Effect of Vitamin D Supplementation Guideline on Nurses' Care and Associated Outcomes for Preterm Neonates with Respiratory Distress Syndrome

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Abstract

One of the major challenges for neonatal care is prematurity and related problems, particularly respiratory distress syndrome (RDS). There is a link between lung development and vitamin D has been shown in numerous studies. **The aim of the study was**: To evaluate the effects of vitamin D supplementation guidelines on nurses' care and associated outcomes for preterm neonates with respiratory distress syndrome. **Subjects and Methods: Design**: A quasi-experimental research design was used to achieve the study's aim. **Setting**: The study was conducted at the neonatal intensive care unit (NICU) affiliated to Sohag University Hospital. **Sample**: The study included a convenience sample of (50) nurses working in the previously mentioned study setting with a purposive sample included 50 preterm neonates chosen from the previously mentioned setting with respiratory distress syndrome receiving traditional therapy plus vitamin D 400 IU/day. **Tools**: Tool (1) A structured interviewing schedule; Tool (II): an Observation Checklist to assess the nurses' practice regarding their care provided for the neonates with respiratory distress syndrome; Tool (III): Preterm neonatal assessment sheet. **Results**: The majority of nurses had average knowledge after the implementation of the instructional guidelines. Also, preterm neonates supplemented with vitamin D had a significant improvement in all pulmonary function parameters, lower Downs score, and fewer hospital stays. **Conclusion**: Vitamin D supplementation guidelines have positive effects on improving nurses' knowledge and practices regarding respiratory distress syndrome and Vitamin D supplementation. Also, improved associated outcomes for preterm neonates with respiratory distress syndrome such as decreases in the severity, rate of complications, and duration of hospital stay in the preterm neonates with respiratory distress syndrome who received vitamin D/Day post-guidelines implementation compared to pre-guidelines implementation. **Recommendations**: Provide nurses with well-planned instructional guidelines to improve their knowledge and practices regarding Vitamin D supplementation. Vitamin D should be supplemented to preterm neonates with respiratory distress syndrome

Keywords: Guidelines**,** Nurses' care, Preterm neonates, Respiratory distress syndrome, Vitamin D

Introduction:

The main risk factor for neonatal RDS is premature birth. The primary cause of perinatal death and disability worldwide is preterm birth, which continues to be a significant public health issue on a global scale. In addition to respiratory distress syndrome (RDS), intraventricular hemorrhage, necrotizing enterocolitis, bronchopulmonary dysplasia, sepsis, persisting ductus arteriosus, and retinopathy, preterm newborns can also experience other issues. In 2019, Gupta and Tin. Infection, hyperbilirubinemia, and other conditions can still affect late-preterm infants whose gestational ages are between 34 and 36 weeks. Feeding issues are more prevalent in preterm babies. According to reports, term newborns had a 2.3% death rate and 11 times as many cases of respiratory distress syndrome (RDS). (**Kalyoncu et al., 2018)**.

During the first few days following delivery, respiratory failure is most frequently caused by respiratory distress syndrome (RDS). Other variables, including maternal diabetes, cesarean birth without prior labor, fetal hypoxia, and having second twins, can also contribute to the development of RDS in addition to preterm (Misra et al., 2018). Hyaline membrane disease was previously known as respiratory distress syndrome (RDS). Due to the link between lung immaturity and the most frequent cause of

respiratory distress in premature newborns, insufficient pulmonary surfactant production. Because of the lack of surfactants, there is an increase in surface tension at the air-liquid interface of the terminal respiratory units, which leads to atelectasis, an increase in ventilation-perfusion mismatch, and the possibility of lung injury because of a strong inflammatory response (**Martin &Fanaroff, 2019**).

The final unfolding of the alveolar septa, which increases the lung surface area, contributes to the anatomical and functional immaturity of the lungs that causes respiratory distress syndrome in newborns. Neonates are born with multiple undeveloped and numerous uninflatable alveoli, even though it happens during the last trimester of pregnancy (McCance & Huether, 2019). Early respiratory distress, including cyanosis, tachypnea, intercostal, subcostal, and sternal recession, expiratory grunting, and reduced breath sound, characterizes RDS clinically. Consequently, any delay in the detection of airway anomalies could be fatal (**American Lung Association, 2021).**

Although respiratory distress syndrome is predominantly thought to affect preterm neonates, it can also affect babies who were delivered close to or at term. Any newborn with early respiratory distress should have it on the list of possible diagnoses. Rarely, genetic disorders such as surfactant protein B or ABCA3 deficiency can affect newborns with RDS. So, according to Hamvas et al. (2017), surfactant therapy is regarded as one of the key components of management. Numerous variables, such as having a sibling with RDS, women with diabetes, cesarean or induction of labor, delivery issues that limit blood flow to the newborn, and numerous pregnancies, might increase the risk of RDS (**Negi et al., 2018**). Since Egypt has a prevalence rate of 11,193 for newborn respiratory distress syndrome. However, newborns born before 37 weeks account for the majority of RDS instances. Additionally, the risk of RDS increases with decreasing gestational age, with the highest risk being associated with babies born before 30 weeks of gestation (**Wambach JA, & Hamvas, 2017).**

The main functions of vitamin D, a steroid hormone, are the maintenance and control of calcium levels in the body as well as the formation of a strong skeleton (Jolliffe et al., 2019). The best-circulating biomarker of vitamin D metabolism is believed to be serum levels of 25-hydroxyvitamin D, which reflect contributions from both diet and sun exposure as sources of vitamin D (Brehm et al., 2019). There is a strong correlation between maternal and newborn vitamin D deficiency in Arabs, which is frighteningly high. According to one study, 88% of Arab newborns and nearly 85% of Arab pregnant mothers are vitamin D deficient or insufficient (**Fouda et al., 2017).** Vitamin D and its metabolites may have an impact on the developing fetus's genetic signaling throughout pregnancy, which may reduce the chance of some undesirable outcomes through a still-unknown mechanism. Pregnancy is a time of rapid development and physiological changes in the developing fetus (**Wagner & Hollis, 2018).**

All the standard precautions needed for any preterm infant, as well as those put in place to correct imbalances, are included in the management of RDS. The most important supportive practices are those that maintain acid-base balance, a neutral thermal environment, adequate tissue perfusion and oxygenation, adequate hydration and electrolyte status, adequate tissue oxygenation, adequate tissue oxygenation with continuous positive airway pressure (CPAP), or mechanical ventilation, and finally the prevention of neonatal hypotension. Conflict persists despite recent improvements in the perinatal therapy of neonatal respiratory distress syndrome (RDS), which is a leading cause of infant mortality globally (**Steinhorn et al., 2019**).

