Effectiveness of Structured Educational Program on Knowledge and Practice among Nurses Regarding Body Fluid Balance Assessment for Critically Ill Patients

Hala Abd El-SalamSheta[1], Manal Hamed Mahmoud[2]

1(Lecturer of Medical surgical- Nursing, Faculty of Nursing, Benha University, Egypt)
2(Assistant Professor of Medical-Surgical Nursing, Faculty of Nursing, Benha University, Egypt)
Corresponding Author: Hala Abd El-Salam Sheta

Abstract: *Assessment of fluid status and maintaining its' balance is a very important concept for critically ill patients.* **Aim of the study:** *To evaluate effectiveness of structured educational program on knowledge and practice among nurses regarding body fluid balance assessment for critically ill patients. Research design: A quasi-experimental research design was utilized in this study.* **Setting:** *The current study was conducted in intensive care unit of Benha University Hospital.* **Subjects:** *Purposive sample of 60 critical care nurses were included in this study.* **Tools of data collection:** *Two tools were used. Tool I- A structured interviewing questionnaire: consisted of 2 parts to assess: 1) Demographic characteristics of nurses staff. 2) Nurses' knowledge about body fluid balance. Tool II -Observational checklist to assess nurses' practice for assessing body fluid balance: consisted of 3 parts to assess: 1) Patients' fluid status. 2) Measuring of fluid input. 3) Measuring of fluid output.* **Results:** *Knowledge and practice levels were found to differ significantly in relation to years of experience. There was a highly statistically significant difference in nurses' practice between before and after educational program regarding to fluid balance assessment for critically ill patients. There were statistically significant relation between levels of knowledge and practice.* **Conclusion:** *Nurses' knowledge regarding to fluid balance assessment for critically ill patients showed obvious improvement and good practice after structured educational program.* **Recommendations:** *Setup a project that aims to improve nurses' performance by implementing evidence based practice. Ongoing monitoring of staff nurses' practice by head and charge nurses when caring for critically ill patients who receiving fluid therapy and provision of guidance to correct poor practices.*
Keywords: *Critically ill patients, Educational Program, Fluid balance, Nurses' Knowledge and Practice,*

I.   Introduction

Fluid balance is a term used to describe the balance of the input and output of fluids in the body to allow metabolic processes to function correctly**(Welch, 2010)**.Fluid balance plays an important role in the management of a critically ill patient who complain from serious problems that affect body function. The accurate assessment of the fluid balance data that is collected during physical assessment is an essential part of the baseline patient information that guides medical and nursing interventions aimed at achieving physiological stability in a patient and prevent complications **(Asfour, 2016) and (AbdElalem and Fouad, 2018).**

Fluid intake which indicates all fluid that enter the body through mouth in the form of oral fluid, intravenous solutions or medications, Nasogastric tube feed, and total parenteral nutrition. Fluids output means all fluids that leave from the body through urine, stool, vomiting, nasogastric tube aspiration, insensible losses, surgical wound drainage, chest drains. When the result between the fluid intake and output are equal that indicates fluid balance **(AbdElalem and Fouad, 2018)**. Evaluating and documenting patients' fluid balance is of the great importance in the understanding and management of the patients' clinical status especially critically ill patients who complain from diseases that result in accumulation of body fluid as in hypertension, tissue and peripheral edema, respiratory failure, and increased cardiac demand**(Asfour, 2016) and (AbdElalem and Fouad, 2018).**

Maintaining a balance between fluid intake and output plays an important role in the management of a critically ill patient. The accurate assessment of the fluid balance data collected during physical assessment as well as during monitoring activities and record-keeping forms an essential part of the baseline patient information. Changes in a critically ill patient's fluid balance can complicate the patient's clinical condition**(Mohammed, 2014)**

