

Research Article

# Effects of Swaddle Bath on Temperature, Heart Rate and Oxygen Saturation in Premature Infants

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**Abstract.** Indonesia has the fifth highest rates of preterm birth. The action of premature infants bathing every day may result in stress. A swaddle bath is a technique of bathing to provide the feeling of the womb so that babies feel comfortable and avoid stress, shown by stability of vital signs and a lack of stress behavior. The purpose of this research was to examine the effects of a swaddle bath vs. conventional bath methods on the temperature, heart rate and oxygen saturation of premature infants. This research was a quasi-experimental pretest-posttest study with a control group. The 50 participants were divided into the swaddle bath group (n = 25) and the conventional bath group (n = 25). The inclusion criteria were: gestation age = 30-36 weeks, temperature > 35°C and ≤ 37.5°C, SpO<sub>2</sub> = 90-94%, body weight ≥ 1,500 grams, and not in intensive care. Before and after bathing, the baby's temperature was measured with an axilla thermometer, heart rate with a stethoscope and oxygen saturation with a pulse oximeter. The data were analyzed using the Wilcoxon test and Mann-Whitney test. The results showed that there was no significant difference in the temperature, heart rate or oxygen saturation before vs. after the swaddle bath (p= 0.087, p = 0.55, p = 1.00, respectively). However, there was a significant difference in the temperature, heart rate and oxygen saturation after the swaddle bath compared with the conventional bath (p = 0.019, p = 0.041, p = 0.024, respectively). We can conclude that the swaddle bath affected the temperature, heart rate and oxygen saturation in the premature infants and that the vital signs remained stable and normal.

**Keywords:** conventional bath, heart rate, oxygen saturation, premature, swaddle bath

## 1. Introduction

The United Nations (UN) data is said to have 15 million premature infants annually in the world. This number continues to increase annually. Indonesia ranks in five countries with the highest premature births after India, China, Nigeria, and Pakistan [1]. Various risks of health disorders can be experienced by premature infants due to the functions and systems of the body that are not yet perfect, so that premature infants need intensive care in the Perinatology room and the Neonatal Intensive Care Unit (NICU) [1]. The environment and invasive or non-invasive actions at the time of treatment can be a stress

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trigger for premature infants [2]. Exposure to stress in infants can lead to prolonged crying, changes in vital signs and can affect brain development [3].

If the incidence of stress in the premature infant is not anticipated. The premature infant will have difficulty in increasing her weight because the energy has been depleted due to stress response and experiencing impaired neurological development and behavior in the future [4]. Non-invasive measures performed daily and may result in the stress of the infant is bathing [1, 5]. The stress response demonstrated by premature infants during the bathing procedure can be crying, tremor, grimace, loss of body temperature, and changes in vital signs [6, 7] Currently developed research on the use of Swaddle during tub bathing, known as swaddle bath. The aims of swaddle bath are to provide comfort such as when still in the womb [8]. When premature babies feel comfortable then the baby will be avoided from stress. This is demonstrated by stables of vital signs and no stressful behavior. Infants will have time to sleep and have sufficient energy for the growth and development of various organ systems [1, 8]. The core problem that needs to be researched further is the effectiveness of swaddle bath against the stress response of premature infants during the bathing process characterized by changes in the vital signs and the duration of crying.

Al Ihsan Hospital is the District public Hospital (RSUD) owned by the government of West Java. They have baby care room facilities Level 1 and Level 2. This makes the Al-Ihsan Hospital as a referral place for premature birth cases in the area of West Java. The study of Swaddle bath effect on the physiological and psychological conditions of premature infants has never been done in the hospital. Currently research on the influence of bathing towards premature infants in the Al Ihsan Hospital was limited to the conventional bath techniques. The purpose of this research was to determine the effectiveness of swaddle bath and conventional bath on premature infants' vital signs (temperature, heart rate and SpO<sub>2</sub>) level.