While nurses working in the NICU should be competent and trained through the ongoing education program, they also have a significant role to play in the care of high-risk and preterm newborns. As a result, it's important to evaluate nurses' understanding of RDS in neonates to increase that knowledge and stop RDS issues in such newborns (Cloherty et al., 2020). Nurses are crucial in providing care for newborns with RDS, performing physical examinations, monitoring for grunting, and measuring respiratory rates to determine the severity of the condition. Nursing staff

The nurse should carefully evaluate the infant's respiratory status to determine the level of respiratory distress, evaluate the infant's cardiac rate & rhythm; count the apical pulse for one minute; note any irregularities in the rate or bounding pulses; additionally, the nurse should prepare emergency equipment that is ready to be used in the event of cardiac or respiratory arrest (**Luis et al., 2018**).

To reduce newborn mortality and morbidity, nurses play a crucial role in the care of high-risk and preterm infants. Nursing care for newborns with RDS includes helping with ET intubation, continuing mechanical ventilation as needed, measuring oxygen concentration, monitoring the SaO2 continuously, and watching the baby's reaction to oxygen. Because the gag reflex is useless and the cough is ineffectual, suctioning is required. Additionally, it's crucial to encourage healthy nutrition and hydration. Maintaining normal body temperature, preventing infection, maintaining fluid and electrolyte balance, promoting enough nutrition through gavage feeding, and regularly monitoring respiratory and cardiovascular function are all essential nursing goals (**Hay, et al, 2019)**.

The nursing intervention also focuses on maintaining nutrition and taking comfort measures like posture and hygiene. Close observation for appropriate lung expansion is essential for successful nursing care because mucus plugging, which can happen in newborns placed on a ventilator following surfactant administration, requires constant monitoring and attention. Additionally, it will be crucial to provide the family with emotional support as well as information regarding NICU procedures. The most effective strategy to prevent neonatal RDS is to avoid prematurity, however adequate prenatal care also leads to healthier infants and fewer preterm births. Steroids speed up the maturation of fetal lungs, hence avoiding unnecessary or poorly timed CS is also advised.

by stimulating type II pneumocytes that produce the phospholipids necessary for surfactant production and help to speed up lung maturity, this therapy can reduce the rate and severity of neonatal RDS (**Lissauer & Clayden 2019).**

Significance of the study:

According to estimates, 10%–12% of newborns in Egypt are born prematurely, and respiratory distress syndrome (RDS) is a common issue in these infants. After birth, this condition frequently deteriorates for the first two to four days before gradually improving. Infants that suffer from severe respiratory distress syndrome may pass away. Most frequently, this happens between the second and fourth day after birth. It may be deadly and cause long-term issues since the organs either received too much oxygen or didn't get enough oxygen. A mother who is vitamin D insufficient is equivalent to a fetus who is vitamin D deficient since the placenta is the main source of vitamin D for the growing fetus. with an increased risk of several negative effects on the mother and fetus, including gestational diabetes, preeclampsia, birth weight before 37 weeks, and other tissue-specific disorders (**Dror & Allen, 2018).**

Neonatal 25(OH) D levels are raised by vitamin D administration throughout pregnancy. Numerous disorders affecting the respiratory system may also be impacted by vitamin D insufficiency (Wagner et al., 2019). A lack of vitamin D during pregnancy and the first few years of life has also been linked to altered lung development, a reduction in lung volume, and impaired lung function. Additionally, those with low vitamin D levels may be more susceptible to respiratory infections **(Foong &Zosky, 2019)**. Therefore, this study aimed to evaluate the effects on nurses' care and associated outcomes for preterm neonates with respiratory distress syndrome.

Operational definitions:

Preterm infants fed enterally should receive vitamin D supplementation of 400–800 IU/day within the first days of life and continue up to 40 weeks of GA. This should be followed by 400 IU/day (Pludowski et al., 2017).

Aim of the study:

To evaluate the effects of vitamin D supplementation guidelines on nurses' care and associated outcomes for preterm neonates with respiratory distress syndrome

Research hypothesis:

H1: Nurses' knowledge and practices regarding respiratory distress syndrome will be improved after the implementation of the vitamin D supplementation guidelines.

H2: Preterm neonates with respiratory distress syndrome who will receive vitamin D supplementation will have a significant decrease in severity, rate of complications, and duration of hospital stay.

Subjects and Method:

Research design:

A quasi-experimental research design was used to achieve the study's aim.

Setting:

The study was conducted at the neonatal intensive care unit (NICU) affiliated to Sohag University Hospital, Egypt. These settings were chosen because of the high prevalence of neonates in the selected setting, as well as the fact that it serves the most populous region of the country.

Subjects:

The sample is divided into the main sample (nurses) & care sample (neonates):

Main sample (nurses): The first group consists of a convenient sample consisting of (50) male and female nurses who are working in the previously mentioned settings were taken regardless of their gender and years of experience in the neonatal intensive care unit for more than 6 months

Care sample (neonates): consists of a purposive sample of included 50 preterm neonates chosen from the previously mentioned setting with RDS receiving traditional therapy plus vitamin D 400 IU/day.

Sample size:

The sample size was calculated based on a power analysis of 0.95(β=1-0.95=0.5) at alpha .05 (one-sided) with a large effect size (0.5) was used as the significance, and 0.001 was used as the high significance.