The effective management of critically ill patients requires accurate assessment of their fluid balance status. This assessment includes appropriate monitoring of fluid intake and output, as well as the accurate calculation and correct recording of this data therefore, is essential that a critical care nurse implements appropriate fluid balance monitoring, accurate calculation and correct recording to deliver safe, quality patient care **(Diacon and Bell, 2012) and (Asfour, 2016).**

Fluid overload has been linked with adverse outcomes and inaccurate monitoring and recording of the fluid balance associated with increasing mortality rate in intensive care unit. Fluid balance recording is often inadequate or inaccurate because of staff shortages, lack of training or lack of time **(Mogileeswari and Ruth, 2016) and (Payen et al., 2008).**Fluid balance monitoring is a part of the scope of nurses' practice. Therefore, nurses working in ICUs should have knowledge and skills for assessing and monitoring body fluid. Nurses are responsible and accountable for the accurate recording and calculation of fluid balance when caring for critically ill patients. Therefore, it is very important for nurses who work in intensive care unit to perform correct, appropriate assessment and monitoring of body fluid to promote patients' safety and managing patients' fluid balance is as equally important as carrying out any other patient care activity for the critically ill**(Boyd et al., 2011), (Abdullah, 2014)and (AbdElalem and Fouad, 2018).**

Significant of Study

In critically illness, homeostasis is disrupted and along with inadequate tissue perfusion potentially leads to multiple organ failure The fluid balance of a patient is essential for preserving homeostasis and to maintain optimal tissue perfusion, thus monitoring fluid balance plays an important role in the managing a critically ill patient. Current literature and best nursing practice emphasize the importance of accurate and correct fluid balance monitoring in critically ill patients including recording fluid intake and output on a purpose designed fluid balance chart **(Diacon and Bell, 2014) and (AbdElalem and Fouad, 2018).**

Aim of the study

The current study aimed to evaluate effectiveness of structured educational program on knowledge and practice among nurses regarding body fluid balance assessment for critically ill patients.

Research hypothesis:

The nurses' knowledge and practice will be improved positively after the implementation of educational program regarding body fluid balance assessment for critically ill patients.

II. Subjects and Methods

Research design:
Quasi-experimental research design was used to meet the aim of this study.

Setting:
The study was conducted at intensive care unit at Benha University Hospital.

Subjects:
Purposive sampling technique was used to select the samples. The sample comprised of sixty nurses who working in the above mentioned setting, according to the following criteria:

Inclusion criteria:
1- Nurses' qualifications (diploma or diploma with specialty and baccalaureates degree).
2- Nurses less than a year ICU experience.
3- Both male and female.
4- Nurses working at intensive care unit and have the ultimate responsibility and accountability for the patients allocated to their care in the ICU.
5- Nurses who willing to participate in the study.

Data Collection Tools:
Two tools were used to collect study data:
Tool I- A structured interviewing questionnaire, developed by the researcher after reviewing related literatures. It was based on **(Ruth & Mogileeswari, 2016) (Waqas et al., 2017),** and scientific references. And written in simple clear Arabic language consisted **of two parts as the following:**
Part (1):Demographic variables: characteristics of studied subjects to collect baseline data which consist of six items namely, age, gender, educational qualification, years of experience, marital status, and pervious participation program.

Part (2):Nurses' knowledge questionnaire: it was devoted to assess nurses' knowledge about body fluid balance. This part consisted of thirteen questions as regard definition of fluid balance, importance of body fluid, how fluid moves around the body (Fluid compartments),types of fluid, percent distribution of body fluid, causes of dehydration, signs and symptoms of dehydration, complications of dehydration, causes of over-hydration, signs and symptoms of over-hydration, complications of over-hydration, methods for measuring fluid input, methods for measuring fluid output and indications for using accurate fluid balance chart.

Knowledge scoring system: all knowledge variables were scored according to the items included in each question. A question which implies a 4 items answer would have a score of 4 and another that implies 5 items answer would have a score of 5 and so on and each item has answer with" unknown" that implies 0. The score of the items was summed – up and the total divided by the number of the items, giving a mean score for the part and means and standard deviations were computed. Total knowledge score presented in three categories as, Good >75%, average 50 – 75%, and poor <50%.