## 2. Methods

The research design to be used was quasi-experimental pretest-posttest control group design. Variable Independent in the intervention group was swaddle bath while in the control group was conventional bath. The dependent variables for this study were the vital signs consisting of temperature, heart rate and SpO<sub>2</sub>. The design of this research is as follows:

The population of this research was premature infants with the aged 30-36 weeks. The sample size was calculated to be 50 premature infants with the following inclusion and exclusion criteria:

1. Criteria of inclusion

1. Premature infants in stable condition (S:  $> 35^{\circ}\text{C}$ - $< 37.5^{\circ}\text{C}$ ;  $\text{SpO}_2$  90-94%)

2. The weight of infants before bathing is  $\geq 1500$  grams

3. The premature infants was not in the NICU

## 2.1. Data Collection

This research instrument consists of data collection instruments and interventional instruments. The data collection instruments used an axilla thermometer, oxymetry, stethoscope, and stop watch. While the intervention instrument in the form of check list procedure swaddle bath and conventional bath.

The data collection techniques were done with the following steps. After the preparation of the environment and the bathing tools were completed, nurses bath hands and wore personal protective equipment. The pre test was done by measuring the temperature, heart rate and  $\text{SpO}_2$  before giving bath. Premature infants were swaddled with a soft cloth and warmed before being immersed in warm water with temperature  $37.7^{\circ}\text{C}$ - $38.3^{\circ}\text{C}$  in midline flexion position with water depth under the shoulder. Then the baby is bathed using a washcloth and soap ranging from the face, neck, chest, stomach, genital and back for 5 minutes. After finishing the baby in the swaddle back using a soft and warm cloth. After completion of the baby's completed re-measured temperature, heart rate and  $\text{SpO}_2$  post bathing. The baby control group was washed with conventional bath techniques without swaddle.

The principles of the justice ethics was done by giving bath each respondent. The beneficence principle was done by conducting a test of ethics for the bathing protocols, in collaboration with the room nurses who have experienced in conducting swaddle bath and conventional bath, in cooperation with the doctor in charge To monitor patient safety during the implementation of interventions. The principle of autonomy ethics will be applied by giving freedom to the baby's parents to participate in or not in this research after informed consent.

## 2.2. Data Analysis

The univariate analysis was performed on demographic characteristics data using average description statistics. Test results of the normality of research data were not normal distribution so using Wilcoxon nonparametric statistic test to determine the average difference before and after action on group intervention and control group. Mann Whitney's nonparametric statistic test was conducted to determine the average difference between two non-paired (independent) groups. The median difference in the heart rate and oxygen saturation after an action on the intervention group and control group.

## 3. Results

The results of demographic characteristics in both groups do not show meaningful differences, including gender, gestation age, infant weight, and the age of the baby when they are bath (table 1).

The research results in the control group in table 2, the mean rank of temperature, heart rate and oxygen saturation of infants premature before being bath with conventional bath techniques are 0.00, 11.31 and 10.75. While the temperature, heart rate, oxygen saturation after the mean rank is 13.00, 14.50, and 13.08. The test result statistic obtained the value  $P = 0.000$  (temperature), value  $P = 0.045$  (heart rate), and  $P = 0.013$  ( $SpO_2$ ). With the alpha 5% there was a significant difference temperature, heart rate, oxygen saturation of infants premature between before and after being bath with the technique conventional bath. This suggested that the conventional bath was less secure for infants premature because it causes changes in temperature, heart rate, and oxygen saturation after being bath.

The results of the research in the intervention Group on table 3, obtained mean rank of temperature, heart rate and oxygen saturation of infants premature before being bathed in the technique swaddle bath was 7.10, 8.25 and 6.50. While the mean rank of temperature, heart rate and oxygenated saturation were 9.14, 12.00 and 6.50. The test results statistic obtained  $P = 0.087$  (temperature),  $p = 0.55$  (heart rate), and  $P = 1.00$  ( $SpO_2$ ) values. It can be deduced in Alpha 5% there was no significant difference temperature, the heart rate and oxygen saturation of infants premature between before and after being bath with the technique of swaddle bath. It means that swaddle bath was safely done in infants premature because it does not cause changes in temperature, heart rate and oxygen saturation after premature infant were bath.

