# Knowledge and perception of nurses regarding fluid and electrolyte balance in intensive care units

**Hanaa Ibrahim El Sayed**
Associate Professor of Pediatric Nursing, Ibn Sina National College, Saudi Arabia

**Azza Anwar Aly\***
 Associate Professor of Medical Surgical Nursing, Ibn Sina National College, Saudi Arabia

**Amira Mahmoud**
Lecturer of Nursing Management, Ibn Sina National College, Saudi Arabia

**Linie Arcipal\***
Clinical instructor of Obstetric Nursing, Ibn Sina National College, Saudi Arabia

***Abstract***---Background: Fluid balancing activities must be accurately monitored as part of the patient's baseline information, which informs medical and nursing interventions to attain physiological stability. Therefore, the aim of this study was to explore nurses' knowledge and perception of maintaining fluid and electrolyte balance. Methods: Descriptive design was used to conduct this study. Settings: This study was conducted at Maternity and Children Hospital, Makkah City, Saudi Arabia. Sample: A convenient sample of 66 nurses was represented in this study. The data were collected through a structured interview online questionnaire to assess nurses' knowledge and perception of maintaining fluid and electrolyte balance. Results: The findings revealed that all studied nurses were female (100%) and more than half of the studied sample was Saudi Arabian (56.1%). More than half of the studied sample had correct knowledge about the average urine output, the required amount of fluid intake per day, and normal measurement of CVP (60.6%, 59.1%, and 53.0% respectively). The majority of studied nurses reported that time management, workload, lack of skills, training, and lack of communication with other healthcare workers are affecting fluid balance monitoring. In conclusion: The findings of the study clearly revealed the need for a teaching program to enhance the knowledge and perception of maintaining fluid and electrolyte balance. Recommendation: Ongoing in-service education programs must be designed and implemented in

Intensive Care Units to improve nurses' knowledge and perception regarding fluid and electrolyte balance.

***Keywords***---fluid balance, knowledge, perception, nurses.

## Introduction

Fluid balance is a term used to entitle the balance of the input and output of fluids within the body to permit metabolic processes to function correctly, around 52% of total body weight in females and 60% in males is fluid (Welch, 2011). Homeostasis is dependent on fluid and electrolyte balance, and critical care nurses play a significant role in recognizing and treating physiologic stressors that disrupt homeostasis in critically ill patients (Hassan et al., 2021 & Porth, 2011). Fluids regulate body temperature, transfer nutrients and gases throughout the body, and transport waste materials from cells to excretion sites. There are six basic electrolytes: sodium, potassium, calcium, chloride, phosphorus, and magnesium (Hinckle et al., 2022).

Electrolytes are a key component of body fluids that help maintain chemical balance. Fluid and electrolyte balance is a dynamic process that is necessary for survival and equilibrium. (Hinckle and Cheever, 2022). The intracellular space and the extracellular space are the two- fluid compartments in the human body (Asfour, 2016). Electrolytes are active molecules or cations that have positive charges and anions that have negative charges that are found in body fluids. Sodium, potassium, calcium, magnesium, and hydrogen ions are the most common cations found in bodily fluids. Chloride, bicarbonate, sulfate, and proteinate ions are the most common anions (Hinckle et al., 2022).

Fluid and electrolyte levels in critically ill individuals can be affected by a variety of causes. The main cause of this imbalance is the disease process in critically ill patients. Nurses' practice errors, such as improper hydration and electrolyte administration and drug administration errors are other contributing causes (Lee, 2010). These factors are interfering with the absorption of electrolytes and have a negative impact on the function of body organs that are responsible for maintaining fluid and electrolyte balance (Porth, 2011). In Intensive Care Units (ICUs), fluid and electrolyte abnormalities are the most commonly reported issues (Leilah et al., 2019). These abnormalities have been linked to a higher rate of morbidity and mortality in critically ill individuals. Early detection and treatment of fluid and electrolyte imbalances can improve patient outcomes; reduce the length of time spent in critical care, and lower healthcare costs (Buckley, 2012).