Inclusion criteria:

- Both sexes
- Preterm neonates who had respiratory distress syndrome were admitted to the NICU.
- Preterm neonates' ages ranged between 30 weeks and 36 weeks gestation.

Exclusion criteria:

- Full-term neonates, preterm less than 30 weeks
- Preterm neonates with apparent congenital anomalies
- Preterm neonates who are suffering from neonatal sepsis, hypoxia, on mechanical ventilation, an infant of a diabetic mother

Tools of data collection:

Four data collection tools were used to carry out the current study.

Tool I: A structured interviewing schedule: It was developed by the researchers after reviewing the related literature (**Negi, et al., 2018; Martin, 2017; Foong & Zosky, 2019; and Mohamed, 2018**), and it was written in Arabic language to suit study sample. It is composed of five parts:

Part (1): Assess nurses' characteristics, such as; age, gender qualifications, and years of experience.

Part (2): Nurses' knowledge related to neonatal respiratory distress syndrome, which includes The definition, risk factors, clinical manifestations, diagnostic tests, strategies of prevention, and management of neonates with RDS all topics covered by nurses' knowledge of neonatal respiratory distress syndrome. There were 8 questions in all, and they were all multiple-choice.

Part (3): Nurses` knowledge regarding nursing care of preterm neonates with RDS, such as; knowledge of maintaining body temperature, managing fluids properly, providing good nutrition, promoting circulation, administering oxygen therapy, suctioning the newborn with RDS, caring for the newborn on a ventilator, estimating blood gases, preventing nosocomial infections, administering medications, and prognosis Following are the ratings for nurses' knowledge::

Part (4): Nurses' knowledge related to vitamin D supplementation for preterm neonates with RDS which includes their knowledge about; definition, causes, risk factors, effects, and doses.

Scoring system:

The correct incomplete answer received a (1) mark, and a (0) mark if it wasn't known. Each complete/correct answer of knowledge received (2) marks. Regarding nurses' knowledge of the RDS and vitamin D supplementation, a total knowledge score was calculated and subsequently converted to a percent score.

The total level of nurse knowledge was categorized according to (**Hegazy and Abusaad, 2019**) into:

− Good knowledge for scoring more than 75%
− Average knowledge for the score 75% - 60%
− Poor knowledge for a score less than 60%

Tool II: an Observation Checklist to assess the nurses' practice regarding the care provided for neonates with RDS: It was adopted from (**the European Consensus Guidelines on the Management of Neonatal Respiratory Distress Syndrome in Preterm Infants, 2013**). It was used to evaluate the regular nursing care given to newborns with RDS within the incubator. Ten practices were conducted in all. It featured the following behaviors: which comprise 64) of the following items:

1) Count for a full minute while using a timer to check the baby's respiratory health while they are quiet, particularly when they are not hungry or just after feedings (3 items).
Taking care of the baby in an incubator or under a radiant warmer will help to maintain a thermoneutral environment.
(3 items) Maintaining appropriate blood glucose levels
4- The nine essential metrics are being monitored.
5 - Add extra oxygen and ventilation (10 things)
6- Give a healthy dietary boost by giving intravenous fluids and electrolytes (5 items).
8 Consistently monitor blood gases (5 items)
9 Suctioning of the neonate either through oralor nasal suctioning (10 items)
10 Check regularly blood gases (5 items)
11 Use a septic method and prevent nosocomial infections (7 items)
12 Maintain open lines of communication with parents throughout the newborn's hospital stay, as well as throughout discharge care and follow-up treatment (7 items)

Scoring System for the Practice of the studied nurses:

Each step of practice received a score based on whether it was completed correctly or wrongly. If it was not completed, it received no score. According to (Hegazy and Abusaad, 2019), all nursing practices were categorized into three categories: • Competent practice if the nurse received a score of greater than 75%. If the nurse received a score lower than 75%, the practice was incompetent.

Tool III: Preterm neonatal assessment sheet. After evaluating relevant literature **(Wagner et al., 2019; Dror & Allen, 2018),** the researcher created this questionnaire to analyze preterm neonatal features and identify the most frequent vitamin D supplementation-related side effects that might arise. There are three sections:

Part (1): Analyse the characteristics of the preterm neonates under study, including their gestational age, gender, age at admission, weight, and current weight.

Part (2): Included the most common effects related to vitamin D supplementation. It included the most common effects that occurred after vitamin D supplementation. Pneumothorax, pulmonary hemorrhage, ventilator-acquired pneumonia, sepsis, and bronchopulmonary dysplasia were some of these side effects.

Part (3): Preterm neonates' medical outcomes assessment sheet: It was created by researchers to evaluate how newborns' conditions changed after receiving vitamin D supplements. It included; oxygen inhalation and length of hospital stay.

Tool IV: Downs score assessment sheet (Downes et al., 1970): This Downs score calculator checks for respiratory distress in pediatric patients based on pulmonary function parameters such as respiratory rate and infant clinical signs of respiratory distress.

Items	0	1	2
Respiratory rate	<60 bpm (0 points)	60-80 bpm (1 point	>80 bpm (2 points
Cyanosis	Nil (0 points)	In-room air (1 point	In ≥40% (2 points
Air entry	Normal (0 points)	Mild decrease (1 point	Marked decrease (2 points)
Grunt	None (0 points)	Audible with a stethoscope (1 point)	Audible with the naked ear (2 points)
Retraction	Nil (0 points)	Mild (1 point)	Moderate (2 points)

Methods:

- Preparatory phase:

Validity and Reliability:

Using textbooks, papers, journals, and scientific periodicals, the researchers reviewed all relevant past, present, regional, and international literature. This assisted the researchers in understanding the research challenge and provided direction as they created the study tools. By presenting the study tools to five experts, including three in pediatric nursing from the faculty of nursing and two in neonatal medicine from the faculty of medicine at Sohag University, the researchers ensure that the items of the tools were adequately representative of what they were supposed to measure. The tools were modified in accordance with the experts' assessments of the instruments' language structure, substance, and order. The experts concurred on the material, however, they suggested a few modest linguistic alterations to make the data more specific and clear. Changes were done as indicated. The Cronbach's Alpha test was used to evaluate the internal consistency dependability of each tool's item. For the structured interviews schedule, it was 0.83, and for the nurses' observation checklist, it was 0.86. Alpha coefficient test for Cronbach's; r = 0.82 for toolIII, and r = 0.73 for tool IV.

