

# The Effect of Empowerment Program for Nurses Regarding Management of Children with Phenylketonuria

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## ABSTRACT

**Context:** Phenylketonuria (commonly known as PKU) is an inherited disorder that increases the levels of a substance called phenylalanine in the blood. If PKU did not diagnose early in life or the affected children with PKU do not be compliant with the treatment regimen (food), it leads to severe cognitive or behavioral problems, seizures, and autistic symptoms.

**Aim:** The current study aimed to evaluate the effect of empowerment program on nurses' management of children with phenylketonuria.

**Methods:** Quasi-experimental research (one group pre/post-test) design was used to conduct this study. The study was carried out in the hereditary unit, and hereditary outpatient clinics at Ain Shams Specialized Hospital for children affiliated to Ain Shams University. A convenient sample of all available nurses working in the previously mentioned study settings (80 male and female bedside nurses) from the beginning of May 2018 to the end of October 2018. Two tools were utilized for data collection for the current study. They are the structured interview questionnaire to assess the nurses' knowledge regarding the management of children with phenylketonuria and the nurses' performance observation checklists regarding nursing care provided for children with phenylketonuria

**Results:** nurses' knowledge regarding phenylketonuria was unsatisfactory before the empowerment program, while there is a statistically significant improvement between pre and post empowerment program implementation. Nurses' practice regarding phenylketonuria was incompetent before the empowerment program compared to post empowerment program. There is a positive statistical relationship between nurses' knowledge and practice post-program implementation.

**Conclusion:** The study revealed that the empowerment program had a positive effect on the nurses' knowledge and practice towards the management of children with phenylketonuria. The current study recommended continuous education and training sessions about the management of children with phenylketonuria that should be provided to upgrade the knowledge and improve the practice of nurses caring for PKU children. Availability and accessibility of printed guidelines, posters, and simple handouts regarding the management of children with phenylketonuria.

**Keywords:** Nurses' management, empowerment program, children and phenylketonuria

## 1. Introduction

Phenylketonuria (PKU) is one of the inherited disorders of metabolism that causes an increase in the blood of a chemical known as phenylalanine. Phenylalanine comes from an individual's diet and is used by the body to make proteins. Phenylalanine is found in all food proteins and some artificial sweeteners. Without dietary treatment, phenylalanine can build up to harmful levels in the body, causing mental retardation and other serious problems (Waters *et al.*, 2018).

Phenylketonuria is an inborn error of phenylalanine (Phe) metabolism caused by an inherited deficiency in L-phenylalanine-4-hydroxylase activity, leading to elevated levels of phenylalanine in body fluids (Camp *et al.*, 2014). Children with PKU diagnosed by newborn screening who begin dietary treatment during the neonatal period usually show healthy neurological development. However, these children may have lower intelligence quotients and exhibit mild neuropsychological disturbances, including impaired motor skills, visual function, attention, inhibition, and

memory, especially when compared with non-phenylketonuria siblings and healthy individuals. These disorders are equally frequent in males and females (Georgianne, 2014; Burlina *et al.*, 2019).

PKU occurs in all ethnic groups, with an estimated worldwide prevalence of 1 in 10,000 live births to 1 in 15,000 neonates (Waters *et al.*, 2018). Screening for a newborn has been used to detect PKU since the 1960s. As a result, severe signs and symptoms of PKU are seen rarely. When untreated, the neurotoxic accumulation of phenylalanine results in severe intellectual disabilities. However, the most severe cognitive sequelae are now generally avoided through early detection and dietary treatment to limit phenylalanine intake. Nevertheless, persons with early and continuously treated PKU experience neuropsychological impairment, particularly related to executive abilities (Hawks, Strube, Johnson, Grange & White, 2018).

Early and continuously treated PKU (ECT-PKU) prevents intellectual disability and the most severe neurodevelopmental consequences of PKU. However, there is a higher risk of a slight decrease in intelligence and neuropsychological problems. These outcomes are due to a

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complex array of factors, including phenylalanine toxicity. Phenylalanine levels targets in children with ECT-PKU are supposed to prevent neuropsychological problems, but they are still higher in comparison with the average level of non-PKU children (Mitchell, Trakadis & Scriver, 2011).