Overall, electrolyte problems can present in a variety of ways in ICU patients, and they may be linked to a number of acute or chronic illness conditions (Buckley, 2012). The rate of variability in serum concentration, as well as the magnitude of change, may be related to the severity of clinical signs and symptoms of electrolyte imbalances (Lee, 2010). Symptoms for any specific electrolyte problem vary significantly, ranging from asymptomatic to life-threatening complications (Hassan et al., 2021). Electrolyte imbalances in ICU patients might present with a variety of clinical signs and symptoms (e.g., nausea, vomiting, and muscle

weakness). Despite this, medicines are frequently identified as a possible cause of electrolyte abnormalities and symptoms in patients (Abd Elalem and Fouad, 2018).

The management of acute electrolyte disorders in the ICU requires discontinuation of the suspected or known agents causing or contributing to the abnormality (McLfferty et al., 2011). Alternative medications should be considered in patients who require acute management or long-term drug therapy for their disease state (Buckley, 2012). Supportive measures are often required for patients who present symptoms and revolve around the specific clinical manifestations. Management also includes close monitoring of the patient's symptoms, as well as laboratory data for drug-induced electrolyte disorders (Abd Elalem and Fouad, 2018).

Increased awareness of the drugs associated with each condition can help prevent electrolyte abnormalities (Herbert and Elsayed, 2016). Unfortunately, ICU patients may be more susceptible to certain electrolyte imbalances (e.g., patients with chronic kidney disease might be treated with several medications associated with hyperkaliemia) (Buckley, 2012). In ICU patients, increased monitoring of specific intravenous fluids and nutrition requirements is critical for reducing or eliminating the danger of electrolyte abnormalities (Besen et al., 2015). To avoid clinical consequences, critically sick patients with non-drug and drug-induced electrolyte imbalances should be regularly monitored (Abd Elalem and Fouad, 2018).

Fluid balance monitoring is a part of the scope of nurses' practice (Vijayan, 2011). The incorrect calculation of fluid balance means that every patient management decision was influenced by inaccurate fluid balance information (Joseph, 2019 & Buckley, et al., 2010). Therefore, nurses working in ICUs are responsible and accountable for the accurate recording and calculation of fluid balance when caring for critically ill patients (Asfour, 2016). Nurses play a vital role in caring for ill patients through assessment and careful maintenance of fluid and electrolyte balance in patients (Elliot and Coventry, 2013). They are in a position to continually monitor and early detect any changes in a patient's condition that require prompt management, such as fluid and electrolyte imbalances (Hassan et al., 2021). They should also have critical thinking and advanced problem-solving skills, and practice-based upon evidence based research in order to provide high-quality patient care that is described as the process for attainment of the highest degree of excellence in the delivery of patient care (Aslam et al., 2017).

Nursing standard is the level of performance and practice that is accepted or expected from nurses. It is a useful tool to promote nurses' practice and ensure high quality of care (Hassan et al., 2021). It offers a base for measuring the quality of care delivered to achieve quality assurance in nursing are concerned with developing procedures, policies, and rules that promote health care services (Bennett, 2010). Therefore, the study aim of the current study was to explore nurses' knowledge and perception of maintaining fluid and electrolyte balance at Maternity and Children Hospital, Makkah City.

**Aim of the study**

This study aims to explore nurse's knowledge and perception of maintaining fluid and electrolyte balance at Maternity and Children Hospital, Makkah City.

**Objectives**

- To determine the knowledge regarding fluid and electrolyte balance among nurses at Maternity and Children Hospital, Makkah City.
- To identify nurses' perception of fluid and electrolyte balance.
- To identify factors affecting fluid balance monitoring.

**Research questions**

- What is the level of critical care nurses' knowledge regarding fluid balance monitoring?
- What are the nurse's perceptions regarding fluid balance monitoring?
- What are the factors affecting fluid balance monitoring?

**Material and Method**

**Design**

Cross-sectional study was utilized for this study.

**Setting**

This study was conducted at Maternity and Children Hospital, Makka City, Saudi Arabia.

**Sampling**

Convenient sample of 66 nurses will be included during the period from February to March 2021. The sample size was selected based on a total number of 147 nurses using the online sample size calculator for a cross-sectional study with a 5% confidence interval and 95% confidence level.

**Inclusion criteria**

- Nurses' qualifications (diploma or Technical nursing institute and baccalaureates degree)
- All nurses who will be on duty at the time of interview at Maternity and Children Hospital.