Exploratory phase:

Ethical considerations:

Managers at the hospital gave their official approval for the study to be carried out. The nurses were then told of the study's objective, methodology, advantages, and nature as well as their right to withdraw from it at any time and without cause, and their verbal or written agreement was gained before they could participate in the study. The parents of premature newborns were also asked for their consent orally. Subjects were informed that the results were Data won't be used in any upcoming studies. Through the coding of all data and the protection of all information taken, each subject's confidentiality and anonymity were guaranteed.

Pilot Study:

The instruments' viability, dependability, and clarity were assessed on 10 percent of the study sample—5 nurses and 5 preterm newborns. The purpose of the study was to evaluate the tools' applicability and identify any potential difficulties that might arise during the researchers' data collecting. As a series of inquiries and clarification, also look for any unique issues with the assertions. The fact that the data collection process took 25 minutes was another helpful estimation.

Field of Work:

From the start of January 2021 until the start of August 2021, data were gathered. The nurses who were involved in the study provided oral consent after being informed of its purpose, methods, advantages, and time frame to elicit their cooperation. This was done immediately after receiving ethical approval. The researchers then began interviewing each nurse separately, which took between 20 and 25 minutes to measure their level of understanding. The researchers then began evaluating the care given by nurses in the course of their real job for each preterm neonate (routine care) three days per week with follow-up of the condition of preterm neonates before and following the guidelines. An overview of the session's contents was given at the start, followed by explanations, demonstrations, and repeat demonstrations. Following the completion of data collection, the quality of nursing care was evaluated, and nurses were given instructions on how to care for preterm newborns. Four stages of data collecting were carried out (phases of assessment, planning, execution, and evaluation):

A. Assessment phase:

Each nurse was interviewed individually before applying the instructional guidelines to collect nurses' database lines, and their knowledge about the RDS and vitamin D supplementation using tool I. Nurses' practices regarding their care provided for neonates with RDS by using the tool II. Assessment of the most common effects that occurred after vitamin D supplementation and assess the improvement of neonates' condition after application of the vitamin D supplementation. It included; oxygen inhalation and length of hospital stay by using tool III. An assessment of the function parameters such as respiratory rate and infant clinical signs of respiratory distress by using tool IV.

B. Planning phase:

Depending on the work completed in the assessment phase; goals, priorities, and expected outcomes were formulated to meet nurses' needs regarding RDS and vitamin D supplementation. The investigator designed the instructional guidelines depending on the real need assessment of the studied nurses via reviewing of associated literature and based on updated relevant on RDS and vitamin D supplementation. The instructional guidelines covered theoretical and practical skills related to RDS and vitamin D supplementation in NICU. A booklet containing the content of the instructional guidelines was designed by the researchers; it was written in simple Arabic language and supplemented by photos and illustrations to help nurses understand the content.

The general aim of the instructional guidelines:

Improve the nurses' knowledge and practices regarding respiratory distress syndrome and vitamin D supplementation effects and decrease complications, oxygen inhalation, and hospitalization stay among preterm neonates in the neonatal intensive care unit.

Specific objectives of the instructional guidelines:

- Define respiratory distress syndrome.
- Enumerate the causes of respiratory distress syndrome.
- Determine the risk factors of respiratory distress syndrome.
- Identify the function of surfactant
- List the clinical manifestations of respiratory distress syndrome.
- Identify diagnosis test for respiratory distress syndrome.
- List the methods of prevention of respiratory distress syndrome.
- Apply management of preterm neonates with RDS
- Apply nursing care for preterm neonates with RDS
- Define vitamin D supplementation for preterm neonates with RDS
- Enumerate the causes of vitamin D supplementation
- List the risk factors for vitamin D supplementation
- Describe the effects of vitamin D supplementation
- Identify the doses of vitamin D supplementation for preterm neonates with RDS

The program consisted of theoretical knowledge about:

1. Definition of respiratory distress syndrome
2. Causes of respiratory distress syndrome
3. Risk factors of respiratory distress syndrome
4. Function of surfactant
5. Clinical manifestations of respiratory distress syndrome
6. Diagnosis test of respiratory distress syndrome
7. Methods of Prevention of respiratorydistress syndrome
8. Management of preterm neonates with RDS of respiratory distress syndrome
9. Nursing care for respiratory distress syndrome
10. Definition of vitamin D supplementation for preterm neonates with RDS
11. Causes of vitamin D supplementation
12. Risk factors for vitamin D supplementation
13. Effects of Vitamin D Supplementation
14. Doses of vitamin D supplementation for preterm neonates with RDS

The practical skill included the following procedure:

- Determine the baby's respiratory condition by counting for a full minute while using a timer. Ideally, this should be done while the preterm neonate is not hungry or right after feedings

- Preterm neonates should be cared for in an incubator or beneath a radiant warmer to maintain a thermoneutral environment.
- maintaining normal blood sugar levels
- Keeping an eye on the essential indicators
- Supply additional oxygen and ventilation
- Provide intravenous fluids and electrolytes along with good dietary assistance.
- Using either oral or nasal suction to suction the premature newborn
- Frequently check blood gas levels
- Use the aseptic method and prevent nosocomial infections
- Maintain effective communication with the parents during the newborn's hospital stay, as well as during discharge care and follow-up treatment.
- The recommended dose of vitamin D 12- Regularity of dose intake
- Blood sampling for 25(OH) D14- Vitamin D dose adjustment

C. Implementation phase:

The developed instructional guidelines were applied at Neonatal Intensive Care Unit in three sessions; three theoretical and two practical sessions; each session was taken in 35- 45 minutes. Nurses were divided into small groups; (8 in each group) for theory and practical sessions and the re-demonstration of practical sessions was done individually for each nurse. Various teaching methods were used in the form of lectures, group discussions, demonstrations, and re-demonstrations. The teaching media used were colored posters, PowerPoint, videos, and hand out. Moreover, the instructional booklet was given to each nurse to attract her attention, motivate her and help with reviewing at home, and support teaching and practice at home. As well as, each preterm neonate with RDS and supplemented with vitamin D was observed for 2 weeks before and after instructional guidelines implementation.