Nurse empowerment has the ability and power to act professionally. The empowerment is having a greater sense of self-esteem or confidence, control over one's life, or power to do something. Therefore, nurse empowerment is characterized by the ability to share in more positive and productive behaviors as a result of the individual's perception of self-efficacy and competence to meet the demands of the job. Empowerment includes self-determination and a sense of control over one's work (Purdy, Laschinger, Finegan, Kerr, & Olivera, 2010).

The importance of empowerment in nursing is that the nurses feel that they have the power to authorize their job, satisfaction in their job, and feel appreciated. Besides, they feel less exhausted also in their work. It also enhances the care of patient outcomes. A powerless nurse is an ineffectual nurse. Powerless nurses have more job stress compare to empowered nurses. Powerlessness is the cause of burnout in work (Manojlovich, 2007; Essays, 2018).

## **2. Significance of the study**

In Egypt, the incidence of PKU is unknown, but in all cases, around 8000 cases follow up in genetic clinics in Egypt. The prevalence in the population is approximately 4 cases per 100,000 individuals. It is diagnosed through performing screening test of serum Phenylalanine level between one and seven days after birth, through pricking the heel of the newborn and test the blood obtained for phenylalanine concentration. PKU, unfortunately, in Egypt, this screening test is not routine. Consequently, it is discovered later, and the parents of the child have to cope with the burden of daily care related to the illness (Abdelrahim, Ahmed & Mostafa, 2013). So, this empowerment program is performed to improve nurses' knowledge and practices regarding the management of children with phenylketonuria.

## **3. Aim of the study**

The current study aimed to evaluate the effect of empowerment program on nurses' management of children with phenylketonuria through:

- Assessing nurses' knowledge and practice regarding phenylketonuria.
- Designing and implementing empowerment program based on nurses' actual needs assessment about phenylketonuria.
- Evaluating the effect of implemented empowerment program on nurses' knowledge and practice toward management of children with Phenylketonuria

### **3.1. Research Hypotheses**

- Nurses who are exposed to the empowerment program regarding management with phenylketonuria will exhibit improved knowledge compared to pre-exposure levels.

- Nurses who are exposed to the empowerment program regarding management with phenylketonuria will exhibit improved competencies compared to pre-exposure levels.
- There will be a positive correlation between nurses' knowledge and practice scores after the empowerment program.

## **3.2. Operational definition**

### *Empowerment*

It is a positive concept of power or authority is given on doing something. Empowerment also refers to uniting people to achieve a common goal in the community.

## **4. Subjects & Methods**

### **4.1. Research design**

Quasi-Experimental research (one group pre/post-test) design was used to conduct this study. Quasi-experimental studies have been accepted widely and used in the social sciences for several years. Quasi-experimental research shares similarities with the traditional experimental design or randomized controlled trial, but it specifically lacks the elements of random assignment for treatment or control (Bärnighausen et al., 2017).

### **4.2. Research Setting**

The study was carried out in the hereditary unit and hereditary outpatient clinics at Ain Shams Specialized Hospital for children. Hereditary unit located on the third floor containing four big rooms, each room contains two beds, each bed attached with monitor and oxygen source.

### **4.3. Subjects**

A convenient sample of all available male and female bedside nurses (80) working in the previously mentioned study setting. They are caring for the children with phenylketonuria, through the morning and afternoon shifts for six months from the beginning of May 2018 to the end of October 2018.

### **4.4. Tools of the study**

The researcher developed the current study's tool. These tools included the following:

#### **4.4.1. A Structured Interview Questionnaire**

It developed based on the scientific literature *Camp et al., (2014)* to assess actual nurses' knowledge regarding PKU. It was prepared in Arabic language and comprised two main parts which are:

Part I: Demographic characteristics of the studied nurses as; age, gender, qualifications, years of experience, and attendance of training courses regarding phenylketonuria.

Part II: Nurses' knowledge about phenylketonuria, which consisted of 15 questions (12 multiple choice questions and three open-ended questions) covering the components related to; definition, causes, classifications, risk factors, signs and symptoms, complications, laboratory investigations, diet restriction, PKU formula, importance of

Phenylalanine control, prognosis, prevention of occurrence of disease, prevention of potential complications of the disease, warning signs and nursing management.

#### Scoring system:

The scoring system consisted of giving score (1) for the correct answer and (0) for the incorrect answer. The total questions composed of (15 marks). The scoring system for total knowledge classified as follows:

- Satisfactory knowledge level: Equal to or more than 80%.
- Unsatisfactory knowledge level: Less than 80%.