**Exclusion criteria**

Nurses who didn't complete the questionnaire sheet

## Tool

A structured interviewing questionnaire, developed by the researchers after reviewing related literature. It was based on Bhagwanjee and Scribante (2007) and scientific references and written in a simple clear language consisting of four parts as the following**:**

- **Part 1:** Biosocial data includes 6 questions related to age, sex, educational level, nationality, years of experience, and attendance of training programs about fluid and electrolyte balance.
- **Part 2:** Nurses' knowledge regarding fluid balance monitoring involves 10 questions. Each question had two levels of responses as the correct answer was given a score of one and the incorrect answer was given a score of zero.
- **Part 3:** Nurses' perception regarding fluid balance monitoring was contained 10 questions divided into three sections:
  **Section 1:** Importance of fluid balance monitoring
  **Section 2:** Fluid balance monitoring questionnaire sheet
  **Section 3:** Fluid balance calculation
  **The scoring system** for section 1 & 2 depend on 5-point Likert scale ranging from (strongly disagree=1), 2 (disagree=2), (uncertain=3), (agree=4) to (strongly agree=5). The possible score range was 1 to 50.
- **Part 4:** Factors affecting fluid balance monitoring as perceived by nurses. The Scoring system: If the factor is affecting fluid balance monitoring, the response is yes and no is the response when the factor is not influencing fluid balance monitoring.

## Ethical considerations

Local permission from IRRB and a local acceptance letter from Vice Dean were obtained. Also, permission to carry out the study from responsible authorities at the hospital after an explanation of the purpose of the study was obtained; they were assured that participation in the study is voluntary. Informed consent was obtained from those who accepted to take part in the study. The confidentiality of collected data was maintained. Data was safely stored in a cabinet and no one can get access to the data except the investigators.

## Statistical analysis

The data was analyzed using SPSS version 22 software. The categorized variables were presented as numbers and percentages. Individual, as well as total Scoring was calculated**.**

**Results**

Table 1
Distribution of nurses according to their socio -demographic characteristics

| Items | No | % |
|---|---|---|
| Age | | |
| 20 -< | 10 | 15.2 |
| 25 -< | 22 | 33.3 |
| 30 < | 6 | 9.1 |
| 35 < | 22 | 33.3 |
| ≥ 40 | 6 | 9.1 |
| Sex | | |
| Male | 0 | 0.0 |
| Female | 66 | 100 |
| Nationality | | |
| Saudi | 37 | 56.1 |
| Non-Saudi | 29 | 43.9 |
| | | |
| Previous training program | | |
| Yes | 28 | 42.4 |
| No | 38 | 57.6 |

Table 1 showed distribution of the studied nurses according to their socio -demographic characteristics, it was revealed that all the studied nurses were female (100%) and more than half of studied sample were Saudi Arabian (56.1%) and more than half of studied sample (57.6%) did not participate in any previous training program.
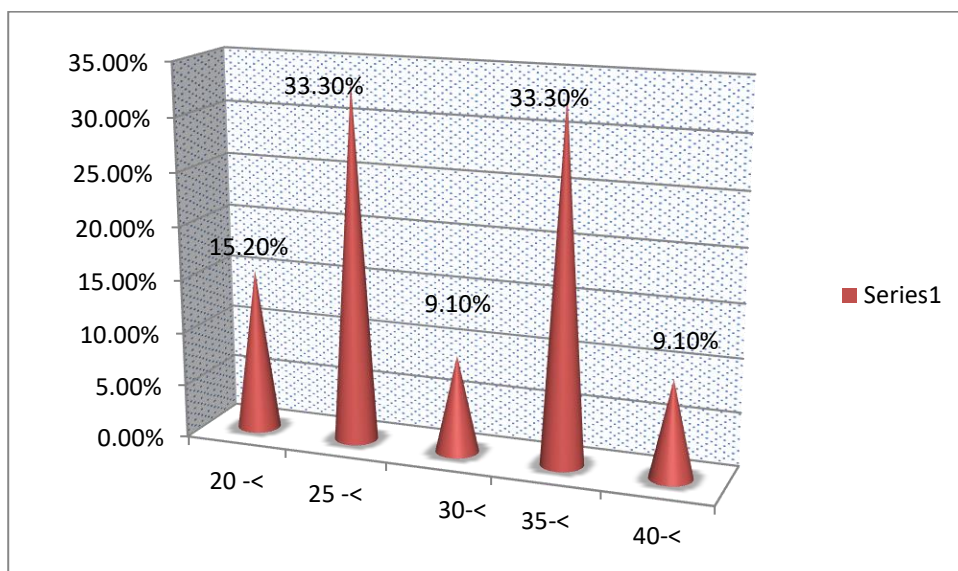


