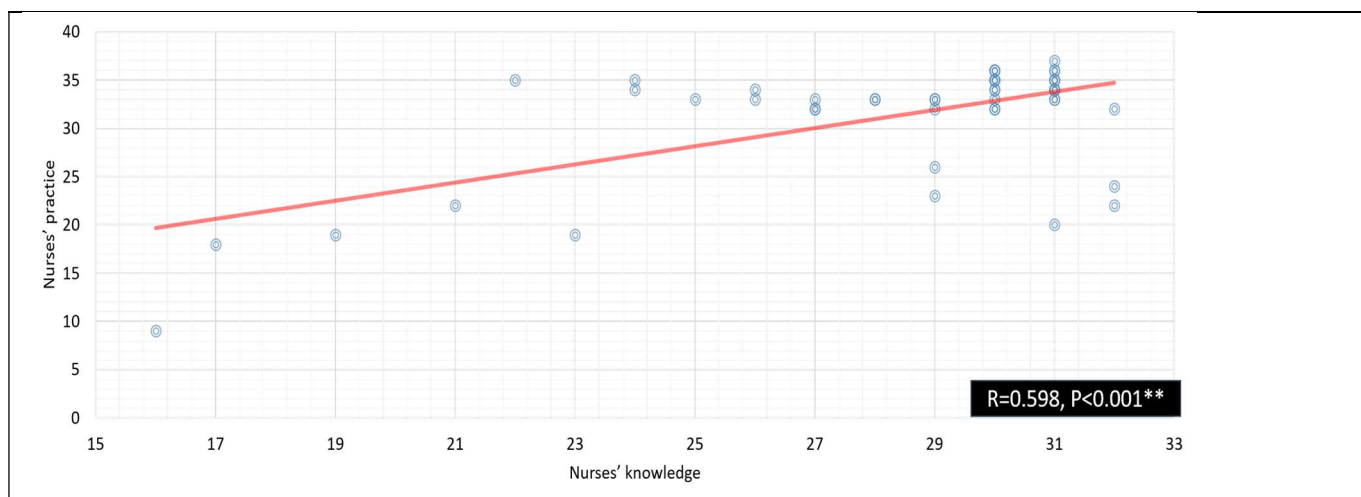
							Significance test		
	before Intervention		Immediate Post		One month after		I	II	III
	N	%	N	%	N	%	X <sup>2</sup> , P	X <sup>2</sup> , P	X <sup>2</sup> , P
<b>Temperature</b>									
Mean ±SD	38.2 ±1.1		37.5 ±1.0		37.4 ±0.9		t=2.427, P=0.056 *	t=1.990, P=0.049 *	t=0.525, P=0.600
<b>Respiration rate</b>									
Mean ±SD	32.4 ±9.5		29.0 ±7.8		29.3 ±7.8		t=1.955, P=0.053	t=1.783, P=0.077	t=0.192, P=0.847
<b>Heart rate</b>									
Mean ±SD	122.8 ±29.1		107.8 ±24.1		109.4 ±24.5		t=2.807, P=0.006 *	t=2.490, P=0.014 *	t=0.329, P=0.742
<b>Blood pressure</b>									
Abnormal	35	70.0	14	28.0	17	34.0	X <sup>2</sup> =17.6 47, P<0.001 **	X <sup>2</sup> =12.9 81, P<0.001 **	X <sup>2</sup> =0.421, P=0.516
Normal	15	30.0	36	72.0	33	66.0			