Tool II: Observational checklist to assess nurses' practice for assessing body fluid balance: this part divided into three parts;

Part (1):to assess patients' fluid status which consist of six items namely, weight, vital signs (temperature, pulse, respiration, blood pressure), abnormal breathing sound, peripheral edema, postural hypotension, laboratory findings for complete blood count, kidney function test (urea, creatinine) and electrolytes. It was based on (**Ruth and Mogileeswari 2016**)(**Vincent and Mahendiran 2015**)(**Waqaset al., 2017**).

Practice scoring system: Practices scoring were calculated as, each item scoring from 0-2.zero means the nurse not done the practice, 1 means the nurses incorrectly done the practice and 2 means the nurses correctly done the practice all items scores were summed up and the total scores of part one was ranged from (0-16). The scoring system was categorized as follow: **a)**Satisfactory nursing practice from 75% to 100% (from 12 to 16) and **b)**Unsatisfactory nursing practice less than 75% (less than 12).Practices was calculated and summarized by means and standard deviations in the results. Total practices were considered satisfactory if the score > or equals 75% and considered unsatisfactory if the score <75%.

Part (2): Measuring of fluid input which consist of eight items namely, all drinks through mouth and measured by standardized sized cups, liquid foods, intravenous fluids: (type of IV fluid, infusion rate, amount of IV fluid), blood transfusion (type, amount), all intravenous medication (IV) given as boluses, nasogastric tube feed, water, flushes/boluses, total parenteral nutrition (record the hourly rate), nursing documentation for fluid input items.

Practice scoring system: each item scoring from 0-2.zero means the nurse not done the practice, 1 means the nurses incorrectly done the practice and 2 means the nurses correctly done the practice. All items scores were summed up and the total scores of part two for fluid input were ranged from (0-18). The scoring system was categorized as follow: **a)**Satisfactory nursing practice from 75 % to 100 % (from 13.5 to 18) and **b)**Unsatisfactory nursing practice less than 75% (less than 13.5).

Part (3): measuring of fluid output which consist of nine items namely, urine, stool/stoma output, Vomiting can be estimated if unable to measure, Nasogastric (NG) tube aspiration, Perspiration/insensible losses (lung; 300, skin; 600), drainage from surgical drains, chest drains, weighing pads and nursing documentation for fluid output to estimate balance between input and output.

Practice scoring system: each item scoring from 0-2.zero means the nurse not done the practice, 1 means the nurses incorrectly done the practice and 2 means the nurses correctly done the practice. All items scores were summed up and the total scores of part three were ranged from (0-18). The scoring system was categorized as follow: **a)**Satisfactory nursing practice from 75 % to 100 % (from 13.5 to 18) and **b)**Unsatisfactory nursing practice less than 75% (less than 13.5).

Method
Ethical Consideration

Human rights must be considered by explaining the aim and benefits of the study as well as the procedure of data collection to all participants clearly. The participants' approvals were taken after informing them that their participation is optionally, and that they have the right to withdraw at any time without any consequences. Then, Verbal and written consent was obtained from each nurse enrolled into the study. The researcher assures maintaining anonymity and confidentiality of objective data.

Pilot study:
A pilot study was conducted on10% of study sample recruited to test the clarity and applicability of the tool and the   necessary modification was done prior to data collection. Nurses who participated in the pilot study were excluded from the main study sample.