Figure 1.  Distribution of the studied nurses according to their age

Figure (1): Distribution of the studied nurses according to their age, approximately one- thirds of the studied sample aged between 25-30 years old and 35-40 years old.
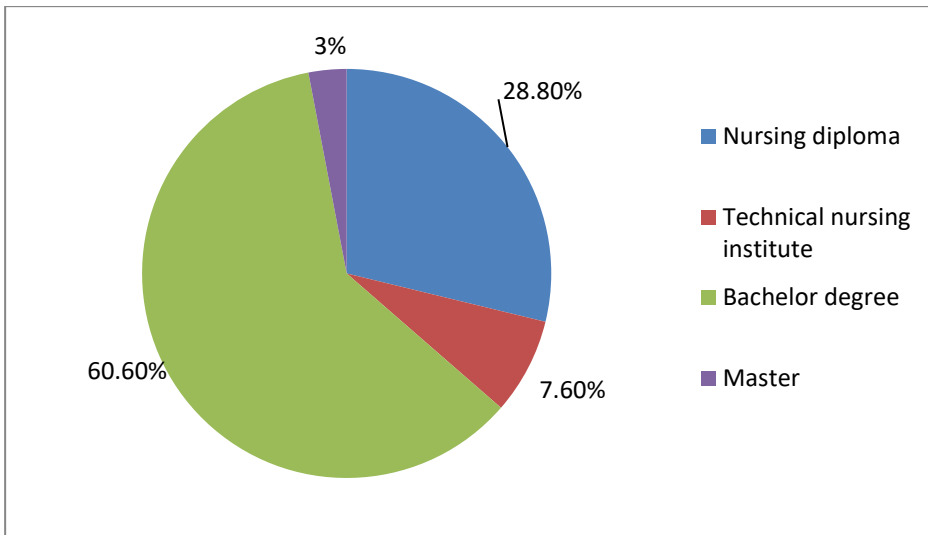


Figure 2. Distribution of the studied nurses according to their educational level

Figure (2) showed the distribution of the studied nurses according to their educational level, more than half of studied sample is a bachelor's degree (60.60%) and less than one-third of studied sample had a nursing diploma (28.80%).
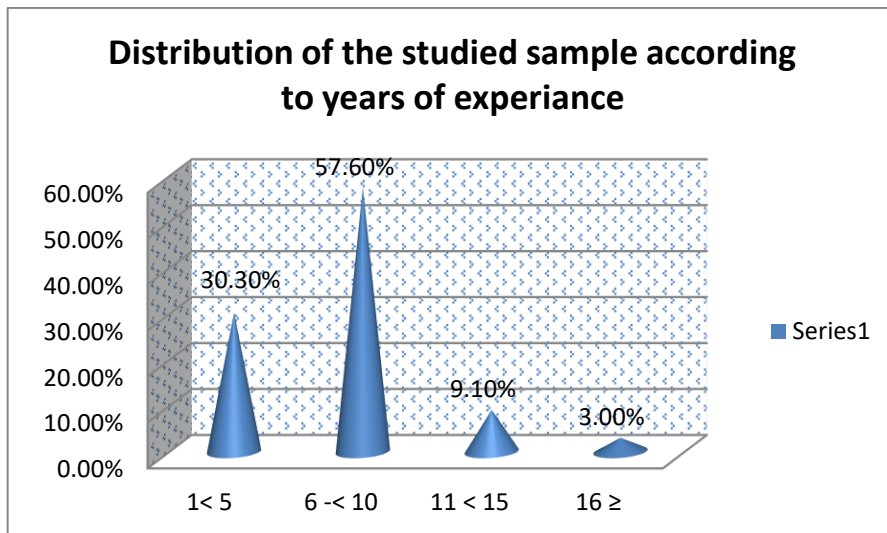


Figure 3. Distribution of the studied nurses according to their years of experience

Figure 3 showed distribution of the studied nurses according to their years of experience, it was illustrated that more than half of the study group had six to ten years of experience and minority of them more than 16 years old (3.00%).