The results of the research in the control group compared with the intervention group in table 4. It was derived that the mean rank of the temperature after conventional bath was 20.70 and after swaddle bath 30.30. Test result statistic obtained value  $P = 0.019$  with alpha 5% there was a significant difference in the temperature of the infant premature infants who was bath by the technique conventional bath with the technique swaddle bath. Result mean rank heart rate after conventional bath was 29.68 and after swaddle bath 21.32. Test result statistic obtained value  $P = 0.041$ , with alpha 5% there was a significant difference in the heart rate of premature infants between who was bath by the technique conventional bath with techniques swaddle bath. Similarly, the mean rank of oxygen saturation after conventional bath was 20.96 and after swaddle bath 30.04. Test result statistic obtained value  $P = 0.024$ , with Alpha 5% there was a significant difference in oxygen saturation of infant premature between infants were bath with techniques conventional bath with techniques swaddle bath.

## 4. Discussion

### 4.1. The average of temperature, heart rate and $SpO_2$ in premature infants before Conventional Bath and Swaddle Bath

This research was done with the aim of knowing the effectiveness of swaddle bath against the vital signs (temperature, heart rate and oxygen saturation) premature infants compared to conventional bath. The results showed that the infant's temperature, heart rate, and oxygen saturation between before and after being bath with conventional bath techniques were significant differences. This suggested that the conventional bath was less secure for infants premature because it causes changes in temperature, heart rate and oxygen saturation after being bath. While in infants premature were bath with the technique swaddle bath no significant difference temperature, heart rate and oxygen saturation before and after being bath. It means that swaddle bath was safer and effectively done in infants premature because it did not affect the change in temperature, heart rate and oxygen saturation.

Swaddle bath was a comfortable bathing procedure and adopted by the healthcare provider as a non-pharmacological action to reduce pain and stress compared to administering an analgesic and provide a calmy effect [9]. Swaddling improved the stability of physiological parameters and reduced signs of stress. The study statistic was not found significant differences in the heart rate and oxygen saturation in infants in swaddle and control groups. The baby's environment was well controlled, such as

TABLE 1: The characteristics of premature infants demographics on intervention groups and control groups

Variable	Swaddle bath n=25	Conventional bath n=25
Boy	12	13
Girl	10	12
Gestational Age	35.84	35.84
Baby body weight	1903.2	1796.8
Gestation during bathing	4.32	8.88

TABLE 2: The Average distribution of temperature, heart rate and oxygen saturation (SpO<sub>2</sub>) in premature infants before and after Conventional Bath in the control group

Variable	N	Mean Rank	P-Value
Temperature Pre-test	25	0.00	0.000
Post-test	25	13.00	
Heart rate Pre-test	25	11.31	0.045
Post-test	25	14.50	
SpO <sub>2</sub> Pre-test	25	10.75	0.013
Post-test	25	13.08	

deep water depth for soaking, water temperature, nurse handling during the procedure to avoid the counfounding in other groups. [8]

Other research results showed significant differences in statistic between two methods of bathing, there were sponge bath and swaddle bath on vital signs, levels of oxygen saturation and crying time. The results of the Caka study (2017)[10] showed that although the oxygen saturation (SpO<sub>2</sub>) before being bath in a significant low intervention group (P = 0.003) compared to the control group. But after being bath SpO<sub>2</sub> the baby increases. The results of this study indicated that swaddle bath gave babies more relaxation than traditional tub bathing [10]. Swaddle Bath had a positive effect on the vital signs, oxygen saturation, crying time, pain and stress levels. Swaddle Bath was a safe act and did not harm premature infants [11].

