

# Neonatal Hypothermia and Associated Risk Factors at Baby Friendly Hospital in Babol, Iran

Delavar MA, Akbarianrad Z<sup>1</sup>, Mansouri MM<sup>2</sup>, Yahyapour M<sup>2</sup>

Fatemezhra Infertility and Reproductive Health Research Center, Department of Midwifery, Babol University of Medical Sciences, Babol, <sup>1</sup>Non-Communicable Pediatric Disease Research Center, Department of Pediatrics, Babol University of Medical Sciences, Babol, <sup>2</sup>Student Research Committee, Babol University of Medical Sciences, Babol, Islamic Republic of Iran

## Address for correspondence:

Dr. Mouloud Agajani Delavar,  
Department of Midwifery,  
Babol University of Medical Sciences,  
Ganjafroz 2247136 Babol,  
Islamic Republic of Iran  
E-mail: moloodaghajani@yahoo.com

## Abstract

**Background:** Thermal care is an important element of Baby Friendly Hospital. **Aim:** The objective of this study was to determine the prevalence of neonatal hypothermia and associated risk factors in healthy full term newborns at a Baby Friendly Hospital. **Subjects and Methods:** A cross-sectional, descriptive study was conducted on consecutively healthy full term neonates recruited during a 1 year. Temperatures were recorded immediately after birth and at the age of 1, 2 and 4 h after birth in order to estimate the prevalence of neonatal hypothermia, defined as axillary temperature less than 36.0°C. The data were collected using an especially questionnaire; data of history of abortion, parity, mode of vaginal delivery, gestational age, birth weight, newborn temperatures, time of the first skin-to-skin contact, time of first breast feeding, first wrapping and first visiting by the pediatrician. Association between neonatal hypothermia and risk factors was determined using logistic regression. **Results:** Axillary temperature showed 41.2%, 47.5%, 46.4% and 37.2% of the a consecutive number of 522 healthy full term neonates were moderately hypothermia immediately after birth, at 1 h, 2 h and 4 h respectively. Spontaneous labor and warming room were associated with decreased risk of hypothermia. A persistently high prevalence of neonatal hypothermia was shown within the first 4 h of vaginal birth. All analyses were carried out using the SPSS version 17.0 (Chicago IL, USA). Test of the associations were done, stepwise multiple logistic regressions. Odds ratios (ORs) were assessed using maximum likelihood and associated 95% confidence intervals were computed. A  $P \leq 0.05$  was considered to be statistically significant **Conclusion:** The findings of this study indicated that a high prevalence of neonatal hypothermia was identified among healthy full term newborn in a Baby Friendly Hospital Initiative. Therefore, it is necessary to emphasize on the development “warm chain” in preventing neonatal hypothermia in Baby Friendly Hospital.

**Keywords:** Baby-friendly, Hospital, Hypothermia, Ira, Newborn

## Introduction

Neonatal hypothermia is an important contributing factor to neonatal mortality and morbidity in both developed and developing countries,<sup>[1-5]</sup> especially in developing countries including Iran.<sup>[6-8]</sup> The World Health Organization (WHO)

Maternal and Child Health program has issued guidelines for prevention of neonatal hypothermia as one of the elements of essential care in newborn at birth and in the 1<sup>st</sup> day of life.<sup>[9]</sup> Thermal care (including the prevention of neonatal hypothermia) is an important element of Baby Friendly Hospital Initiative led by WHO and United Nation Children’s Fund.<sup>[10]</sup> In year 1991, Iran was considered the global leader in term of Baby Friendly Hospital Initiative implementation; 516 hospital in this country have been designated as Baby Friendly Hospital.<sup>[11]</sup> However, Yahanejad Hospital received the Baby Friendly certification graded in 1995. It is suggested that there has been limited progress in preventing of neonatal hypothermia even in healthy full term and vaginal birth newborn.<sup>[6]</sup> Therefore, it is critical to obtain accurate

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information on the prevalence of neonatal hypothermia in healthy full term and the possible associated risk factors in order to determine the magnitude of the problem. This was to ascertain whether the 10 steps of warm chain has become part of routine care of the newborn in the hospital.