Table 2
Nurses' knowledge regarding fluid balance monitoring

| Knowledge Items | N | % |
|---|---|---|
| The average amount of children's urine output | | |
| - Correct | 40 | 60.6 |
| - Wrong | 26 | 40 |
| The required amount of fluid intake for children per day (on average) | 39 | 59.1 |
| - Correct | 27 | 40.9 |
| - Wrong | | |
| Type of vital signs is affected by fluid imbalance | | |
| - Correct | 44 | 66.7 |
| - Wrong | 22 | 33.3 |
| Clinical signs associated with hypervolemia | | |
| - Correct | 54 | 81.8 |
| - Wrong | 12 | 18.2 |
| Nurses action for patients with Hypovolemia | | |
| - Correct | 44 | 66.7 |
| - Wrong | 22 | 33.3 |
| Nurses action for patients with hypervolemia | | |
| - Correct | 51 | 77.3 |
| - Wrong | 15 | 22.7 |
| List types of intravenous solutions for hypovolemia | | |
| - Correct | 50 | 75.8 |
| - Wrong | 16 | 24.2 |
| Normal measurement for CVP in children | | |
| - Correct | 35 | 53.0 |
| - Wrong | 31 | 47 |
| Effective method of assessment of hemodynamic status | | |
| - Correct | 48 | 72.7 |
| - Wrong | 18 | 27.3 |

Table 2 showed nurses' knowledge regarding fluid balance monitoring. It was illustrated that more than half of studied sample had correct knowledge about average amount of urine output, the required amount of fluid intake per day and normal measurement for CVP (60.6%, 59.1% and 53.0% respectively). While, the majority of studied sample had correct information about clinical signs of hypervolemia, nurses' action for patients with hypervolemia, types of intravenous solutions for hypovolemia, and effective method of assessment of hemodynamic status (81.8%, 77.3%, 75.8% and 72.7% respectively).

Table 3
Nurses' perception regarding fluid balance monitoring

| Items of nurses perception | Strongly disagree | | Disagree | | Uncertain | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % | NO | % | NO | % |
| Recording the intake and output is important as recording patient care activities | 4 | 6.1% | 12 | 18.2% | 4 | 6.1% | 34 | 51.5% | 12 | 18.2% |
| Fluid assessment is important to guide nursing care in critically ill patients | 12 | 18.2% | 3 | 4.5% | 2 | 3.0% | 37 | 56.1% | 12 | 18.2% |
| Inaccurate fluid calculation is risk for the critically ill patient | 9 | 13.6% | 7 | 10.6% | 4 | 6.1% | 38 | 57.6% | 8 | 12.1% |
| Fluid balance monitoring is a responsibility of nurses | 12 | 18.2% | 16 | 24.2% | 12 | 18.2% | 22 | 33.3% | 16 | 24.2% |
| The nurse is the only person responsible for fluid calculation | 4 | 6.1% | 16 | 24.2% | 11 | 16.7% | 21 | 31.8% | 14 | 21.2% |

Table 3: showed nurses' perception regarding fluid balance monitoring, it was clarified that more than half of studied sample agreed that recording the intake and output is important as recording patient care activities, fluid assessment is an important to guide nursing care in critically ill patients and inaccurate fluid calculation is risk for the critically ill patient (51.5 %, 56.1%. and 57.6% respectively). Approximately one third of studied sample agreed that fluid balance monitoring is a responsibility of nurses (33.3%) and the nurse is the only person responsible for fluid calculation (31.8%).