Fieldwork:
- Official permissions were obtained from the administrative director of Benha University Hospital.
- Sampling and data collection were started and completed during the period from the beginning of June2018to the end of September 2018. The study was conducted through the following four phases:

Phase I: Preparatory and planning phase:
In the planning stage, approval was obtained from the administrative director of Benha University Hospital. Meeting and discussion was held between the researcher and the nursing administration to make them aware about aims and objectives of the study, as well as, to get better cooperation during the implementation phase of the study. Based on the information obtained from pilot study, in addition to the recent related literatures, the researcher designed an educational program. Its main aim was to improve knowledge and practices among nurses regarding body fluid balance assessment for critically ill patients. A simple booklet was developed for patients, and written in Arabic-language. Which covered all information related to fluid balance. It's included the following items:

Knowledge regarding body fluid balance:
●Definition of fluid balance, importance of body fluid, how fluid moves around the body (Fluid compartments),types of fluid, percent distribution of body fluid, causes of dehydration, signs and symptoms of dehydration, complications of dehydration, causes of over-hydration, signs and symptoms of over-hydration, complications of over-hydration, methods for measuring fluid input, methods for measuring fluid output and indications for using accurate fluid balance chart.

Practices regarding assessment of body fluid balance:
Patients' fluid status:
● Weight, vital signs (temperature, pulse, respiration, blood pressure), abnormal breathing sound, peripheral edema, postural hypotension, laboratory findings for complete blood count, kidney function test (urea, creatinine) and electrolytes.

Measuring of fluid input:
● All drinks through mouth and measured by standardized sized cups, liquid foods, intravenous fluids: (type of IV fluid, infusion rate, amount of IV fluid), blood transfusion (type, amount), all intravenous medication (IV) given as boluses, nasogastric tube feed, water, flushes/boluses, total parenteral nutrition (record the hourly rate), nursing documentation for fluid input items.

Measuring of fluid output:
●Urine, stool/stoma output, Vomiting can be estimated if unable to measure, Nasogastric (NG) tube aspiration, Perspiration/insensible losses (lung; 300, skin; 600), drainage from surgical drains, chest drains, weighing pads and nursing documentation for fluid output to estimate balance between input and output.

Phase II: Prior health educational program implementation (Pre-test phase):
This phase was followed by collecting baseline data, the study sample was recruited according to the set criteria. Pre- test questionnaire was administered to the study sample to examine their actual level of knowledge and practices regarding body fluid balance assessment. The researcher interviewed the nurses and took the written consent of them to be recruited in the study after explaining the aim of the study, and then distributed the questionnaire sheet after clear explaining the way to fill out. The researcher used tool 1, and tool 2 in this phase.

Phase III: Program implementation phase:
☐The researcher was available in the morning shift at the clinical field for three days / week by rotation.
☐The appointment for starting educational sessions was scheduled with the nurses according to their circumstances.
☐Then nurses were divided into six groups each group consists of 10 nurses, considering time table for their circumstances.

☐The program was conducted with three sessions;(1 session /week), the duration of each session took about 45-60 minute for each group regarding knowledge about body fluid balance assessment and demonstrate the practice related to assessment and measuring of body fluid input and output.

☐First session about (knowledge related to body fluid balance assessment and measuring was given), second session about (procedures related to body fluid balance assessment and measuring was given), third session about (the researcher provided revision with the nurses by using demonstration and re-demonstration).

☐Each educational session was guided by simple written instructions, and then orientation about objectives outline and expected outcomes was done.

☐Different teaching and learning methods were used during the sessions which included; interactive lectures, group discussion, instructional media include: data show, posters, pictures, printed handout and video programs. Which was presented in clear and concise form to be used as memorial reference.

☐ ☐The researcher offered the booklet for every nurse and showed a video for demonstration and re-demonstration.

☐Nurses were allowed to ask questions, explanation, or elaboration in case of misunderstanding.

Phase IV: Program evaluation phase
At the end of the educational program implementation evaluation was done to assess nurses' knowledge and practice about body fluid balance by using post-test assessment, by using the same data collection tools, and comparing the results of the data collected to the pretest results to evaluate the effectiveness of the educational program.

