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The Evaluation of Nurses' Knowledge and Practice About the Temperature of Milk Fed to Infants: A Descriptive Study

Bebeklere Verilen Süt Isısına Yönelik Hemşirelerin Bilgi ve Uygulamalarının Değerlendirilmesi: Tanımlayıcı Bir Çalışma

ÇAĞRI ÇÖVENER ÖZÇELİK *
EDA AKTAŞ **

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ABSTRACT

Aim: The study aimed to evaluate the practices and knowledge of nurses in the neonatal intensive care unit regarding temperature of breastmilk/formula given to infants during feeding.

Methods: This descriptive study comprised 116 neonatal nurses working in an intensive care unit. The research data were collected using the Nurse Identification Questionnaire and the Practices and Knowledge of Nurses Regarding Milk Temperature Questionnaire.

Results: Of the nurses, 52.6% stated that the milk given to infants should be beneath 35°C, 47.4% stated that it should be above 35°C, and 76.4% stated that the temperature of the breastmilk/formula given to infants may cause nutrient loss. It was found that 78.4% of the nurses heated the milk in a warming bath, 6% heated the milk by keeping it at room temperature, and 15.6% preheated the milk with a heater and thermostat. Furthermore, 91.4% of the nurses were found to test the temperature of the breastmilk/formula by placing some on the inner segment of the forearm, 5.2% by using a liquid thermometer, and 3.6% by placing some on the palm.

Conclusion: It was determined that the nurses had insufficient knowledge regarding the proper temperature of the breastmilk/formula and used traditional methods for heating milk and testing its temperature.

Keywords: *Breast milk/formula temperature; neonatal intensive care unit; nurse.*

ÖZ

Amaç: Yenidoğan yoğun bakım ünitesinde çalışan hemşirelerin bebeklere verdikleri süt ısısına ilişkin uygulama ve bilgilerini değerlendirmektir.

Yöntem: Araştırma 116 yenidoğan yoğun bakım hemşiresi ile yapılmıştır. Veriler Hemşireyi Tanıtıcı Bilgi Formu ve Hemşirelerin Süt Isısına İlişkin Uygulama ve Bilgileri Anketi ile toplanmıştır.

Bulgular: Katılımcıların %52.6'sının bebeklere verilen anne sütü/formül süt ısısının 35°C'nin altı, %47.4'ü 35°C'nin üstü olması gerektiğini ve %76.4'ü bebeklere verilen sütün ısıtıldığı sıcaklığın besin kayıplarına neden olduğunu belirtmiştir. Katılımcıların %78.4'ünün anne sütü/formül sütü sıcak su dolu kapta bekleterek, %6'sının oda sıcaklığında bekleterek, %15.6'sının termostatlı ısıtıcı ile ısıttığı saptanmıştır. Aynı zamanda katılımcıların %91.4'ünün anne sütü/formül sütün ısısını bebeğe vermeden önce ön kolun iç yüzü ile, %5.2'sinin sıvı termometresi ile %3.6'sının el/avuçiçi ile değerlendirdikleri bulunmuştur.

Sonuç: Araştırma sonucunda hemşirelerin bebeklere verilmesi gereken süt ısısı ile ilgili yeterli bilgiye sahip olmadıkları görülmüştür. Hemşirelerin süt ısıtırken ve sıcaklığını değerlendirirken geleneksel yöntemleri tercih etikleri saptanmıştır.

Anahtar kelimeler: *Anne sütü/formül süt; hemşire; yenidoğan yoğun bakım ünitesi.*

* Ç Çövener Özçelik, PhD, Assist.Prof., Pediatric Nursing
Marmara University Faculty of Health Sciences Division of Nursing Department, Istanbul
Yazışma Adresi / Address for Correspondence:
Çağrı Çövener Özçelik, Dr. Öğretim Üyesi,
Marmara Üniversitesi Sağlık Bilimleri Fakültesi Hemşirelik Bölümü
Başıbüyük Mh. Başıbüyük Yolu Sk. 9/4/1 Maltepe-Istanbul
Tel: 90 216 330 20 70 Faks: 90 216 399 62 42
e-mail: ccovener@hotmail.com, ccovener@gmail.com