**Table (6): Percentage distribution of children related to their physical measurements**

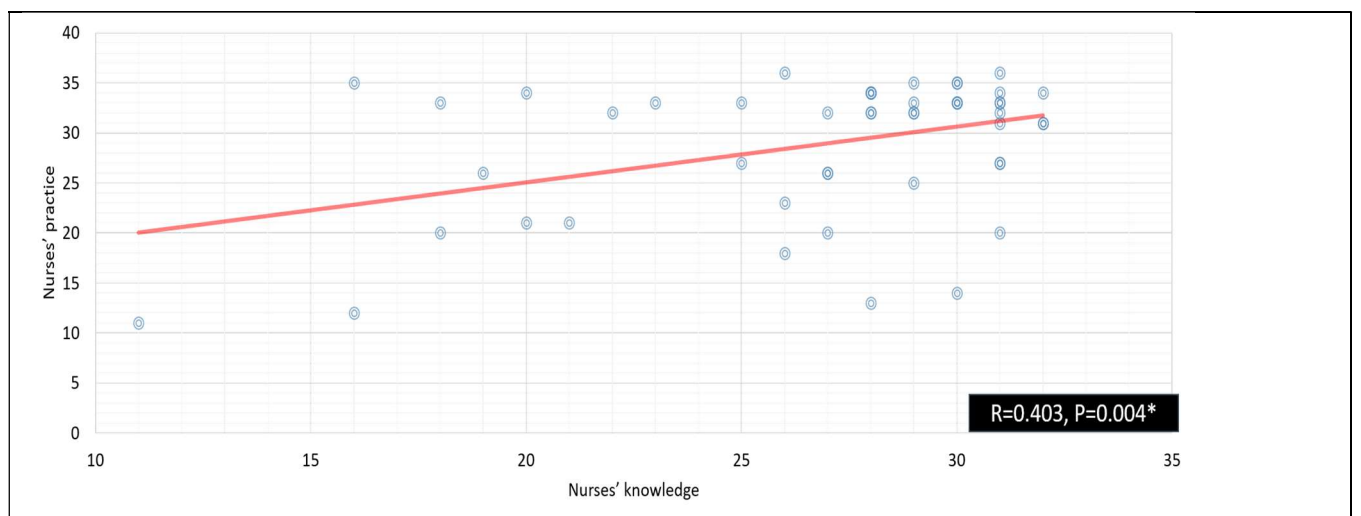
							Significance test		
	before Intervention		Immediate Post		One month after		I	II	III
	No	%	No	%	No	%	t P	t, P	t, P
<b>Weight</b>									
Range 11:17 Mean ±SD	10.9 ±3.1		13.2 ±3.1		13.3 ±3.1		t=1.955, P=0.053	t=1.783, P=0.077	t=0.192, P=0.847
<b>Height</b>									
Range 80:110 Mean ±SD	81.5 ±13.9		91.4 ±9.6		89.2 ±10.7		t=4.562, P=0.006 *	t=4.595, P=0.014 *	t=0.245, P=0.806



**Figure 3. Correlation between Nurses' knowledge and practice scores before intervention**



**Figure 4. Correlation between Nurses' knowledge and practice at immediate post**



**Figure 5. Correlation between Nurses' knowledge and practice after one month**

**Table (7): Relation between the Physical (weight) and physiological measurements**

	before Intervention	Immediate Post	One month after
<b>Blood pressure (Mean ±SD)</b>			
Abnormal	10.7 ±3.2	11.4 ±2.9	11.9 ±3.3
Normal	11.4 ±2.8	15.5 ±3.4	14.8 ±2.9
Student's T – Test	t=0.643, P=0.523	t=3.978, P<0.001**	t=3.196, P=0.003*
<b>Respiration rate</b>			
r – Value	0.202	0.746	0.376
P – Value	0.159	<0.001**	0.008*
<b>Heart rate</b>			
r – Value	0.218	0.883	0.416
P – Value	0.128	<0.001**	0.003*
<b>Temperature</b>			
r – Value	0.225	0.851	0.332
P – Value	0.116	<0.001**	0.020*

**Table (8): Relation between physical (Height) and physiological measurements**

	before Intervention	Immediate Post	One month after
<b>Blood pressure (Mean ±SD)</b>			
Abnormal	81.4 ±14.6	87.8 ±9.5	89.6 ±11.3
Normal	79.7 ±13.0	96.3 ±10.0	97.1 ±10.4
Student's T – Test	t=0.382, P=0.704	t=2.735, P=0.008*	t=2.346, P=0.023*
<b>Respiration rate</b>			
r – Value	0.123	0.608	0.427
P – Value	0.395	<0.001**	0.002*
<b>Heart rate</b>			
r – Value	0.114	0.765	0.330
P – Value	0.432	<0.001**	0.019*
<b>Temperature</b>			
r – Value	0.106	0.734	0.283
P – Value	0.463	<0.001**	0.046*

## Discussion

Infection seen in children who feeding with total parental nutrition via central venous catheter are defined as catheter blood stream infection, when research indicates that the infection originated from the colonized catheter, thus, proper central venous catheter uses and maintenance by qualified nurses have a crucial role in reducing risk of infection. In addition to catheter loss, these infections may result in mortality as well as morbidity. The child's characteristics and the conditions under which parenteral nutrition was given can affect the rates of infection (**Al Salamah et al., 2022**).