Statistical analysis
The collected data were tabulated and analyzed using Statistical Package of Social Science (SPSS) version (20). Variety of statistical methods were used to analyze the data in this study as Qualitative variables were presented as number and percentage distribution., Quantitative variables were presented as Mean and standard deviation were used to estimate the statistical significance difference. Statistical significance was considered at: P- Value > 0.05 insignificant- Value < 0.05 significant, P- Value < 0.001 highly significant.

III. Results

Table (1)illustrates that, more than half of the nurses (51.7 %) at the age between 25 -30 years old with mean age 58.49 ± 9.53; the majority of them(83.3%) were females. More than half of the nurses (53.3%) carrying technical institute. It is clear that the years of experience for (58.3%) were 5 to 10 years. As regard their marital status it was found that more than three quarters of them (76.7 %)was married. The majority of studied nurses (85%) did not participate in any previous training program.

Table (2)demonstrates that, there were highly significant differences between pre and post program implementation in relation to total mean score of nurses' knowledge regarding body fluid balance assessment for critically ill patients and nurses' knowledge was improved significantly post program implementation (P < 0.001).

Table (3) displays that, the total mean score of nurses' practices regarding to assessment of fluid status for critically ill patients' was improved significantly post program implementation (P < 0.001).

Table (4)shows that, there were highly significant differences between pre and post program implementation in relation to total mean score of nurses' practices regarding to measuring fluid input for critically ill patients' for all items of fluid input(P < 0.001).

Table (5)indicates that, there was highly statistically significant improvement in relation to total mean score of nurses' practices post program implementation regarding to measuring fluid output for critically ill patients' for all items of fluid output(P < 0.001).

Table (6)explains that, total nurses' knowledge score regarding body fluid balance assessment there was obvious improvement in the percentage of good knowledge after teaching program.

Table (7)reveals that, nurses' practices regarding body fluid balance assessment through observational checklist it revealed that percentage of satisfactory practice improved post structured educational program.

Table (8)illustrates that, there was highly statistically significant relation between total nurses' knowledge score and practices level regarding body fluid balance assessment pre and post program implementation, this means that when knowledge increased, the satisfactory nursing practice increased.

Table (1): Number and percentage distribution of socio-demographic variables among nurses under study (n=60).

Socio-demographic variables	Study group N=(60)	
	Number (N)	Percentage (%)
Age in years		
< 25	11	18.3
25-30	31	51.7
≥ 30	18	30.0
Mean ± SD	58.49±9.53	
Gender		
Male	10	16.7
Female	50	83.3
Educational qualification		
Diploma in Nursing	10	16.7
Technical Institute of Nursing	32	53.3
Bachelor in Nursing (B.Sc. degree)	17	28.3
B.Sc.Plus higher education	1	1.7
Years of experience:		
<5years	10	16.7
5 – 10 years	35	58.3
>10 years	15	25.0
Marital status		
Married	46	76.7
Single	14	23.3
Attending previous training program		
Yes	9	15.0
No	51	85.0

Table (2): Mean score of nurses' knowledge regarding body fluid balance assessment for critically ill patients pre and post implementation of educational program (n=60).

Nurses' knowledge	Study group N=(60)			
	Pre-program Mean ± SD	Post-program Mean ± SD	Paired-t test	p-value
Definition of fluid balance	0.55 ± 0.59	1.38 ± 0.74	7.13	<0.001
Importance of body fluid	0.98 ± 0.79	2.40 ± 1.39	6.61	<0.001
Fluid compartments	0.75 ± 0.70	1.77 ± 1.17	5.64	<0.001
Types of fluid	1.27 ± 1.05	3.32 ± 1.78	8.36	<0.001
Percent distribution of body fluid	0.73 ± 0.76	2.22 ± 0.98	8.87	<0.001
Causes of dehydration	0.68 ± 0.65	1.40 ± 0.83	5.02	<0.001
Signs and symptoms of dehydration	4.62 ± 2.08	11.32 ± 4.03	12.81	<0.001
Complications of dehydration	1.17 ± 0.92	2.43 ± 1.41	5.62	<0.001
Causes of over-hydration	0.43 ± 0.65	1.33 ± 0.82	6.62	<0.001
Signs and symptoms of over-hydration	4.62 ± 2.08	11.32 ± 4.03	12.81	<0.001
Complications of over-hydration	1.22 ± 0.80	2.57 ± 1.59	5.89	<0.001
Methods for measuring fluid input	0.47 ± 0.62	2.08 ± 1.03	11.82	<0.001
Methods for measuring fluid output	0.75 ± 0.70	1.77 ± 1.17	5.64	<0.001
Indications for using accurate fluid balance chart	0.65 ± 0.60	1.06 ± 1.02	5.63	<0.001
Total knowledge	18.85 ± 6.53	47.10 ± 16.09	24.01	<0.001