** E Aktaş, PhD, Assist. Prof., Pediatric Nursing
Sağlık Bilimleri University Faculty of Nursing Department, Istanbul
e-mail: edanisan@gmail.com

The present study defines the knowledge and practice about the temperature of breast milk/formula delivered to infants at neonatal intensive care units by the nurses. Adequate and balanced nutrition is defined as taking required energy and food compatible with age, gender, physical activity in order to ensure protection of health and healthy development and growth.[1] Neonatal period is the most critical time for a healthy beginning to life and growth and development are the fastest in this period compared with other childhood periods.[2] Breast milk includes all the essential nutritional elements for growth and development of an infant. Thus, it is definitely suggested that the first six month from neonatal period on the infant should take only breast milk and breast milk should also be given with supplementary food till the age of 2.[3] In certain conditions that breast milk is not possible to be given (HIV, loss of the mother), formula is the best choice for infants since it is the most similar type of nutrition to breast milk.[4] The temperature of breast milk/formula is rather crucial in terms of nutritional facts and vital/gastrointestinal signs of the infant as well. Breast milk sucked directly from mother has the ideal temperature. However, the preparation of formula and temperature of it should be handled carefully. The formula should be served without losing its content.[5-7] It is not recommended to heat the preserved breast milk over 400°C since it spoils the content of the milk by leading the loss of enzyme activity.[8] Therefore; microwaves should not be utilized in the heating of fridge-preserved milk; it should be heated with water bath technique. However, the optimal temperature of the water is not stated in the literature.[9,10] Formula is on the other hand should be prepared using boiled and cooled water.[11] In addition, the milk given to an infant in appropriate temperature promotes the development of gastrointestinal functions and speeds up growth process so that shortens the duration of hospitalization.[12] There is limited number of studies in the World literature on the optimal temperature of milk given to infants.[13-17] Lawlor-Klean[12] stated in their study carried out with animals that newborn mice feeding with cold milk experienced mucosal injury, hypotermia and shivering, slowing in gastroenteric blood flow and decrease in development. In another study by Holt et al[13] carried out with preterm infants examining the change in their body temperature due to cold milk from fridge or in body-temperature, the infants given cold milk experienced decrease in their body temperature. In Blumenthal et al.[14] study there is not any difference occurred in the bodies of preterm infants feeding with cold or warm milk in terms of duration of gastric emptying. In other studies on the issue, it was suggested that the toleration of milk, given to preterm infants in body temperature (37°C), was better and the amount of gastric residue was less.[15,16] Such studies point out the problems for infants caused by not given the milk in a standardised temperature.[9,12,13,15-17] However, there are not any standards found in Turkey as in the literature worldwide about temperature of the milk and the method to measure the temperature. Lawlor-Klean et al.[12] study measuring the perception of nurses related with the effect of feeding temperature on infants' general state, it was reported that the milk given in body temperature was appropriate for infants but there was not any standard procedure in the heating of the milk in many of the neonatal intensive care units(NICU). The nurses in the NICU typically measure the temperature of the milk such methods based on individual perception like dropping the milk inner their wrist or handling it.[12] Perception is the process of recognizing and interpreting sensory stimuli.[18] Perception is affected by the factors such as life experience, some relationships get in contact with stimuli, existing conditions in the moment of stimuli, personal and environmental characteristics.[19] The studies emphasise that without any standardised method to measure the temperature of the milk, it might possibly given in an inappropriate temperature depending on perceptional differences and that may lead to various physiological problems.[12,13,15-17]

Neonatal nurses according to their professional nursing roles have a crucial impact on infants', admitting in neonatal or NICU, adjusting to outer environment, healthy development and growth, feeding with breast milk and protection from illnesses.[20,21] Beginning and continuing the feeding of unsuckling neonates is the responsibility of neonatal nurses.[22] Neonatal nurses should observe feeding-related complications and the efficacy feeding care so that they should plan and implement effective nursing interventions accordingly.[23]

Aim

No previous studies conducted on the neonatal nurses' feeding practices and knowledge regarding to milk temperature in Turkey. The aim of the present study was to evaluate the knowledge and practices of nurses regarding milk temperature delivered to infants during feeding.