## Subjects and Methods

This study was conducted at Yahyanejad Hospital, Babol, Iran, between April 2011 and March 2012. During the period, a consecutive number of 522 healthy full term neonates were recruited for assessment of body temperature at regular interval postpartum. The ethics committee of Babol University of Medical Sciences approved the study. Informed written consent was obtained from all pregnant women with vaginal delivery in labor. Exclusion criteria included women with premature labor, prolonged rupture of membranes (>18 h), hypertension, Apgar score less than 7 at 5 min, signs of illness or congenital abnormality. Each vaginal delivery was monitored and managed according to hospital protocol. After vaginal delivery, each newborn was dried and placed in the incubator or under radiant warmer or kept with blanket in an open cot and then dressed. Mother and newborn shared a single bed together in the postpartum room. Intimate skin-to-skin contact between mother and newborn was not practiced except during breast feeding. The hospital had central heating and cooling system. The newborn was not bathed on the 1<sup>st</sup> day. After delivery, the newborns were assessed and body temperature was measured using an axillary digital thermometer (Auxiliary Micro Life MT 3001). Temperatures were recorded immediately after birth in the delivery room and at 1, 2 and 4 h of life. The measuring range of this thermometer was 32-42°C with the nearest tenth of degree accuracy. The thermometer sensor was sterilized with 70% alcohol before each use. After the button power was activated the digital thermometer was put with the sensor in the newborn armpits and turns on, waiting until the alarm sounds. The measurement was done and the score on the screen showed measured body temperature.

Temperature criteria were based on the WHO classification of hypothermia and a temperature was 36.0-36.4°C defined as mild hypothermia, 32.0-35.9°C as moderate hypothermia and below 32.0°C as severe hypothermia.<sup>[12]</sup>

In the 1991 guideline of WHO, it was recommended that rectal temperature should be limited; and axillary temperature should be used routinely for the newborn. Based on the WHO (1991), an axillary temperature less than 36.0°C was defined as hypothermia.<sup>[9,13]</sup> In this study to better examine the risk factors associated with hypothermia, it has been defined as axillary measures of less than 36.0°C as neonatal hypothermia.

Since at the time of this study, data of first skin-to-skin contact, time of first breast feeding, first wrapping, newborn temperature and first visiting by the pediatrician was not

recorded in neonate's hospital document. The questionnaire was valid and reliable as the Cronbach's  $\alpha$  was calculated to be 0.80.

In order to consider the possible of seasonality on the prevalence of neonatal hypothermia, the temperature measurements were conducted in all the four seasons of the year.

All analyses were carried out using the SPSS version 17.0 (Chicago IL, USA). To test the associations between various with neonatal hypothermia, stepwise multiple logistic regressions were used. Odds ratios (ORs) were assessed using maximum likelihood and associated 95% confidence intervals were computed. All independent variables that met the above criteria were included in the multiple logistic models. A  $P \leq 0.05$  was considered to be statistically significant.

## Results

A total of 522 women with vaginal delivery participated in the study. The vaginal delivery with episiotomy rate was 82.6% (431/522) and the vacuum extraction rate 0.8% (4/522). The mean standard deviation (SD) birth weight was 3347.3 (413.2) g with 14.0% (73/522) having a weight lower than 2500 g. Gestational age ranged between 37 and 41 weeks, with a mean (SD) of 39.0 (1.0) weeks. Table 1 shows the distribution of parturient women and their newborn. There were 478 (91.6%) women who never had any abortion [Table 2]. The room temperature was at least 25°C. Axillary temperature taken at the time period just after birth, 60, 120 and 240 min showed that 215 (41.2%), 248 (47.5%), 247 (46.4%) and 194 (37.2%) respectively were hypothermia, defined as axillary temperature below 36.0°C. The ranges of temperatures were between 31.0°C and 38.0°C.

Table 2 shows the number of hypothermic newborn at different time periods based on WHO classification for hypothermia.<sup>[12]</sup> Summing up the data for mild, moderate and severe hypothermia shows that 84.5% were hypothermic immediately after birth, 444 (85.1%) 1 h after birth, 452 (86.6%) 2 h after birth and 427 (81.8%) 4 h after birth based on WHO classification. However risk factors for newborns hypothermia differed by interval from birth to time of temperature measurement, the time period just after birth and a 4 h, persistent pattern of hypothermia has shown.