N.B. For all statistical tests done; P value ˃0.05 insignificant, P value P ≤ 0.05 significant, and P value ˂0.001 highly significant.

Table (3): Mean score of nurses' practices regarding to assessment of fluid status for critically ill patients pre and post program implementation (n=60).

Practices Part one: Items for nursing assessment	Study group N=(60)			
	Pre-program Mean ± SD	Post-program Mean ± SD	Paired-t test	p-value
Weight	0.75 ± 0.70	1.77 ± 1.17	5.64	<0.001
Vital signs	0.900 ± 1.07	2.95 ± 1.19	9.93	<0.001
Abnormal breathing sound	0.900 ± 0.82	2.12 ± 1.04	7.09	<0.001
Peripheral edema	1.25 ± 0.93	3.700 ± 1.51	11.64	<0.001
Postural hypotension	1.32 ± 0.99	3.38 ± 1.69	8.72	<0.001
Laboratory findings	1.12 ± 0.76	2.63 ± 1.10	8.49	<0.001
Total practice score for part one	10.75 ± 2.36	18.67 ± 1.53	27.08	<0.001

Highly statistically significant difference (P < 0.001)

Table (4): Mean score of nurses' practices regarding to measuring fluid input for critically ill patients pre and post program implementation (n=60).

Practices Part two: Items for measuring fluid input	Study group N=(60)			
	Pre-program Mean ± SD	Post-program Mean ± SD	Paired-t test	p-value
All drinks through mouth	0.65 ± 0.60	1.06 ± 1.02	5.63	<0.001
Liquid foods	0.633 ± 0.66	1.22 ± 0.88	7.87	<0.001
Intravenous fluids	1.24 ± 0.92	3.60 ± 1.69	11.64	<0.001
Blood transfusion	10.18 ± 2.23	19.03 ± 2.31	26.81	<0.001
All Intravenous medication given as boluses	1.27 ± 1.05	3.32 ± 1.78	8.36	<0.001
Nasogastric tube feed, water, flushes	7.15 ± 1.67	9.77 ± 2.93	6.07	<0.001
Total parenteral nutrition	5.40 ± 1.69	9.08 ± 0.96	14.55	<0.001
Nursing documentation for fluid input items	0.43 ± 0.65	1.33 ± 0.82	6.62	<0.001
Total practice score for part two	19.75± 7.50	49.13 ± 18.09	28.02	<0.001

Highly statistically significant difference (P < 0.001)

Table (5): Mean score of nurses' practices regarding to measuring fluid output for critically ill patientspre and post program implementation (n=60).