Methods

Study Design

This descriptive study was carried out with 116 NICU nurses in four research and training hospitals with NICUs between December 2013 and March 2014 in İstanbul/Turkey. Total sum of nurses were 137 but 21 nurses didn't agree to participate due to work load and 116 of them completed the data collection process. These four hospitals contains NICUs has level I-II-III in İstanbul Anatolian side that assist approximately more than 900 neonates annually. Only one of those hospitals had a thermostat-controlled heater but it was not used frequently or it was not utilized in an appropriate temperature. The inclusion criterion was voluntarily basis.

Data Collection

Data were collected via face-to-face interviews by the researchers and took approximately 10 to 15 minutes. Data were collected using the questionnaires formed by researchers compatible with literature. "Nurse Identification Questionnaire" consists of eight items to measure the socio demographic characteristics of

the nurses. "Knowledge and Practices of Nurses Regarding Milk Temperature Questionnaire" consists of six items asking the knowledge and practices of nurses regarding the temperature of milk during feeding infants (Appendix). The questionnaire was presented to the expert views of six faculty members in the field of neonatal health. Corrections based on minor suggestions such as word or sentence corrections were made.

Data Analysis

SPSS v.20 (Statistical Package for Social Sciences) was utilized for statistical analysis. Results were obtained from definitive statistical methods (mean, standard deviation, frequency), chi-square test. The results were evaluated at 95% confidence interval, and statistical significance was accepted as $p<0.05$.

Ethical considerations

This study was approved by Marmara University Institutional Review Board (Marmara University-IRB 23.12.2013-15) and the Ministry of Health of Turkish Republic. Informed consents were required for all participants who agreed to participate in the study.

Strengths and limitations

Reaching 84.6% of the target participants (n=116) is a strong side of the study. One of the limitations of the study is the sample was small and the second one is that study findings can only be generalized only for the four hospitals.

Results

137 NICU nurses were included in the study but 21 of them didn't agree to participate due to work load and 116 nurses in total completed the data collection process. The mean age of the nurses who participated in the study was 28.55±5.07 (19-45) and their experience in the NICU was 1,81±0.56 years (%26.7 (n=31) (0-1 years; %64.7 (n=75); 2-10 years and % 8.6 (n=10) 10 years and above).

The distributions of the knowledge and practices of nurses working in the NICU regarding the temperature of the milk given to infants were given in Table 1. 78.2% of the nurses (n=86) stated that they had information on the temperature of the milk delivered to infants. Only 76.4% (n=81) of the nurses stated that when the milk is heated, it might cause losses in nutrients. When the methods used by the nurses to heat breast milk were examined, 78.4% (n=91) of them were found to use the warming bath method. When the methods for preparing formula were examined, 12.1% (n=14) of them were found to boil the milk and add formula, and when the methods for cooling formula were examined, 50% (n=7) of them were found to keep it in a container of cold water, 28.6%(n=4) of them were found to keep it at room temperature, and finally 21.4% (n=3) of them were found to keep it in the fridge.

Comparisons of the knowledge and practices of the participants regarding milk temperature were given in Table 2. It was found out that 82.9% (n=68) of the nurses stated they had information about milk temperature and milk temperature could cause nutrient losses, and 17.1% (n=14) of them stated they didn't have information but milk temperature could nevertheless cause nutrient losses (χ^2=5.673, p=0.02) (Table 2). 14% (n=12) of them indicated that they had information about the temperature at which breast milk/formula should be delivered to infants and water should be boiled before adding formula, with no significant difference between the two items (χ^2=0.534, p=0.46) (Table 2). 50% of the participants who stated they had information about the temperature at which breast milk/formula should be delivered to infants stated that milk should be below 350C and the other 50% stated that it should be above 350C. No significant difference was found. (χ^2=3.285, p=0.070), (Table 2).