Table 4
Fluid balance monitoring sheet

| Items | strongly disagree | | disagree | | uncertain | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % | NO | % | NO | % |
| Nurses are satisfied with the design of the fluid balance chart sheet | 12 | 18.2% | 16 | 24.2% | 22 | 33.3% | 16 | 24.2% | 12 | 18.2% |
| The space to write the fluid numbers on the chart is adequate | 4 | 6.1% | 12 | 18.2% | 8 | 12.1% | 26 | 39.4% | 16 | 24.2% |
| Fluid balance information is recorded in too many different places on patient record | 4 | 6.1% | 16 | 24.2% | 11 | 16.7% | 21 | 31.8% | 14 | 21.2% |

As regards fluid balance monitoring sheet, it was clarified that less one third of studied nurses were uncertain with it (33.3%). While, more than one third of nurses were agreed that the space to write the fluid numbers on the chart is adequate (39.4%). and 31.8% of nurses agreed that fluid balance information is recorded in too many different places on patient record.

Table 5
Fluid balance calculation

| Items | NO | % |
|---|---|---|
| Nurses may be responsible for more than one patient, so it is difficult to monitor all patients regarding the fluid balance. | 58 | 87.9 |
| - Yes | 8 | 12.1 |
| - No | | |
| The 24-hour fluid balance is correctly calculated and documented in the same time every day | 62 | 93.9 |
| - Yes | 4 | 6.1 |
| - No | | |

Table 4: shows Fluid balance calculation, it was illustrated that the majority of nurses reported that they are responsible for more than one patient, so it is difficult to monitor all patients regarding the fluid balance and the 24-hour fluid balance is correctly calculated and documented in the same time every day (87.9% and 93.9% respectively).
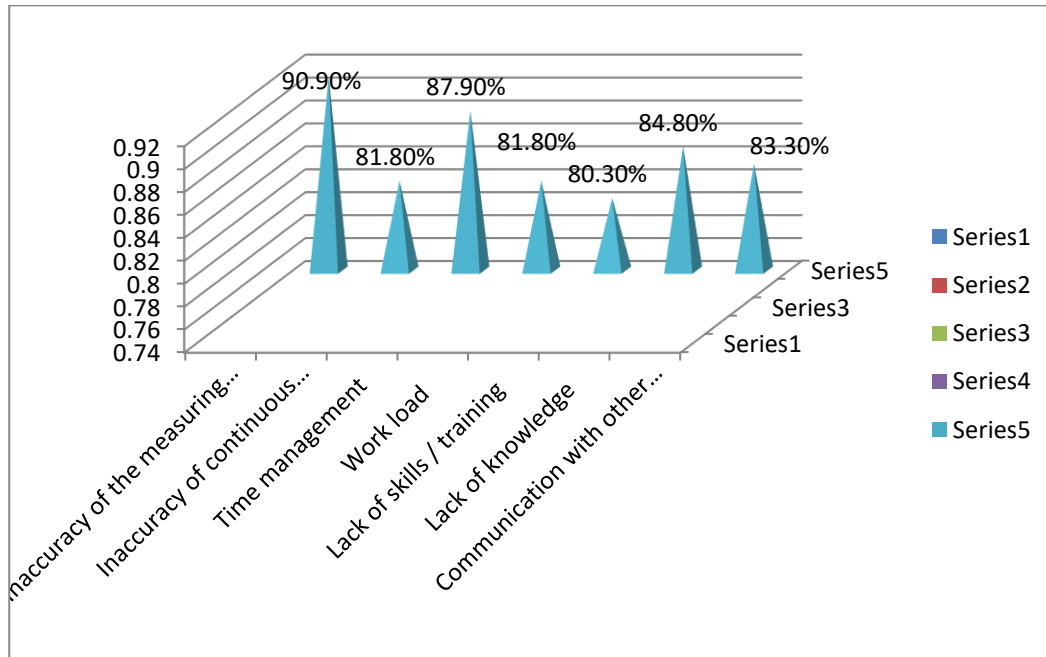


Figure 4. Factors affecting fluid balance monitoring as perceived by nurses

Figure 4 showed factors affecting fluid balance monitoring as perceived by nurses, it was illustrated that the majority of studied nurses reported that inaccuracy of

the measuring equipment & intravenous infusions, time management, workload, lack of skills/ training, lack of knowledge (84.8%), and communication with other health-care workers (90.9%, 87.9%, 81.8%, 80.3%, and 83.3% respectively) are affecting fluid balance monitoring.