#### 4.4.2. Nursing Performance Observation Checklists

It adapted from *National Centre for Inherited Metabolic Disorders, (2014); Hockenberry & Wilson (2015)* and modified by the researchers to assess the actual nurses' practice regarding care of children with phenylketonuria concerning; general observations (5 steps), assessment of neurological status (6 steps), nutrition (6 items), exercise of the children (5 steps), management of hyperthermia (5 steps), protection from complications (3 steps), ongoing education and genetic implications (4 items), and meeting psychological needs for children and their families (6 steps).

#### Scoring system:

Total practice scores were (40 steps). The researcher observed during each procedure for three different times using the nurses' performance observation checklists. The mean was taken of the three observations. A subtotal scoring was counted for each nursing procedure separately. Subtotal and total scoring for practice was classified according to competency level as follows:

- Competent level of practice: Equal to or more than 80%.
- Incompetent level of practice: Less than 80%.

#### 4.5. Procedures

The researcher measured the tools' content validity and asserted that items of the tools were adequately represented what is supposed to be measured by three experts including; one medical-surgical nursing professor, one pediatric medicine assistant professor, and one assistant professor of pediatric nursing from the Faculty of Nursing Benha University, to test the content validity. The experts' modification was done regarding the clarity of sentences, appropriateness of the content, and sequence of items with minor language changes recommended. The internal consistency (reliability) of all items of the data collection tools was assessed using coefficient alpha. It was 0.87 for structured interviewed questionnaires and was 0.83 for nurses' practice observational checklists.

Official permission was obtained for data collection from the hospital manager and head of the hereditary unit and hereditary outpatient clinics at Ain Shams Specialized Hospital for children through submission of official letters issued from the dean of Ain Shams Faculty of Nursing. The title aims and expected outcomes of the study were explained as well as the primary data items to be covered,

and the study was conducted after gaining the necessary permissions.

**Ethical Considerations and Human Rights:** The participation in the study was voluntary. Each nurse informed about the nature of the study, the purpose, procedures, benefits, and all the collected information was protected. Each nurse had the right to fall back from the study at any time without rationale and then the researcher obtained oral consent. Subjects were informed that obtained data for the research purposes only and will not be included in any job evaluation.

A pilot study was carried out for 10% of studied subjects (8 nurses) during April 2018 to assess the feasibility of the research process, clarity, objectivity, applicability, and time needed for the data collection tools. Accordingly, the necessary modifications were done in the form of editing, and some minor language changed. The pilot study subjects were excluded later from the actual study sample.

The actual fieldwork was performed from the beginning of May 2018 to the end of October 2018 to collect data. The average numbers of the studied nurses who were assessed and gave the empowerment program per week were ranged from 7-10 nurses. The structured interviewing questionnaire was filled out by the studied nurses, and the researchers collected observation checklists. Then, the researcher was observing the nurses' practice regarding the care of children with phenylketonuria during their practice.

**Preparation phase:** It included designing and testing different tools of data collection, besides the administrative arrangements to conduct the study and the pilot study. In the beginning, the researchers introduce themselves to the studied nurses. Nurses who agree to participate in the study interviewed individually by the researchers to explain the nature, purposes, and desired outcomes of the study, and oral consent was obtained from these nurses.

**Implementing phase:** The researchers attended the previously mentioned study settings three times weekly during their working shifts (Saturday, Monday, and Tuesday) in the morning and afternoon shifts by rotation. Each nurse was interviewed individually for 15–20 minutes to fill out the structured interviewing questionnaire. The researchers refined and answered any related questions. Then, each nurse was observed during their practice on morning and afternoon shifts using nurses' observational checklists. The time needed for observation for each nurse was 15-25 minutes for three times during care provided for children with phenylketonuria. The mean was taken after the three observations for each nurse.

**Empowerment program construction, implementation, and evaluation:**

As a pretest, the questionnaire was completed by studied nurses. Then the empowerment intervention program was done in nine sessions as three days a week by researchers. Four weeks after the ending of intervention, studied nurses completed the questionnaire as a post-test.