Table 1. Distribution of the Knowledge and Practices of the Participants Regarding Milk Temperature

Knowledge and Practices of Nurses	n	%
Status regarding having information on temperature at which breast milk/formula should be given to infants		
Yes	86	78.2
No	24	21.8
Does the temperature of the milk cause nutrient losses?		
Yes	81	76.4
No	25	23.6
Methods for heating breast milk (*refrigerated)		
Warming bath	91	78.4
Keeping at room temperature	7	6
Heater with thermostat	18	15.6
Methods for preparing formula		
Water is boiled and formula is added	14	12.1
Water is boiled, cooled, and formula is added	102	87.9
Ideal temperature for the breast milk/formula during feeding of the infants		
Below 35°C	61	52.6
Above 35°C	55	47.4
Evaluation method for breast milk/formula temperature		
Inner wrist	106	91.4
Liquid thermometer	6	5.2
Palm	4	3.4
Total	**116**	**100**

The comparisons of the knowledge and practices of nurses regarding milk temperature in terms of experience at the NICU were presented at Table 3. Besides these findings, the practices of the nurses were evaluated according to their experience in NICU. 87.1% (n=27) of the nurses who worked for 0-1 years, %88 (n=66) of those who worked for 2-10 years, and %90 (n=9) of those who worked for 10+ years answered the item on the process of preparation formula as boil the water, cool it

down, and add the formula but cooling temperature was unclear. 90.3% (n=28) of the nurses who worked for 0-1 years, %90.7 (n=68) worked for 2-10 years, and %100 (n=10) worked for 10+ years evaluated milk temperature by using their inner wrist. Even though 9.7% (n=3) of those who worked for 0-1 years and 4% (n=3) of those who worked for 2-10 years evaluated milk temperature through a liquid thermometer, none of those who worked for more than 10 years used this method.

Table 2. Comparison of the Knowledge and Practices of the Nurses Regarding Milk Temperature according to Have Information about Temperature of Milk

Knowledge and Practices of the Nurses Regarding Milk Temperature	Do you have information on the temperature at which breast milk/formula should be delivered to the infant?				
	Yes		No		x^2; p
	n	%	n	%	
Does the temperature of the milk cause nutrient losses?					
Yes	68	82.9	14	17.1	χ^2=5.673
No	11	57.9	8	42.1	**p=0.02***
How do you prepare formula delivered to infants in the neonatal intensive care unit you work at?					
Water is boiled and formula is added	12	14	2	8.3	χ^2=0.534
Water is boiled, cooled, and formula is added	74	86	22	91.7	p=0.46
What is the ideal temperature for breast milk/formula during feeding of the infants?					
Above 35°C	43	50	7	29.2	χ^2=3.285
Below 35°C	43	50	17	70.8	p=0.070

χ^2: Chi-square test *p<0.05

80.6% (n=25) of the nurses who worked for 0-1 years, %84(n=63) worked for 2-10 years, and %30 (n=3) worked for 10+ years used the warming bath method to heat milk. 16,1% (n=5) of those who worked for 0-1 years, %9.3(n=7) of those who worked for 2-10 years, and %60 (n=6) of those who worked for 10+ years heated the milk with a thermostat controlled heater.

Discussion

76.4% of the participants stated that heating of the milk too much might cause loss of nutritional facts (Table 1). Many nutritional elements effect from the heating of the milk. The content of protein, fats, carbonhydrates, vitamins and minerals might differ depending on the temperature of the milk. Nutritional facts of proteins in high-boiling milk decrease. Particularly, the amount of lysin which is one of the essential amino-acids decreases dramatically.[1,24] Correct answers provided by the majority of participants is considered to be associated with education and experience.