D. Evaluation of the instructional guidelines:

Nurses' knowledge and practice were evaluated one month after the implementation of the instructional guidelines using the previously mentioned (pretest) study tools I &II, III, and IV.

Administrative design:

Through the submission of formal letters provided by the dean of the Sohag Faculty of Nursing, approval was gained from the hospitals' managers to collect the data. The study was carried out after obtaining the required permission, and its title, objectives, and outcomes, as well as the key data points to be covered, were all illustrated.

Statistical analysis:

Data were collected, coded, revised, and entered into the Statistical Package for Social Science (IBM SPSS) version 20. The data were presented as numbers and percentages for the qualitative data, mean, standard deviations, and ranges for the quantitative data with parametric distribution, and median with interquartile range (IQR) for the quantitative data with the non-parametric distribution. The Chi-square test was used in the comparison between two groups with qualitative data and Fisher exact test was used instead of the Chi-square test when the expected count in any cell was found less than 5. Independent t-test was used in the comparison between two groups with quantitative data and the parametric distribution and the Mann-Whitney test was used in the comparison between two groups with quantitative data and non-parametric distribution. The comparison between more than two groups with quantitative data and parametric distribution was done by using the One-Way Analysis of Variance (ANOVA) test and the Kruskal-Wallis test was used in the comparison between more than two groups with quantitative data and non-parametric distribution. Spearman correlation coefficients were used to assess the significant relation between two quantitative parameters in the same group. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following: $P > 0.05$: Non-significant (NS). $P < 0.05$: Significant (S). $P < 0.01$: Highly significant (HS).

Results:

Table (1) showed that (62%) of the studied nurses were aged < 25 years with a mean of 24.9 ± 5.8 years and 76% of them were females. Concerning qualifications of the studied nurses

(64%) of them were Technical Institute of Nursingand 36% were Baccalaureate degrees of nursing. Regarding years of experience, 48% of them had experience from 5 – <10 years, and (28%) had experience < 5 years.

Table (2): Represented that, According to the data, 66% of the preterm neonates who were evaluated were male and had gestational ages between 32 and fewer than 34 weeks. In terms of the present age, 64% of the research's preterm neonates were 10 or younger days old, 46% of them their weight onadmission was 1500 < 2000 and the current weight of 44% of them was 2000 < 2500.

Table (3): Illustrated RDS prior and post-instructional guidelines implementation knowledge distribution among the nurses under study. Due to a highly statistically significant difference between the before and post-implementation phases of instructional guidelines, there was an improvement in the student's knowledge ($p < 0.001$).

Table (4): Portrayed, that There was a highly statistically significant difference between the studied nurses' knowledge scores regarding their nursing care of preterm neonates with RDS after instructional guidelines implementation and before instructional guidelines implementation, as shown by the distribution of the nurses according to their knowledge before and after the implementation of those guidelines.

Table (5): Showed that there was a highly statistically significant difference in the studied nurses' post-instructional guidelines implementation knowledge scores compared with their pre-instructional guidelines implementation knowledge scores regarding their knowledge related to vitamin D supplementation of preterm neonates with RDS. This study demonstrated nurses' knowledge related to vitamin D supplementation for preterm neonates with RDS before and after the implementation of the instructional guidelines.

Figure (1): Revealed, Pre- and post-implementation percentage distribution of the nurses under study's overall RDS knowledge scores. The less

Compared to (94%) of those who had good knowledge after the implementation of the instructional guidelines, more than two-thirds (64%) of them had inadequate understanding before the implementation.

Table (6): Presented the study's nurses' scores for competent practice before and after putting the instruction manual's recommendations into practice. The results of the study's nurses' post-implementation practice scores compared to their pre-implementation practice ratings showed a statistically significant difference ($p < 0.05$).

Figure (2): Showed percentage distribution of total practice scores of the studied nurses' pre and post-instructional guidelines implementation. As the majority of them (82%) had incompetent practice pre-instructional guidelines implementation compared with 90% of them who had competent practice post-instructional guidelines implementation.

Table (7): Showed that there was a statistically significant decrease in the complications among the studied preterm neonates with RDS after vitamin D supplementation pre and post-instructional guidelines implementation.

Table (8): Clarified, the increased Oxygen inhalation of the majority of the studied preterm neonates (88%) pre-vitamin D supplementation compared with post-vitamin D supplementation. On the other hand, (56%) of them had a length ofhospital stay of less than 10 days post-vitamin D supplementation compared with pre-vitaminD supplementation.

Table (9): Showed, the preterm neonates who were studied's percentage distribution for the pulmonary function parameters that were impacted by vitamin D supplementation, whereas, improved pulmonary function parameters of the majority of the studied preterm neonates (58%, 56%, 66 %, 40%, 42%) pre-vitamin D supplementation compared with (86%, 82%, 80 %, 76%, 82%) post vitamin D supplementation.