Concerning sociodemographic factors of nurses in study, the findings of current study revealed that nearly half percentage of studied nurses their age ranged from 25 to less than 30 years and most of them were female. **Khalifa et al., (2022)**, who assess effect of nursing care bundle on nurse's performance regarding central line care was agreed with the current result as they mentioned that about half of the studied nurses were between 25 to 30 years old, and most of them were females. The results of current study were accordance with **Watanya et al., (2020)** who conducted a study to assess effects of an educational program on the nurses' performance regarding vascular access infection prevention, who mentioned that most of nurses were female and married.

Regarding their educational level, about half of the nurses under study had bachelor's degree. This finding was in the same line with **Zeyada et al., (2021)** who found that nearly half nurses had bachelor of nursing science, in their study of impact

of educational on nurses' knowledge and practice regarding central line associated blood infection. This finding disagreement with **Moursy & Sharaf (2017)**, who study about vascular access care at hemodialysis unit nurses' compliance to infection prevention and control practice, who mentioned that the majority of the nurses in study, their educational level were diploma.

According to nurses' training program about prevent infection in children depended on total parenteral nutrition nearly two third of nurses didn't, have previous training program about catheter care. This result was in the same line with **Abdelsatir (2019)** who conducted study about improving nurses' knowledge of central line bloodstream infection in children with total parenteral nutrition and found that the majority of nurses didn't have pervious training about central line.

Concerning to knowledge level of nurses under study regarding total parenteral nutrition, infection related to total parenteral nutrition and its management pre, immediately and after one month of implementation of nursing educational program, the findings of the present study showed that, there was statistically significant improvement in the level of nurses' knowledge regarding total parenteral nutrition and its management. Where the most of studied nurses had poor level of knowledge before applying program, while nearly all of them had good level of knowledge after program.

This result corresponded with the findings of **Raghep and Elgazar (2020)** who mentioned that most of nurses within study had inadequate knowledge prior to the

educational intervention and improved to a satisfactory level both immediately and post the program regarding patient care during the insertion and maintenance of central venous catheters. This result was consistent with **Harshita et al., (2022)** who reported that mean score knowledge level of nurses was high immediately, in their study "Effectiveness of education intervention on nurse's knowledge regarding the prevention of central line infection in the intensive care" discovered that posttest knowledge on prevention of infection were higher than pretest score.

The results of this study concur with those of **Abo-El Ezz et al., (2019)** who investigated the foundational knowledge of nurses in a variety of specialties prior to implementing instruction training programs, all of results showed that nurses' knowledge levels were extremely low before being exposed to a defined training program, which enhanced significantly and rapidly after application but then slightly declined at follow-up. Additionally, this outcome was consistent with **El-Sol and Badawy's (2020)**, in their study on the impact of a planned teaching module on ICU nurses' knowledge and practice regarding prevention of central line associated bloodstream infection occurs with total parenteral nutrition, they discovered that nurses' knowledge had significantly improved following the planned teaching module.

This study reported a positive relation between total nurses' knowledge and practice scores regarding catheter care and maintenance, which was consistent with the findings of **Sadawy et al., (2019)**, in their study "Clinical practice guidelines for prevention of central line infection," who

mentioned statistically significant correlation between nurses' knowledge and practice prior to and following the guidelines.

Furthermore, the current investigation revealed a highly significant correlation between the total knowledge of nurses regarding parenteral nutrition and their overall practice. This could be explained by the fact that nurses with competent levels of practice were more likely to have good levels of knowledge. These findings are consistent with the research conducted by **Abdel Fattah et al., (2018)** who discovered a positive correlation between the studied sample's overall knowledge levels and their degree of practice.

### **Conclusion**

Based on the findings of present study, it can conclude that:

Knowledge and practice of pediatric intensive unit's nurses were improved after educational intervention to prevent infection related to total parenteral nutrition, with high statically significant difference. Also, there were improvements of laboratory investigations of involved children after educational program. Educational intervention program have positive effect on both nurses performance, physical and physiological measurements of children receiving total parenteral nutrition.

### **Recommendations**

1- Hospital managers are encouraged to include total parenteral nutrition and central line care in training program for pediatric intensive care unit nurses and recommended to be included in the hospital protocol for management of blood infection occur with children receive total parenteral nutrition.



2- Continuing nursing education to enhance their knowledge and skills regarding total parenteral nutrition and its associated complications.

3 - All nursing staff members must have access to standardized guidelines for managing complications related to central lines.

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