At Table 1, it is clear that majority of nurses utilize warming

Table 3. Comparison of the Knowledge and Practices of Nurses Regarding Milk Temperature According to Experience at the Neonatal Intensive Care Unit

Knowledge and practices of the Nurses Regarding Milk Temperature	How long have you worked as a newborn intensive care unit nurse?						
	0-1 years		2-10 years		10 years and above		x^2; p
	n	%	n	%	n	%	
Does the temperature of the milk cause nutrient losses?							
Yes	25	86.2	50	74.6	6	60	χ^2=3.157
No	4	13.8	17	25.4	4	40	p=0.206
What is the ideal temperature for breast milk/formula during feeding of the infants?							
Above 35°C	14	45.2	34	45.3	7	70	χ^2=2.239
Below 35°C	17	54.8	41	54.7	3	30	p=0.326

χ^2: Chi-square test p< 0.05

bath method to heat breast milk and the use of thermostat is rather limited among nurses. Thermostat-controlled heaters are used to adjust the temperature of the milk to desirable degrees. Their limited use might the result of financial agents. The purchase and maintaining of those heaters might be a financial burden for institutions whereas other methods do not require any financial loads so that they preferred less by hospital administrations. Besides, the heating of the milk takes longer in thermostat-heaters than warm bath method that makes it less preferable for nurses.

As for formula preparation methods, 87.9% of the participants prepare formula with boiled/cooled water. Industrially prepared formulas are used when the breast milk is not completely available or partially available or insufficient from birth. Formulas are produced as powder to mix with safe drinking water or ready to drink bottles. Suppliers provides clean and appropriate instructions about preparation process.[25] Those instruction guide nurses to prepare the formula in right way. However, there is not any standards about the cooling temperature of water and the exact temperature to deliver the formula to infants.

Many of the participants evaluate the temperature of breast milk/formula using inner wrist (Table1). The evaluations held by using touching perception might determine the approximate temperature of the objects.[26] Thickness of the skin on the other hand may differ in terms of age, health and exposure to sun. As the person age's thickness of the skin decreases and also exposure to sunlight makes the skin thicker. In addition, some illnesses like thyroid or diabetes effect the thickness of the skin.[27,28] In the light of this information, nurses are considered to be perceive the temperature of the milk differently by dropping inner wrist while delivering it to infants. That might cause delivering of the milk with high or lower temperatures and lead to negative effects on neonate's body functions. Thus, in order to remove perceptional differences in evaluation of the temperature of the milk[19] and to ensure the standards, the use

of liquid thermometers is recommended.

Those participants having knowledge on breast milk temperature responded that heating of the milk cause loos of nutritional facts. The concept of "baby-friendly hospital" has a positive impact on concerns towards breast milk and the knowledge about the issue[29] In order to provide correct information about breast milk and to avoid false practices a programme called "The Promotion of Breastfeeding and the Baby-Friendly Hospitals Initiative" was started by Ministry of Health of Turkish Republic in 1991.[30] Within the scope of this programme hospitals which desire to get the title of "infant-friendly" have to provide education on breast milk to patients and health care professionals. Nurses who participate in our study might be provided education within the scope off this programme or in their schools.

The nurses who reportedly have adequate knowledge on formula was observed to prepare it in a wrong way (Table1). It leads to loss nutritional fact in the milk. Lack of enough information in the literature about the exact temperature of the breast milk might be the reason for the mistakes in practise by nurses. 91.7% of the nurses prepare the formula correctly even though they do not have adequate knowledge. It is estimated that they practise it correctly as the result of master-apprentice relation. We consider that experienced nurses (master) guide the younger nurses (apprentice) about profession-related practices. However, not every practice of the experienced nurses can be accepted as correct. Younger nurses should compare the practices they held in NICU with literature information and should follow the correct practices to minimize malpractices.

Many of nurses apply warming bath method to heat the milk. Warming bath method does not base on knowledge on the contrary it is considered as a traditional method used in NICU. In some units, where no heaters available, this method might be utilized but it is better to measure the temperature of hot water beforehand by taking into consideration that above 40°C[1,24] the breast milk/formula spoils. The temperature of heated milk should be re-measured before delivering it to infants.