The empowerment program was designed based on the actual needs assessment of the studied nurses, then the

program implemented and evaluated. This program aimed to improve nurses' knowledge and enhance their practice regarding the management of children with phenylketonuria. The implementation of the empowerment program was carried out in the previously mentioned study setting. The empowerment program designed to increase the sense of control, improve the ability and skills, and reduce the burden of nursing care for children with PKU. Thus, empowerment training programs implemented for nurses in the form of workshops and educational guidelines. The researcher distributed and explained the booklet content to the studied nurses to be used as a guiding reference later on. Training of nurses was conducted using a laptop with MS PowerPoint presentations 2010 made from the educational contents of the guiding booklet. The program was carried out for a group of studied nurses that entailed (7-10 nurses) according to their working conditions, their mental and physical readiness.

The Empowerment Program was carried out for three weeks period and one week for pre and post-test. A schedule suitable for nurses was prepared to conduct the program that included; date, topic, place, time, and duration of each session. The total numbers of sessions were nine sessions (6 for practice and 3 for theory). Each session took about 45 to 60 minutes, including the time for open discussion during the training in addition to 2 sessions for pretest and post-test.

At the beginning of the first session, an orientation session conducted regarding the importance and the expected outcomes for each studied nurse. Unambiguous and straightforward words of the Arabic language were utilized. At the end of each session, the nurses' queries were answered to correct any misunderstanding, obtain feedback about the previous session, and discuss the objectives of the new session in addition to demonstration and re-demonstration for practical procedures.

Different teaching methods were used for conducting the empowerment program, such as; lectures, brainstorming, small group discussions, role play, demonstration, and re-demonstration for practical procedures by using real objects. Suitable teaching aids as colored posters, mannequins, and real objects were prepared, especially for practice. Nurses were motivated to cooperate and actively participate in all stages of the study.

Evaluation phase: After completion of the empowerment program, the evaluation was done in two stages. The first stage performed to secure the learning of the educated materials that were included in each session, and the second stage of the evaluation was performed post-test completing the empowerment program to evaluate the outcomes of the implemented empowerment program using the same tools for data collection.

#### **4.6. Data analysis**

The collected data were revised, organized, tabulated, and analyzed by using SPSS (Statistical Package for the Social Science Software) statistical package version 20 on

IBM compatible computer. Numerical data (Quantitative data) was presented in tables by using Mean, Standard deviation ( $X \pm SD$ ), while qualitative data were expressed as frequency and percentage. Chi-square was used to compare pre and post-intervention findings. Pearson correlation test ( $r$ ) was used for measuring the correlation between quantitative variables.

P-value was used to determine significance regarding:

- P-value  $> 0.05$  to be statistically insignificant.
- P-value  $\leq 0.05$  to be statistically significant.
- P-value  $\leq 0.001$  to be highly statistically significant.

#### **5. Results**

Table 1 describes the characteristics of the studied nurses, the majority of the nurses' age ranges between 20 to less than 30 years (67.5%), with the mean age of  $24.44 \pm 7.82$  years. The majority of them were females (88.8%), and more than three-quarters of them (77.5%) had secondary school diploma in nursing. Additionally, 80.0% had less than ten years of experience with the mean years of experience are  $5.38 \pm 3.18$ , while no one of them attending training courses regarding phenylketonuria.

Table 2 reveals the comparison of studied nurses' knowledge regarding phenylketonuria pre and post empowerment program implementation. It clarifies highly statistically significant differences between pre and post empowerment program implementation (p-values=0.000).

Table 3 demonstrates the comparison of studied nurses' practice regarding the management of children with phenylketonuria pre and post-empowerment program implementation. It reveals that there is a highly statistically significant difference between pre and post empowerment program implementation (p-values=0.000).

Table 4 reveals a comparison of the studied nurses' total knowledge and total practice regarding the management of children with phenylketonuria pre and post empowerment program implementation. It shows that, before the implementation of the program, the majority of nurses (91.25% & 87.5) have unsatisfactory knowledge and incompetent practice regarding the management of children with phenylketonuria, respectively. In contrast, after empowerment program implementation, the highest percentage of nurses (96.25% & 88.75%) had satisfactory knowledge and competent practice, respectively, regarding the management of children with PKU. This table also shows highly statistically significant differences between pre and post empowerment program implementation for both knowledge and practice (p-values=0.000).

Table 5 shows the correlation between total nurses' knowledge, total practice regarding the management of children with phenylketonuria after empowerment program implementation and their characteristics. This table illustrates a positive statistically significant correlation between total nurses' knowledge and total practice score ( $r = 0.481$  &  $p = 0.00$ ) with a non-significant correlation revealed between total knowledge and age, qualifications, and nurses' gender.