Practices Part three: Items for measuring fluid output	Study group N=(60)			
	Pre-program Mean ± SD	Post-program Mean ± SD	Paired-t test	p-value
Urine output	0.73 ± 0 .76	2.22 ± 0 .98	8.87	<0.001
Stool or stoma output	0.80 ± 0.72	1.12 ± 1.02	6.08	<0.001
Vomiting estimated if unable to measure	0.52 ± 0.57	1.36 ± 0.73	6.12	<0.001
Nasogastric tube aspiration	4.83 ± 0.98	9.15 ± 1.23	23.35	<0.001
Perspiration/insensible losses	0.33 ± 0.55	1.33 ± 0.72	5.52	<0.001
Drainage from surgical drains	0.76 ± 0.67	2.03 ± 1.12	5.72	<0.001
Chest drains	0.77 ± 0.79	2.72 ± 1.42	9.38	<0.001
Weighing pads or estimation of fluid on a pad	0.48 ± 0.65	1.40 ± 0.83	6.01	<0.001
Nursing documentation for all items of fluid output	0.55 ± 0.59	1.38 ± 0.74	7.13	<0.001
Total practice score for part three	8.88 ± 3.45	23.50 ± 6.08	14.63	<0.001

Highly statistically significant difference (P < 0.001)

Table (6): Number and percentage distribution of nurses' total knowledge score regarding body fluid balance assessment pre and post program implementation (n=60).

Nurses' knowledge	Pre-program N=(60)		Post-program N=(60)	
	(N)	(%)	(N)	(%)
Poor	50	83.3	5	8.3
Average	4	6.7	3	5.0
Good	6	10	52	86.7

Table (7): Number and percentage distribution of nurses' practices level regarding body fluid balance assessment pre and post program implementation (n=60).

Nurses' practices	Pre-program N=(60)		Post-program N=(60)	
	(N)	(%)	(N)	(%)
Nurses' practices related to nursing assessment:				
unsatisfactory	55	91.7	12	20
satisfactory	5	8.3	48	80
Nurses' practices related to measuring fluid input:				
unsatisfactory	58	96.7	10	16.7
satisfactory	2	3.3	50	83.3
Nurses' practices related to measuring fluid output:				
unsatisfactory	54	90	8	13.3
satisfactory	6	10	52	86.7

Table (8): Relationship between total nurses' knowledge score and practices level regarding body fluid balance assessment pre and post program implementation (n=60).

Variables	Score	Study group N=(60)		Independent t- test	p-value
		Pre-program Mean ± SD	Post-program Mean ± SD		
Total knowledge	Poor	64.48 ± 7.19	109.80 ± 3.45	40.18	<0.001
	Average	65.01 ± 4.99	111.81 ± 3.49		
	Good	68.69 ± 9.89	117.89 ± 2.69		
Total practice	unsatisfactory	64.64 ± 7.29	108.73 ± 5.27	4.04	<0.001
	satisfactory	64.10 ± 4.72	115.49 ± 3.65		

Highly statistically significant difference (P < 0.001).

IV. Discussion

A critical care unit is a highly specialized unit in which patients are admitted with life-threatening conditions in need of close observation and intensive care by highly skilled nurses to ensure accurate assessment and documentation of patient fluid intake and output char t**(Eldsouk et al., 2016)**.This discussion of the results will be presented in four sections; First section concerned with the socio-demographic variables. The second section will high light the nurses' knowledge regarding body fluid balance assessment pre and post program implementation. Third section concerned with nurses' practices regarding body fluid balance assessment pre and post program implementation. Fourth section illustrates relationship between total nurses' knowledge score and practices level regarding body fluid balance assessment pre and post program implementation

I-Socio-demographic variables of the sample:

The present study showed that, more than half of the nurses at the age between 25 -30 years old, this result were in accordance with **Abd Elalem and Fouad (2018) and Eldsouk et al.,(2016)** who reported that, a study about nurses' knowledge and practice concerning fluid and electrolyte balance among patients with congestive heart failure, they founded that the majority of nurses who working at Zagazig University Hospitals in medical and cardiac ICU units, their age were below thirty years. The result also comes in agreement with **Waqaset al.,(2017)** who mentioned that two third of nurses in post-operative cardiac surgical patients admitted in ICU were age group 23-35years.concerninggender the current study revealed that the majority of them were female. The result also comes in agree with **Waqaset al.,(2017)**who stated that research to evaluate the practices and knowledge of nurses regarding fluid and electrolyte administration in post-operative cardiac surgical patients admitted in ICU, most of nurses were female. Regarding training program, the present study revealed that, the majority of nurses had no training program. This finding is contradicted by **Ruth and Mogileeswari (2016)** whose study results revealed that less than one quarter of nurses did not receive a training course. Also, **Taxas Health Resources (2013)** mentioned that patients in ICU and CCU require complex assessment, high intensity, therapies, interventions and continuous nursing vigilance, so the nurse must be supplied with the best and newest technology, skills and experiences through the continuous training program.