Half of the participants who reportedly have knowledge about milk temperature indicated that optimal milk temperature is above 35°C and the other half remarked it as below 35°C (Table 2). According to the study by Lawlor Klean et al.[12] optimal temperature of breast milk was found out between 35,5°C and 37,2°C. Results' being equal for our participants shows us that nurses do not have sufficient knowledge on the issue. It is deduced that nurses responded the question inferentially. Yet the temperature of breast milk during its delivering is highly important. In the study by Holt et al.[13] infants were delivered cold and body-temperature milk and the results were compared. Ultimately, it was found that milk temperature affected activity, sleep patterns, liquid/food intake and malnourishment of neonates. Additionally, it was expressed that the temperature of milk delivered to infants had an impact on their body temperature. The studies on the issue show that lack of a standard temperature measurement method might lead various problems especially for preterm infants.[9,12,13,15-17] Neonates have less brown fatty tissue and muscle and also they have more skin surface in proportion to body weight. Such factors reduces their adjusting ability of body temperature and increases the tendency to hypothermia.[31,32] So, it is rather substantial to keep their body temperature stable. Overall, it is considered that the temperature of the milk delivered to infants should have some standards.

Majority of participants responded the question about the relation between milk temperature and loss of nutritional facts correctly (Table 3). This might due to nurses' education not just their experience. The education provided by Ministry of Health of Turkish Republic within the scope of "Neonatal Nursing Certificate Programme" gets positive results about breast milk.[33]

It was identified that having knowledge about milk temperature did not have any relations with experience (Table 3). Since the breast milk/formula did not measure using a liquid thermometer, nurses delivered the milk in an estimated temperature. Thus, experience does not always mean adequate knowledge about optimal temperature of the milk delivered to infants.

Strength and Limitations

137 nurses were aimed to participate in the study however, it was carried out with 116 participants in total. Reaching of 84.6% of aimed participants is the strong side of the study. Twenty-one nurses did not want to allocate their time to complete the questionnaire. This might be the weak side of the study.

Conclusions

As a result of the present study it was seen that NICU nurses do not have sufficient knowledge about the exact milk temperature. Additionally, nurses prefer mostly traditional methods while heating the breast milk/formula or evaluating its temperature.

Implications for nursing practice

This study is applicable to clinical practice easily. Protocols should be constituted for feeding infants in standardized breast milk/formula temperature; heating and measuring temperature methods. Providing permanent education and monitoring clinical practice is important to ensure continuity of outcomes. This study provides a basis for future researches in the standardization of the milk temperature and thus, improves the neonatal nursing care and neonatal health.

APPENDİX

KNOWLEDGE AND PRACTİCES OF NURSES REGARDİNG MİLK TEMPERATURE FORM

1. What is the ideal temperature for breast milk/formula during feeding the infants?

1) 37,7°C
2) 35,5°C -37,2°C
3) 32,2°C-35°C
4) 30°C -31,6°C
5) 26,6°C -29,4°C
6) 23,8°C -26,6°C
7) Below 23,8°C

2. Does the temperature of the milk cause nutrient losses?

1) Yes (Explain)_____
2) No

3.In your neonatal intensive care unit, which method is used for heating breast milk?

1) by keeping the milk in a container filled with hot water (Explain)_____
2) by keeping milk in room temperature
3) Other (Explain)_____

4. How do you prepare formula delivered to infants in the neonatal intensive care unit you work at?

1) Water is boiled and then the formula is added to boiled water (Explain)_____
2) Water is boiled and then it is cooled. Formula is added into this water (Explain)_____

(If you chose the second option, go to question 6)

5. In your neonate intensive care unit, which method is used for cooling the formula?

1) By keeping it in a container filled with cold water (Explain)_____
2) By keeping it in room temperature
3) By keeping it in a refrigerator
4) Other (Explain)_____

6.How do you evaluate the breast milk's/formula's temperature before giving it to the infant?

1) The inner wrist
2) By measuring the temperature with an infrared thermometer
3) By measuring the temperature with a liquid thermometer
4) Other (Explain)_____

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