**Discussion**

Maintaining an accurate balance of fluid in the body is crucial to health. Nurses play an important role in assessing and monitoring fluid balance. The findings of the present study revealed that all the studied nurses were female (100%). These findings agreed with Culleiton,   and Simko, (2011) who stated that all study samples (100%) were females. These results may be explained that nursing is a universal feminine profession in society culture.   More than half of the studied sample is Saudi Arabian (56.1%). More than half of the study group had six to ten years of experience. These results were inconsistent with Abd Elalem and Fouad, (2018) who found that (77.5%) of nurses have less than five years of experience while only 22.5% of the studied sample from 5-10 years of experience. Also, it was contradicting Hinckle and Cheever, (2022) who stated that (36.54%) have 1-5 years of experience in critical care units and (37.02%) have 6-10 years of experience.

The current study showed that, more than half of the studied sample (57.6%) did not participate in any previous training program. These study findings agreed with Porth, (2011) who illustrated that sixty percent of critical care nurses, had no previous workshop attendance.  Also, results were validated by Vijayan, (2011) who concluded that the majority of studied nurses (85%) did not participate in any previous training program. This illustrated that in-service training programs for nurses are a very important concern that helps nurses to be updated by a nursing science that enhances nursing practice. Regarding the distribution of the studied nurses according to their age, approximately one-third of the studied sample was aged between 25-30 years old and 35-40 years old (33.3%). This was contradicted by Hassan et al., (2021) who mentioned that more than half of the studied sample from nurses between the age of 25 - 35 years old (67.1%), and only (6.3%) of the sample ' age was more than 35 years. Distribution of the studied nurses according to their educational level, more than half of the studied sample are bachelor's degrees (60.60%) and less than one-third of the studied sample had nursing diplomas (28.80%). This result was in line with Culleiton and Simko, (2011) they found that most of the participants (98.2%) held a baccalaureate degree in nursing. Otherwise; this was contradicted by Vijayan, (2011) who mentioned that half of the study sample graduated from a technical institute.

Concerning nurses' knowledge regarding fluid balance monitoring, it was illustrated that more than half of the studied sample had correct knowledge about the average amount of urine output, the required amount of fluid intake per day, and normal measurement for CVP (60.6%, 59.1%, and 53.0% respectively). This was similar to Pegram and Bloomfield (2015) who illustrated that the mean score of nurse knowledge was less than half of the satisfactory knowledge scores therefore, Hassan et al., (2021) recommended  In-service education should be conducted for all nurses in the ICUS regarding assessment and monitoring of

fluid balance. While the majority of studied sample have corrected information about clinical signs associated with hypervolemia, nurses' actions for patients with hypervolemia, List types of intravenous solutions for Hypovolemia, and Effective method of assessment of hemodynamic status (81.8%, 77.3%, 75.8%, and 72.7% respectively). The results of the current study may be attributed to the administration of continuous intravenous infusions. This was in line with the study done by Bhagwanjee and Scribante, (2007) who revealed that the level of nurses' knowledge regarding fluid balance monitoring in ICUs was moderately adequate. Therefore, the Nursing and Midwifery Council (NMC) has issued clear guidance on the importance of record-keeping and states that:' Nurses are required to have the knowledge and competence to care for patients, which includes understanding the indications for and importance of fluid balance charts. Fluid management should be accorded the same status as a drug prescription (McGloin, 2015).

The majority of the studied sample has corrected information about clinical signs associated with hypervolemia, nurses' actions for patients with hypervolemia, List types of intravenous solutions for Hypovolemia, and effective method of assessment of hemodynamic status (81.8%, 77.3%, 75.8%, and 72.7% respectively). This was inconsistent with Kanakalakshmi, (2014) who found that 15% of nurses have adequate knowledge, 62% have moderately adequate knowledge and 23% have inadequate knowledge. Therefore, enhancing nurses with educational programs will improve their knowledge. This was consistent with Scales and Pilsworth (2008) who reported that nurses should be equipped with theoretical and practical knowledge about fluid balance monitoring to promote patient safety. Respectively was similar to Mogileeswari & Ruth, (2016) who conducted a study to assess nurses" knowledge and practice regarding fluid therapy