**Table (1): Frequency and percentage distribution of the studied nurses according to their demographic characteristics (n=80).**

Personal characteristics	Study sample N=80	
	No	%
<b>Age in years</b>		
20 - < 30	54	67.5
30 - < 40	25	31.2
≥ 40	1	1.3
X ±SD	24.44 ± 7.82	
<b>Gender:</b>		
Male	9	11.2
Female	71	88.8
<b>Qualifications</b>		
Diploma	62	77.5
Technical	7	8.8
Bachelor's degree in nursing	11	13.8
<b>Years of experience</b>		
<1 year	0	0.0
1 - < 10 years	64	80.0
≥ 10 years	16	20.0
X±SD	5.38 ± 3.18	
<b>Attendance of previous training courses regarding phenylketonuria</b>		
Yes	0	00.0
No	80	100.0

**Table (2): Comparison of the studied nurses' knowledge regarding phenylketonuria pre and post empowerment program implementation (n=80).**

Knowledge elements	Pre-program implementation (80)				Post-programm implementation (80)				X <sup>2</sup>	P-value
	Correct		Incorrect		Correct		Incorrect			
	No	%	No	%	No	%	No	%		
Definition	18	22.50	62	77.50	68	85.00	12	15.00	62.85	0.000
Causes	8	10.0	72	90.0	70	87.5	10	12.5	36.45	0.000
Classifications	10	12.5	70	87.5	54	67.5	26	32.5	42.16	0.000
Risk factors of the acute stage	10	12.5	70	87.5	61	76.25	19	23.75	44.23	0.000
Signs and symptoms	19	23.75	61	76.25	65	81.3	15	18.8	53.03	0.000
Complications	12	15.0	68	75.0	68	75.0	12	15.0	42.15	0.000
laboratory investigations	7	8.75	73	91.25	63	78.8	17	21.3	79.64	0.000
Diet restriction	14	17.5	66	82.5	72	90.0	8	10.0	60.45	0.000
PKU formula	9	11.25	71	88.75	67	83.8	13	16.3	32.45	0.000
Importance of Phenylalanine control	5	6.25	75	93.75	71	88.75	9	11.25	38.94	0.000
Prognosis,	18	22.50	62	77.50	64	80.00	16	20.00	52.93	0.000
Prevention	14	17.5	66	82.5	67	83.8	13	16.3	43.2	0.000
Prevention of potential complications	19	23.75	61	76.25	59	73.25	21	26.25	24.21	0.000
Warning signs	7	8.75	73	91.25	61	76.25	19	23.75	38.48	0.000
Nursing management	14	17.5	66	82.5	67	83.8	13	16.3	41.66	0.000

A statistical significance difference ( $P \leq 0.05$ )

**Table (3): Comparison of the studied nurses' practice regarding the management of children with phenylketonuria pre and post empowerment program implementation (n=80).**

Items	Pre-program implementation (80)				Post-program implementation (80)				X <sup>2</sup>	P-value
	Competent		Incompetent		Competent		Incompetent			
	No	%	No	%	No	%	No	%		
General observations	7	8.75	73	91.25	67	83.8	13	16.3	64.45	0.000
Assessment of neurological status	10	12.5	70	87.5	59	73.25	21	26.25	42.69	0.000
Nutrition	19	23.75	61	76.25	68	75.0	12	15.0	42.06	0.000
Exercise	10	12.5	70	87.5	61	76.25	19	23.75	44.23	0.000
Management of hyperthermia	19	23.75	61	76.25	65	81.3	15	18.8	53.03	0.000
Safety measures	12	15.0	68	75.0	68	75.0	12	15.0	36.45	0.000
Ongoing education and genetic implications	5	6.25	75	93.75	67	83.8	13	16.3	79.64	0.000
Psychological needs	14	17.5	66	82.5	72	90.0	8	10.0	60.45	0.000

A statistical significance difference ( $P \leq 0.05$ )

**Table (4): Comparison of the studied nurses' total knowledge and total practice regarding the management of children with phenylketonuria pre and post empowerment program implementation (n=80).**

Items	Pre-program implementation (80)		Post-program implementation (80)		X <sup>2</sup>	P-value
	No	%	No	%		
<b>Total knowledge</b>						
Satisfactory	7	8.75	77	96.25	64.08	0.00**
Unsatisfactory	73	91.25	3	3.75		
<b>Total practice</b>						
Competent	10	12.5	71	88.75	56.34	0.00**
Incompetent	70	87.5	9	11.30		