Table (1): Percentage distribution of the studied nurses regarding their demographic characteristics (n. =50)

Demographic characteristics	No.	%
Age (Years)		
< 25 years	31	62
25 - ≥ 36 years	19	38
Mean ± SD	**24.9 ± 5.8**	
Gender:		
Male	12	24
Female	38	76
Qualifications:		
Technical Institute of Nursing	32	64
Baccalaureate degree in nursing	18	36
Years of experience:		
< 5 years	14	28
5 – <10 years	24	48
10 - ≥15 years	12	24

Table (2): Percentage distribution of the studied preterm neonates according to their characteristics (no=50)

Preterm neonates; characteristics	No	%
Gestational age (weeks): 30< 32 32 <34 34≤ 36	15 31 4	30.0 62.0 8.0
Gender Male Female	33 17	66.0 34.0
The current age in days 5<10 10<15 5<20	14 32 4	28.0 64.0 8.0
Weight on admission 1500 < 2000 2000 < 2500 ≥ 2500	23 17 10	46.0 34.0 20.0
Current weight 1500 < 2000 2000 < 2500 ≥ 2500	19 22 9	38.0 44.0 18.0

Table (3): Percentage distribution of the studied nurses' knowledge regarding neonatal respiratory distress syndrome pre and post-instructional guidelines (n =50)

Nurses' knowledge regarding neonatal respiratory distress syndrome	No =(50)				X^2	P-value
	Pre instructional guidelines (%)		Post instructional guidelines (%)			
Definition of respiratory distress syndrome	29	58.0	50	100.0	18.392	<0.00 1*
Causes of respiratory distress syndrome	30	60.0	50	100.0	36.44	<0.001*
Risk factors of respiratory distress syndrome	32	64.0	50	100.0	16.63	<0.001*
Function of surfactant	25	50.0	48	96.0	19.45	<0.001*
Clinical manifestations of respiratory distress Syndrome	34	68.0	50	100.0	17.33	<0.001*
Diagnosis test	34	68.0	50	100.0	14.32	<0.001*
Management of neonates with RDS	35	70.0	50	100.0	14.56	<0.001*

(*) statistically significant at p ≤0.05

(**) highly statistical significance at p < 0.001

Table (4): Percentage distribution of the studied nurses according to their Knowledge about nursing care of preterm neonates with RDS pre and post-instructional guidelines implementation (no= 50)

Nurses` knowledge regarding nursing care of preterm neonates with RDS	No =(50)		X^2	P-value
	Pre instructional guidelines (%)	Post instructional guidelines (%)		
Maintenance of body temperature	50.0	100.0	18.392	<0.00 1*
Proper fluid management	44.0	90.0	36.44	<0.001*
Good nutritional support	40.0	92.0	16.63	<0.001*
Circulation	38.0	96.0	19.45	<0.001*
Oxygen therapy	56.0	88.0	17.33	<0.001*
Suctioning of the neonate with RDS	52.0	86.0	14.32	<0.001*
Care of neonate on ventilator	58.0	84.0	14.56	<0.001*
Blood gases estimation	54.0	82.0	27.33	<0.001*
Prevention of nosocomial infection	60.0	96.0	24.32	<0.001*
Medication administration	62.0	96.0	24.56	<0.001*

(*) statistically significant at p ≤0.05
(**) highly statistical significance at p < 0.001

Table (5): Percentage distribution of the studied nurses according to their Knowledge about vitamin D supplementation for preterm neonates with RDS pre and post-instructional guidelines implementation (no= 50)

Nurses` knowledge regarding vitamin D supplementation	No =(50)				X^2	P-value
	Pre instructional guidelines (no/%)		Post instructional guidelines (no/%)			
Definition of vitamin D supplementation	24	48.0	50	100.0	88.32	<0.00 1*
Causes of vitamin D supplementation	28	56.0	45	90.0	56.46	<0.001*
Risk factors of vitamin D supplementation	20	40.0	46	92.0	66.62	<0.001*
Effects of vitamin D supplementation	22	44.0	45	90.0	69.43	<0.001*
Doses of vitamin D supplementation	19	38.0	44	88.0	57.34	<0.001*

(*) statistically significant at p ≤0.05
(**) highly statistical significance at p < 0.001

Figure (1): Percentage distribution of total knowledge scores of the studied nurses about RDS pre and post-instructional guidelines implementation

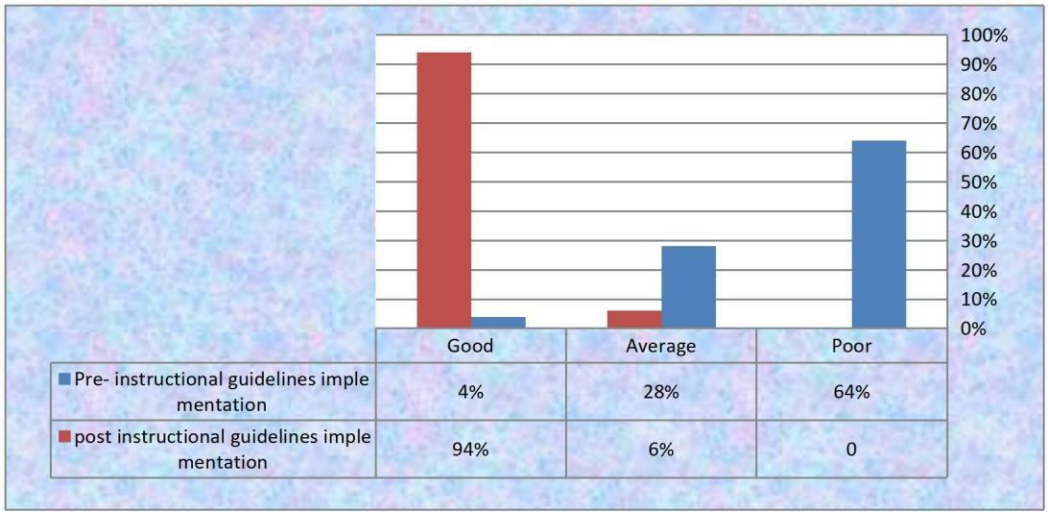

Table (6): Distribution of the studied nurses regarding their competent practice scores pre and post-implementation of the instructional guidelines (No=50)