II) -Nurses' knowledge regarding body fluid balance assessment pre and post program implementation:

As to nurses' knowledge regarding body fluid balance assessment for critically ill patients, the current study concluded that there were highly significant differences between pre and post program implementation in relation to total mean score of nurses' knowledge regarding body fluid balance assessment for critically ill patients and nurses' knowledge was improved significantly post program implementation this analysis was agreement with **Aslam et al., (2017) and AbdElalem and Fouad (2018)**who stated that the do not have

sufficient knowledge about regarding fluid and electrolytes administration which affect in the quality of nursing care and its impacts on patients special education programs would increase the awareness and knowledge about body fluid balance assessment among nurses. Also, this finding was in accordance with **Asfour (2016)**who reported that more than a third of nurses had inadequate knowledge related to measuring fluid input and output; education programs may have a positive effect on imparting knowledge of the nurses.

III) - Nurses' practices regarding body fluid balance assessment pre and post program implementation:

As regarding to nurses' practice related to body fluid balance assessment among nurses ,the present study revealed that total practices scores was improved significantly post program implementation. This finding was in accordance with **Eldsouk et al., (2016) and Diacon and Bell (2014)**who showed that, there was an enhancement of nurses' practices about fluid and electrolyte balance among patients with congestive heart failure after providing an education program about body fluid monitoring. Also these results agree with **Kolet al.,(2017)** who concluded that continuous in-service training program for nurses is considered very important concern that help the professional nurse to know the new in the nursing science which enhance nursing practice. Also similar to **Vincent and Mahendiran (2015)**who found that monitoring of fluid balance is inaccurate for all wards that lead to a negative effect on the safety of patients. This problem can be overcome by increasing awareness and education about the importance of maintaining fluid equilibrium.

IV)- Relationship between total nurses' knowledge score and practices level regarding body fluid balance assessment pre and post program implementation:

The present study showed that, there was highly statistically significant relation between total nurses' knowledge score and practices level regarding body fluid balance assessment pre and post program implementation, this means that when knowledge increased, the competent nursing practice increased. This is confirmed with **AbdElalem and Fouad (2018)**who emphasized on that there was statistically significant relation between nurses' knowledge score and level of practice regarding body fluid balance assessment post intervention. Also in the same line with **Aslam et al., (2017) and Chaghari et al., (2004)** who illustrated that empowering education is a model designed for in-service training for nurses that advisable to match the training programs according to educational needs related to practical skills for nursing staff. The empowering education assisted nurses for completing the professional tasks competently and correctly. Also, **James (2003)**stated that every practicing nurse needs to acquire theoretical and technical information which is necessary to develop her skills in clinical practice. Technical skills cannot be separated from intellectual and interpersonal skills. Intellectual skills related to technical skills include the nurses' knowledge of the principles and steps of the procedure.

V. Conclusion

The current study concluded that, implementation of health education program has a positive effect on improvement of the nurses' knowledge and practices level regarding body fluid balance assessment post program implementation compared to preprogram implementation. These results justified the research hypothesis.

VI. Recommendations

This study recommended that emphasize the importance of a continuous in-service educational program regarding body fluid balance assessment for nurses working or dealing with critically ill patients. Further study with replication of the current study on a larger probability sample is recommended to achieve generalization of the results and wider utilization of the designed educational program.

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