*A statistical significance difference (P≤0.05)*

**Table (5): Correlation between total nurses' knowledge, total practice regarding the management of children with phenylketonuria after empowerment program implementation and their characteristics (n=80).**

Items	Total knowledge	
	r	P-Value
<b>Total practice</b>	0.481	0.00
<b>Age of the nurses</b>	0.004	0.961
<b>Qualifications</b>	0.039	0.645
<b>Gender</b>	0.017	0.834

*A statistical significance difference (P≤0.05)*

## 6. Discussion

Phenylketonuria (PKU) is caused by a deficiency in the gene that helps the creation of the enzyme required to break down phenylalanine. Without this enzyme which is necessary to process phenylalanine, development of a dangerous buildup can occur when a person with PKU eats foods that are high in protein, this metabolic defect leading to that, phenylalanine increases to toxic levels in the blood and can cause mental retardation, seizures, learning disabilities, and emotional problems if the infant or adult is untreated or inadequately treated (Marcason, 2013; Anderson & Leuzzi, 2014).

As regards the demographic characteristics of the studied nurses, the total number of them was eighty nurses; slightly more than two-thirds of them, their ages ranging from 20 to less than 30 years with the mean age of them were 24.44±7.82 years. The majority of them were females that might be due to the higher percentage of the nurses in Egypt were females and may also be related to the nursing study in the Egyptian Universities was limited for females only till fifteen years ago. More than three-quarters of studied nurses had a diploma in nursing school. As well, more than three-quarters of them had 1 to less than ten years of experience.

This result agreed with the result carried out in Egypt by Khalaf & Said (2017) in a study about "Educational program for nurses regarding the management of children with maple syrup urine disease during acute intermittent late-onset." The study indicated that the majority of the studied nurses were females. More than two-thirds of them their age was ranged between 20 to less than 30 years. More than three-quarters of them had secondary school diploma in nursing with one to less than ten years of experience.

Regarding nurses' knowledge about phenylketonuria, the findings of the current study reflected that the scores of most the studied nurses' knowledge before empowerment program implementation were unsatisfactory. These findings go in line with Sabaq & Said (2015) in a study carried out in Egypt about "Effect of educational program on nurses' performance regarding safe medications administration through nasogastric tube among critically ill children." The study reported that all nurses had an unsatisfactory level of knowledge before educational program implementation.

This finding also supported by Khalaf & Said (2017), who stated that total scores of nurses' knowledge before program implementation were unsatisfactory. This finding may be due to deficiency of training programs in this field, unavailability of printed and unambiguous guidelines regarding the management of children with phenylketonuria, lack of cooperation among the multidisciplinary team, lack of motivation for nurses, and also, lack of the desire for their knowledge improvement.

Regarding nurses' practice about the management of children with phenylketonuria, the finding of the present study revealed that the majority of nurses had incompetent practice before empowerment program implementation. This finding may be related to a lack of continuous education and training sessions regarding the management of children with PKU. These findings are in agreement with a study carried out by Fouad & Abd Elmoneem (2016) about the "Nursing intervention program for family caregivers having children with Phenylketonuria." They found a highly statistically significant improvement post-program compared to pre-program implementation at (p < 0.001).

In the same line, these findings were in agreement with Kong & Rajikan (2015) in a study about "Growth and nutritional status of children with maple syrup urine disease

(MSUD): A 6-months follow up study in Institute of Pediatric, Hospital Kuala Lumpur (HKL)", who found that majority of nurses had incompetent practice pre-program implementation regarding maple syrup urine disease.

Regarding total nurses' knowledge, there was a significant improvement in the studied nurses' total knowledge after the implementation of the empowerment program. These findings are supported the hypothesis number one in the current study. These findings also were consistent with the findings of *Lee & Lin (2013)* in a study about "The effectiveness of an e-learning program on pediatric medication safety for undergraduate students: A pretest–a post-test intervention study." They found an improvement in nurses' knowledge after the implementation of the education program.

One crucial aspect to consider was that most nurses after program implementation gave correct knowledge regarding phenylketonuria. This finding may be due to the empowerment program was an effective and successful method for increasing the studied nurses' knowledge, which participates in reducing malpractice regarding the management of children with phenylketonuria. This finding was supported by *Amiri, Khademian, & Nikandish, (2018)* in a study about "The effect of nurse empowerment educational program on patient safety culture: A randomized controlled trial," who stated that there were highly statistically significant differences in the level of knowledge after empowerment educational program for empowering nurses.