Nurses` competent practice scores	No =(50)				X^2	P-value
	Pre-instructional guidelines have been done correctly and complete (no/%)		Post-instructional guidelines have been done correctly and complete (no/%)			
Assess respiratory status	24	48.0	47	94.0	128.36	<0.00 1*
Maintain thermoneutral environment	28	58.0	45	90.0	156.43	<0.001*
Ensuring normal blood glucose levels	23	46.0	46	92.0	136.63	<0.001*
Monitoring the vital parameters	27	54.0	48	96.0	69.42	<0.001*
Provide supplemental oxygen and ventilation	26	52.0	43	86.0	47.54	<0.001*
Provide good nutritional support	28	56.0	46	92.0	134.78	<0.00 1*
Suctioning of the neonate	33	66.0	45	90.0	67.98	<0.001*
Check regularly blood gases	20	40.0	41	82.0	48.34	<0.001*
Prevent nosocomial infection	21	42.0	40	80.0	23.13	<0.001*
Communicate effectively with parents throughout the length of hospital stay of the neonate and at discharge	18	36.0	39	78.0	19.56	<0.001*
The recommended dose of vitamin D	19	39.0	45	90.0	59.43	<0.001*
Regularity of dose intake	23	46.0	47	94.0	48.56	<0.001*
Blood sampling for 25(OH)D	20	40.0	44	88.0	122.72	<0.001*
Vitamin D dose adjustment	16	32.0	43	86.0	27.96	<0.001*

(*) statistically significant at p ≤0.05

(**) highly statistical significance at p < 0.001

Figure (2): Percentage distribution of total practice scores of the studied nurse's pre and post-instructional guidelines implementation

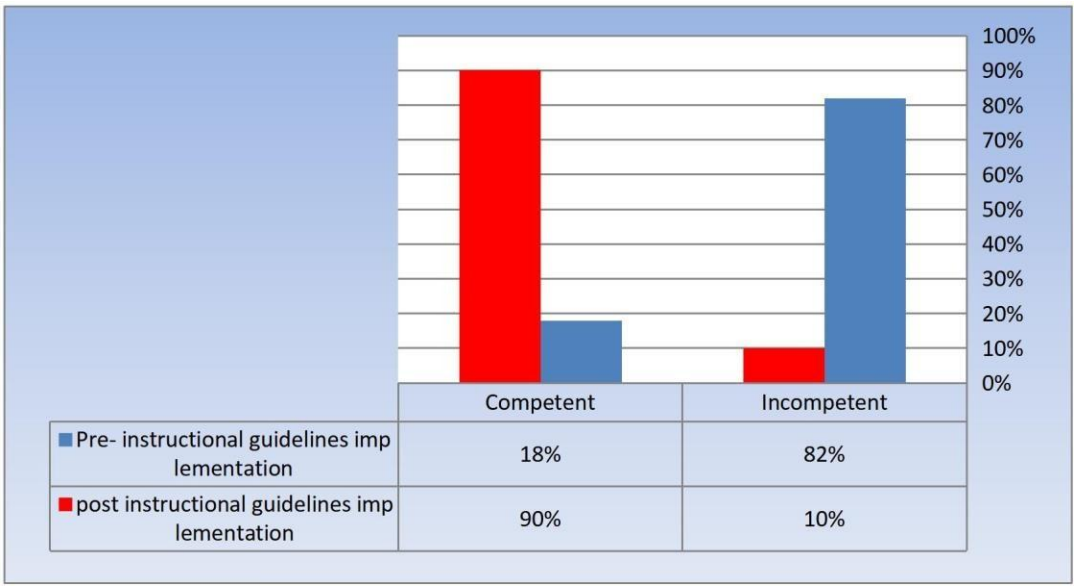

Table (7): Comparison between the studied preterm neonates with RDS as regards their complications after vitamin D supplementation pre and post-instructional guidelines implementation

Complications	Pre instructional guidelines (no/%)		Post instructional guidelines (no/%)		Chi-square test	
	No	%	No	%	X^2/f*	P-value
No	30	60%	46	92%	6.725	0.034
Yes	20	40%	4	8%		
Pulmonary hemorrhage	6	30%	2	50%		
Ventilator acquired pneumonia	4	20%	0	0.0%		
Pneumothorax	6	30%	2	50%		
Sepsis	4	20%	0	0.0%		

**P value ≤ 0.001 high Statistical significant differences

Table (8): Percentage distribution of the studied preterm neonates regarding the effect of vitamin D supplementation on their condition (No=50)

Items	No =(50)		X^2	P-value
	Pre-vitamin D supplementation (no/%)	Post vitamin D supplementation (no/%)		
Oxygen inhalation				
Yes	(44) 88.0	(14) 28.0	**122.32**	**<0.00 1***
No	(6) 12.0	(36) 72.0		
Hospital stay in days				
10	(4) 8.0	(28) 56.0	**115.42**	**<0.001***
20	(19) 38.0	(18) 36.0		
≤ 30	(27) 54.0	(4) 8.0		

**P value ≤ 0.001 high Statistical significant differences

Table (9): Percentage distribution of the studied neonates regarding the effect of vitamin D supplementation on their pulmonary function parameters (No=50)

Items	Pre vitamin D supplementation (no/%)		Post vitamin D supplementation (no/%)		X^2	P-value
Respiratory rate	29	58.0	43	86.0	32.78	<0.05*
Cyanosis	26	56.0	41	82.0	109.56	<0.05*
Air entry	33	66.0	40	80.0	119.81	<0.05*
Grunt	20	40.0	38	76.0	113.42	<0.05*
Retraction	21	42.0	41	82.0	129.31	<0.05*

*P Value ≤ 0.05 Statistical significant differences (S);
**P value ≤ 0.001 high Statistical significant differences

Discussion:

For newborns, respiratory distress is a typical sign. The severity of this pulmonary insufficiency syndrome worsens over the first two days of life. Premature newborns are typically affected. Babies who have respiratory distress syndrome (RDS) or hyaline membrane disease (HMD) may require additional oxygen and assistance breathing. The severity of the condition, the baby's size and gestational age, the presence of infection, and how long the illness lasts all affect the course of RDS. whether the infant requires mechanical breathing assistance. Over the first 48 to 72 hours, RDS often gets worse (Martin, 2019). Therefore, the purpose of the current study was to assess how preterm newborns with respiratory distress syndrome and nurses' awareness of vitamin D supplementation were affected by educational recommendations.