Immediately after birth, all newborns were observed to have no body contact with the mother. A statistically significant difference was seen between hypothermia and temperature of the delivery room ( $P < 0.01$ ). The prevalence of neonatal hypothermia was significantly observed more in temperature of the delivery room than in those with temperature >27.5°C. Parity, abortion, gestational age, newborn weight did not differ significantly when newborns babies with hypothermia and those without hypothermia were compared.

Table 3 shows that on bivariate analysis at 4 h after birth, temperature of postpartum room below 27°C ( $P < 0.01$ ) and delivery room below 27°C ( $P < 0.01$ ) were associated with high prevalence of hypothermia. The adjusted OR for neonatal hypothermia in women whose had Spontaneous vaginal delivery was significantly lower than in those with episiotomy ( $P < 0.01$ ). After adjusting confounding factors, no significant association was found for parity, abortion, gestational age, delayed appropriate clothing and skin-to-skin contact and neonatal hypothermia problems.

**Table 1: Distribution of parturient women and their newborn in relation on to newborn temperature control ( $n = 522$ )**

Variables	N (%)
Parity	
0	243 (46.6)
1	216 (41.4)
≥2	63 (12.1)
Abortion	
0	418 (91.6)
≥1	44 (8.4)
Mode of current vaginal delivery	
Spontaneous vaginal delivery	87 (16.7)
Vaginal delivery with episiotomy	431 (82.6)
Vacuum extraction	4 (0.8)
Birth weigh	
Low birth weight <2500 g	73 (14.0)
Normal birth weight ≥2500 g	449 (86.0)
Temperature of delivery room	
≤27.5°C	321(61.5)
>27.5°C	201 (38.5)
Gestational age	
37-39 weeks	347 (66.5)
>39 weeks	175 (33.5)
Appropriate clothing initiation	
≤20 min	432 (82.8)
>20 min	90 (17.2)
Skin-to-skin contact initiation	
<20 min	44 (8.4)
20-35 min	390 (74.7)
>35 min	88 (16.9)
Breastfeeding initiation	
≤20 min	293 (56.1)
>20 min	229 (43.9)
Timing to visiting baby by pediatric	
≤8 h	395 (75.7)
>8 h	127 (24.3)

## Discussion

The exact prevalence of neonatal hypothermia in Iran is unknown. The results of this study showed that the overall prevalence of neonatal hypothermia (axillary temperature <36°C) were high among healthy full term newborn in a Baby Friendly Hospital Initiative. However, it is difficult to generalize this prevalence to neonatal hypothermia in Iran because this study was conducted in only one Baby Friendly Hospital Initiative.

However, at the Yahaynejad Hospital, temperature of the newborns is not checked routinely and incubator or radiant heater is just used to re warm newborn babies. The mercury-in-glass thermometer is just used to check of mother temperature routinely. The 10 step of “warm-chain” who included drying immediately, keeping the baby with the mother, delayed bathing, skin-to-skin contact, breastfeeding, sufficient wrapping of the baby after birth, sufficient warmed room, warm transport (if necessary) and warm resuscitation were applied in the hospital at birth and during the following hours. In spite of development, neonatal hypothermia occurred frequently as in other studies undertaken in developing countries. [14, 15]

A study by Ogunlesi *et al.* [14] evaluated temperature of a Nigerian Neonatal Unit healthy within the first 72 h of life. The prevalence of hypothermia (axillary temperature less than 36.5°C) at 6 h after birth was similar to that found in the present study (80.6%).

However, the prevalence of neonatal hypothermia in developed countries is usually lower than that in developing countries. It is mostly confined to low birth weight, preterm and other high risk neonates. In California, prevalence of neonatal hypothermia among very low birth weight was 56.2% on admission of neonatal intensive care units. [16] Zayeri *et al.* in a study in Tehran using rectal temperature found that prevalence neonatal hypothermia (<36.5°C) at 20 min after birth was 53.3%. [17] These findings suggest that neonatal hypothermia is common in Iran, even in healthy full term following vaginal birth. Therefore, follow-up interventions in the community in order to determine the magnitude of the problem among newborns delivered at Baby Friendly Hospital.