Nevertheless, after the empowerment program implementation, there was a highly statistically significant improvement for nurses' practice regarding the management of children with phenylketonuria. These findings also supported the second research hypothesis. This finding may be due to the empowerment program makes refreshment to nurses' knowledge, which in turn led to the improvement in their practice. In addition to the practical sessions taught during the program implementation. These results following *Babaeipour-Divshali, Amrollahimishavan, Vanaki, Abdollahi, & Firouzkouhi (2016)* in a study about "Effect of head nurse empowerment program on staff nurses' job satisfaction at two educational hospitals in Rasht, Iran," who mentioned that continuous educational training programs for nurses are required to maintain competent level of practice.

The findings of the present study proved that there was a positive correlation between total studied nurses' knowledge and their total practice after empowerment program implementation. This finding clarifies that these nurses' practice directly influenced by their knowledge and knowledge is essential to achieve competent practice. These findings also supported hypothesis number three. *Potratz (2012)*, in a study about "Transforming Care at the Bedside: A Model to Promote Staff Nurse Empowerment and Engagement" who reported that, nurses who experienced higher levels of empowerment participate in more innovative behaviors such as determine problems, generate ideas, support and implement their ideas.

The results of the present study clarified that there was no statistically significant relationship between total nurses' knowledge with their age after empowerment program implementation. These results are agreed with *Abdullah, Mohammed & Ismail, (2014)* in a study about "Nurses' knowledge and practices about the administration of medications via nasogastric tube among critically ill patients," who found that there was no significant correlation between age of nurses under the study and their knowledge. The results of the current study disagreed with *Khalaf & Said (2017)*, who stated that there was a highly statistically significant relation between total nurses' knowledge with age after program implementation.

Regarding the relation between total nurses' knowledge, total practice, and level of qualifications, the present study findings clarified that there was no statistically significant relation between studied nurses' qualifications with their total knowledge after empowerment program implementation. This finding clarifies that nurses' practices directly influenced by their knowledge and knowledge are basic to achieve best practices. Additionally, young, newly graduated nurses are more cooperative and more receptive to higher education and memorization abilities than older nurses.

These findings disagreed with *Hamed, (2009)* in a study about "Nurses performance during cardio-pulmonary resuscitation in the intensive care unit and cardiac care unit at Benha University hospital." The study reported that nurses having a Bachelor's degree, their knowledge, and practice scores were significantly better than diploma nurses because of the received basic knowledge and practice during academic years in their faculties, which is different from that received by diploma nurses. This finding also contradicted by *Khalaf & Said (2017)*, who stated that there was a highly statistically significant relationship between nurses' level of education with total knowledge and practice scores after program implementation.

Regarding the studied nurses' gender, the present study showed that there was no statistically significant relationship between the studied nurses' gender with their knowledge after empowerment program implementation. This finding may be due to that many other factors affect knowledge and practice of studied nurses, such as receiving continuous training or educational programs, availability of printed guidelines, and protocols of care. These results were consistent with *Sabaq & Said (2015); Khalaf & Said (2017)*, who found that there was no statistically significant correlation between male and female nurses with their total knowledge scores.

## 7. Conclusion

Based on the results of the present study, it can be concluded that the research hypotheses were agreed upon them. The empowerment program is a highly effective and successful method to upgrade nurses' knowledge and to enhance their practice regarding the management of children with phenylketonuria. Although, there was a statistically significant positive correlation between total

knowledge of the studied nurses and total practice after empowerment program implementation. As well as, non-statistically significant relations between knowledge of the studied nurses, their ages, qualifications, and gender after empowerment program implementation.

## 8. Recommendations

In light of the findings of the present study, the following recommendations are suggested:

- Continuous training and education programs should be provided for nurses regarding the management of children with phenylketonuria to ensure adequate knowledge and competent practice.
- Printed universal guidelines and simple handouts regarding the management of children with phenylketonuria should be available to guide the nurses' practice on each genetic unit.
- Concurrent interaction with the health care team and nurses will ensure safe practice regarding the management of children with phenylketonuria.
- Further study can be proliferated on other hospitals using a large sample size to generalize the findings.

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