According to the findings of the current study, the mean age of the nurses who were the subject of the investigation was 24.9 5.8. This could be the root of

the lack of nursing expertise. This outcome was comparable to that of a study by Paret (2018), who discovered that nurses often ranged in age from 20 to 25 years old in their study named "Acute Respiratory Distress Syndrome in Children." Based on the findings of the current study, it was determined that the majority of the nurses under study were female. Additionally, the bulk of them held nursing school diplomas. These outcomes matched those of Mohammed's (2004) research " Quality of Nurses' Performance In Neonatal Intensive Care Units "and found that the majority of studied nurses were females, and had diplomas in nursing school.

According to the present study's findings on the features of preterm newborns with RDS, it was analyzed, less than two-thirds of their gestational age was between 32 and fewer than 34 weeks. Respiratory distress syndrome, which primarily affects premature newborns, may be to blame for this. Less than two-thirds of the preterm neonates were 1500–2000 pounds when they were admitted, whereas less than half of them were 2000–2500 pounds at this point. In a study on the "Quality of Nursing Care for Neonates with Respiratory Distress Syndrome Outcomes" conducted by Mohamed (2010), it was found that more than half of the neonates were male.

The current study clearly shows that the total knowledge scores of the studied nurses had increased concerning their knowledge of RDS and nursing care of preterm neonates with RDS post-instructional guidelines implementation as compared to pre-guidelines implementation. The paucity of training programs for neonatal nursing care, in the researchers' opinion, maybe the cause of this. Additionally, this result shows the beneficial effects of the application of instructional guidelines, which are tailored to the demands of the examined nurses and provide them with adequate knowledge. This improvement highlights how eager most nurses who have been studied are to learn more about their RDS.

This result is in the same line as **Amin, (2004**) who studied "Intervention Nursing Program for Care of High-Risk Neonate at Mansoura Hospitals " and reported that there were higher increases in study group subjects' knowledge mean scores immediately after post-nursing implementation than pre-implementation. The results of the present study are similar to what was reported by **Alison et al., (2019**) who did a study about " Mortality and Adverse Neurologic Outcomes Are Greater in Preterm Male Infants " and discovered that there was a statistically significant difference between the total mean scores of nurses' meningitis knowledge before and after the implementation of the CP guidelines. The current study's findings are consistent with those of a study conducted by Hussein (2018), who investigated the "Effect of Using Clinical Pathway on Improving Clinical Outcomes of Infants with Pneumonia World" and discovered a statistically significant difference in the mean scores of nurses' knowledge of pneumonia between the pretest and posttest scores.

The present study findings revealed that there was a highly statistically significant difference in the studied nurses' post-instructional guidelines implementation knowledge scores regarding vitamin D supplementation of preterm neonates with RDS.From the researchers' point of view, reflecting the success of implementing the instructionalguidelines regarding vitamin D supplementation.

The present study results revealed an improvement in studied nurses' competent practice post-instructional guidelines and the majority of them had competent practice post-instructional guidelines implementation. From the researchers' point of view, it reflected the good impact of the instructional guidelines on improving practices**.** These confirmed the significant modifications in the studied nurses' practice that reflected the main goals of the implementation of the instructional guidelines. This finding was in agreement with **Fan et al., (2020),** who stated that having the proper knowledge and practicing it leads to a change in health behavior. Furthermore, **Rana et al. (2020**) found that enough individual knowledge is linked to good illness management and health promotion. Knowledge deficit is linked to poor health and maladaptive disease prevention behavior, according to a study by

Ricardo et al., (2018). This is in accordance with Mahmoud and **Martin & Fanarof (2018)** They discovered a clear improvement in practice scores of the study group subjects after the adoption of the nursing clinical pathway as opposed to before.

The current study revealed that there was a statistically significant decrease in the complications among the studied preterm neonates with RDS after vitamin D supplementation pre and post-instructional guidelines implementation. This finding confirmed the association between vitamin D supplementation and decreasing complications in preterm neonates with RDS. These results are supported by The same findings reported in a study by Cetinkaya et al. (2019) that looked at the relationship between vitamin D insufficiency and BPD in premature infants (gestational age 32 weeks) who were brought to the NICU with a diagnosis of RDS.

The current study revealed that increased Oxygen inhalation of the majority of the studied preterm neonates' pre-vitamin D supplementation compared with post-vitamin D supplementation. Following vitamin D administration, more than half of them spent less than 10 days in the hospital. Furthermore, Hegazy et al.'s (2018) research on the "Association between serum 25(OH) vitamin D level at birth and respiratory morbidities among preterm neonates" supports this. They discovered that preterm neonates with RDS had significantly lower mean serum 25(OH) d concentrations than those without RDS. The group with RDS and low 25(OH)D concentrations spent more time in the hospital than the group without. This might be a result of vitamin D supplementation's impact on care.

Results of the current study highlighted

Especially in newborns who are critically ill. According to Rhew et al. (2019), who studied "Early Switch and Early Discharge Strategies in Patients With Community-Acquired Pneumonia," they discovered that the study group showed improvements in respiratory signs and/or symptoms, a decrease in o2 daily requirements, an increase in the ability to take oral medications, and a faster decrease in I.V. fluids than the control group.

that vitamin D supplementation improved pulmonary function parameters of the majority of the studied preterm neonates' post-vitamin D supplementation. From the researchers' point of view, it confirms that Vitamin D supplementation is a highly effective method to improve pulmonary function parameters among preterm neonates with respiratory distress

Conclusion:

From the result of the present study, it can be concluded that the implementation of Vitamin D supplementation guidelines has positive effects on improving nurses' knowledge and practices regarding respiratory distress syndrome and Vitamin D supplementation. Also, improved associated outcomes for preterm neonates with respiratory distress syndrome such as decreases in the severity, rate of complications, and duration of hospital stay in the preterm neonates with respiratory distress syndrome who received vitamin D/Day post-guidelines implementation compared to pre-guidelines implementation

Recommendations:

In the light of the results of this study, the following recommendations were suggested:

- Providing nurses with well-planned instructional guidelines to improve their knowledge and practices regarding Vitamin D supplementation.
- Vitamin D should be supplemented to preterm neonates with RDS
- Replication of the current study with a larger sample in different settings is required for generalizing the results.

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