We found decreased odds of hypothermia for spontaneous vaginal delivery and warming room. We speculate that the

**Table 2: The number and percentage of newborns with hypothermia at different time periods ( $n = 522$ )**

Temperature (°C)	Immediately after birth	1 h	2 h	4 h
	N (%)	N (%)	N (%)	N (%)
Normothermia (36.5-38.0°C)	81 (15.5)	78 (14.9)	70 (13.4)	95 (18.2)
Cold stress (<36.5°C)	226 (43.3)	196 (37.5)	210 (40.2)	233 (44.6)
Moderate HT (32-35.9°C)	215 (41.2)	247 (47.3)	247 (46.4)	194 (37.2)
Sever HT (<32°C)	0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)

HT: Hypothermia

**Table 3: Adjusted OR<sup>a</sup> from multiple logistic regression models for the association of various factors and neonatal hypothermia of healthy newborn at 4 h after birth with various factors**

Variables	OR	CI (95%)	P value
Gestational age			
37-39 weeks	1.29	0.89, 1.87	0.18
>39 weeks	1.00		
Parity			
0	0.71	0.39, 1.29	0.26
1	0.69	0.38, 1.27	0.23
≥2	1.00	1.00	
Abortion			
0	1.32	0.70, 2.46	0.39
≥1	1.00		
Mode of current vaginal delivery			
Spontaneous vaginal delivery	0.33	0.20, 0.52	<0.001
Vaginal delivery with episiotomy	1.00		
Temperature of delivery room			
≤27.5°C	3.54	2.43, 5.14	<0.001
>27.5°C	1.00		
Temperature of postpartum room			
≤27.5°C	1.91	1.30, 2.82	<0.001
>27.5°C	1.00		
Appropriate clothing imitation			
≤20 min	1.53	0.96, 2.42	<0.01
>20 min	1.00		
Skin-to-skin contact initiation			
≤20 min	2.33	0.99, 5.46	0.51
20-35 min	0.94	0.58, 1.51	0.80
>35 min	1.00		
Breastfeeding initiation			
≤20 min	0.96	0.61, 1.38	0.84
>20 min	1.00		
First visiting baby by pediatric			
≤8 h	0.41	0.26, 0.65	<0.001
>8 h	1.00		

OR: Odds ratio, CI: Confidence interval, <sup>a</sup>OR mutually adjusted for the entire variable reported in the table

reason for no other confounding variables associated with hypothermia may be due to the likelihood that lack of premature labor, prolonged rupture of membranes, cesarean section, low Apgar score in the study population. In addition hypothermia was not found to be associated with keeping mother and baby together, skin-to-skin contact, gestational age, delayed appropriate clothing, breastfeeding. A possible explanation for the lack of association is the distribution of our subjects in this study.

This study used the cross-sectional design to determine the associated risk factors in healthy full term newborns at a Baby Friendly Hospital, whereas future studies that use longitudinal data will provide stronger evidence on this association. However, appropriate analysis of cross-sectional data will provide a valuable initial step in identifying relations between risk factors and neonatal hypothermia. Some previous studies

of neonatal hypothermia used rectal temperatures for body temperature in the newborn. [17, 18] In addition, the digital axillary thermometry was used for definition of neonatal hypothermia. This could result in misclassification due to errors in the defining hypothermia. However, Padilla-Raygoza *et al.* has shown that the digital axillary thermometry is the best choice for measuring body temperature compared with skin and other thermometry. [19]

Selecting inclusion and exclusion criteria for the study, using four observations during the study period for recording body temperature of newborn without any intervention and using multivariable (adjusted OR) analysis at the analysis stage could be strength of the study.

Despite the limitations and strengths mentioned, this study has an important implication for future research and program. It seems that health workers were relatively unaware of the guidelines of the Baby Friendly Hospital Initiative. Therefore, assessment of newborn care ward routines among in the initial newborn period should be important in preventing heat losses.

The results of this study may be useful in order to develop “warm chain” for preventing neonatal hypothermia in Baby Friendly Hospital. This suggestion raises the question of whether “regular monitoring of armpit temperature newborn through a digital thermometer” should be added as one step to 10 steps of warm-chain, or it is more cost effective to focus on the preventing of neonatal hypothermia in the 1<sup>st</sup> day of life.

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