Concerning nurses' perception toward fluid balance monitoring, it was clarified that more than half of the studied sample agreed that recording the intake and output is important as recording patient care activities, fluid assessment is important to guide nursing care in critically ill patients and inaccurate fluid calculation is the risk for the critically ill patient (51.5 %, 56.1%. and 57.6% respectively). This was clarified by Asfour, (2016) who reported that there was a discrepancy between fluids ordered and fluids recorded as administered. This clarified the need for knowledge for conserving fluid and electrolyte balance and maintaining tissue perfusion. In the same line Malekzadeh et al., (2013) and Vijayan, (2011) have pointed out that fluid balance plays an essential role in nursing management, as preserving homeostasis is crucial to maintaining optimal tissue perfusion.

Approximately one-third of the studied sample agreed that fluid balance monitoring is a responsibility of nurses (33.3%) and the nurse is the only person responsible for fluid calculation (31.8%). This was consistent with Hassan et al., (2021) who reported that almost all nurses performed unsatisfactorily regarding monitoring and managing fluid and electrolyte abnormalities. The result of the pre-test might be related to the main cause of inaccurate fluid balance monitoring was a shortage of nursing staff and workload in ICU. Therefore, Reid, (2004) stated that critical care nurses should be able to diagnose and respond to fluid

balance irregularities. Therefore, Mogileeswari and Ruth, (2016) recommended educational programs about fluid prescribing guidelines in the ICU.

As regards the fluid balance monitoring sheet, it was clarified that less than one-third of the studied nurses were uncertain about it (33.3%). While more than one-third of nurses agreed that the space to write the fluid numbers on the chart is adequate (39.4%), 31.8% of nurses were agreed that fluid balance information is recorded in too many different places on patient records. This clarifies the need for conducting training programs and frequent nursing assessments. This was in line with Lee, (2010) who recommended that the fluid balance chart should be assessed and updated regularly and designed for each intensive care unit individually. In addition, Bennett, (2010) emphasized the importance of improving nurses'" knowledge in the enhancement of fluid balance monitoring practice. This highlighted the need for continuing education programs for critical care nurses on preserving fluid and electrolyte balance. This was similar to Hunt and Sendell, (1987).

Regarding fluid balance calculation, it was illustrated that the majority of nurses reported that they are responsible for more than one patient, and the 24-hour fluid balance is correctly calculated and documented at the same time every day (87.9% and 93.9% respectively). This indicated that frequent assessment and observation can enhance nurses' practice. This was in line with Lee, (2010) and Vincent & Mahendiran, (2015) emphasized the importance of improving nurses' knowledge in the enhancement of fluid balance monitoring practice. Regarding the factors affecting fluid balance monitoring, the majority of studied nurses reported that inaccuracy of the measuring equipment & intravenous infusions, time management, workload, lack of skills/ training, lack of knowledge (84.8%), and communication with other healthcare workers (90.9%,87.9%, 81.8%, 80.3%, and 83.3% respectively) are affecting fluid balance monitoring.  The results of this study are similar to Dicon, and Bell (2014) who reported that shortage of nursing staff, a deficit in knowledge, and a heavy workload are factors affecting fluid balance monitoring.

**Conclusion**

In the light of the present study, it was concluded that less than two-thirds of the studied sample had correct knowledge related to the average amount of urine output, fluid intake per day and normal measurement for CVP (60.6%, 59.1%, and 53.0% respectively). Meanwhile, the majority of studied sample have corrected information about clinical signs associated with hypervolemia, and nurses' actions for patients with hypervolemia (81.8% and 77.3% respectively). The majority of studied nurses reported that inaccuracy of the measuring equipment, time management, and workload is affecting fluid balance monitoring (90.9%, 87.9%, and 81.8% respectively).

**Recommendations**

Based on the results of this study the following recommendations are suggested: Educational interventions should be implemented for all nurses to improve their knowledge about fluid balance monitoring.

- Updating knowledge and performance of ICU nurses and newly joined ICU nurses about fluid balance monitoring
- Continuing in-service educational programs and emphasizing evidence-based practices regarding fluid balance monitoring
- Simple documents to provide information for nurses about the unit and treatments
- Seminars should be focused on the issues that need improvement for nurses' awareness of sepsis

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