TABLE 3: The average of temperature, heart rate and oxygen saturation (SpO<sub>2</sub>) in premature infants before and after Swaddle Bath on the intervention group

Variable	N	Mean Rank	P-Value
Temperature Pre-test	25	7.10	0.087
Post-test	25	9.14	
Heart rate Pre-test	25	8.25	0.55
Post-test	25	12.00	
SpO <sub>2</sub> Pre-test	25	6.50	1.00
Post-test	25	6.50	

TABLE 4: The average distribution of temperature, heart rate and oxygen saturation (SPO<sub>2</sub>) In Premature Infants after Conventional Bath and Swaddle Bath

Variable	Measurement	N	Mean Rank	P Value
Temperature	Post Con.Bath	25 25 25	20.70 30.30	0.019<0.05
Heart rate	Post Swa.Bath	25 25 25	29.68 21.32	0.041<0,05
SpO <sub>2</sub>	Post Con.Bath		20.96 30.04	0.024<0,05
	Post Swa.Bath			
	Post Con.Bath			
	Post Swa.Bath			

## 4.2. The average of temperature, heart rate and oxygen saturation in premature infants after Conventional Bath and Swaddle Bath

### 4.2.1. The Temperature

There were statistically significant differences between bathing methods on temperature, heart rate and oxygen saturation levels. The premature infants could still maintain their body temperature and did not suffer from loss of heat by swaddle bath technique. In the results of the study average temperature of the body of premature infants before being bath 36.9 °C and after being bath 37 °C. The use of swaddle technique during bathing of babies will provide comfort such as when still in the womb by creating an environment similar to the warm uterus. One of the advantages of this bathing method was reduce the temperature change in neonatal [8]. Swaddle Bath showed as a bathing technique that reduced the most stress and safest stress to avoid large temperature changes in premature infants. The premature infant's body temperature has decreased less than the other bathing types [1, 8, 12]. Swaddle bath techniques do covering and immersing newborn babies, thereby reducing heat loss through radiation, conduction and evaporation [12]. If the bathing process causes the infant hypothermia then other negative effects will occur such as hypoxemia and hypoglycemia [1, 12].

This was relevant to previous research that temperature loss were significantly smaller in the technique of bathing swaddle bath compared to conventional bath, as well as with less crying time. The positive effect of swaddle bath was maintains body temperature [1] and reduced neonatal stress when bath. The newborn body temperature in the group Swaddle Bath as soon as it was bath and after 10 minutes was significantly more high compared to the traditional tub bathing group [10]. The Swaddle bath method was convenient and suitable in neonatal premature at NICU. [1]

The temperature of the body in this regard as a vital sign, was the most frequently observed part of the research on the neonatal bathing procedure due to the most easy neonatal loss of heat when bathing [13]. In addition, a low-temperature environment

could reduce the infant's body temperature during bathing. The study showed that the baby's body temperature decreased in such a way during a bath regardless of whether the baby was wrapped or not. Contrary to this study randomly obtained clinical trials at 50 premature infants that the body temperature was significantly higher on babies who waddle bath [1].

Comparison of conventional bath and swaddle bath in infants showed that the body temperature after bathing was lower in the conventional bath group [1]. It could be noted that swaddle bath was a bathing technique that produces the variation in body temperature changes and sponge bathing was one of the causes of changes the infant's body temperature, although the evidence was still limited.

#### 4.2.2. The Heart Rate

The results of the study obtained there was significant difference in the heart rate of premature infants between conventional bath and swaddle bath. The results of this study were a heart rate of premature infants before being bath 140 x/min and after being bath at 140 x/min. This means there was no change in the hear rate although it was already bathing with swaddle bath. This suggests that swaddle bath was better than conventional bath.

The same previous research that sponge bathing has been showed to significantly increase heart rate, respiratory rate and decreased vagal tone [14, 15]. Similarly, the infant's heart rate was higher in the traditional group tub bathing after the period was bath. The heart rate on the Swaddle Bath group was significantly lower than the traditional tub bath after being bath ( $P = 0035$ ), it was recommended that babies bathe more comfortably with the technique of swaddle bath [10].

If the premature infant's heart rate decreases BMJ Best Practice (2011) contributes if the infant's heart rate less than 100x/minute to be given additional oxygen or fluid drip. If the heart rate decreases below 60x/minute the team will do CPR, as well as provide fluid and medication through drip for the premature infant.

In addition, if there was destabilization of body temperature, and the presence of stimulation handling during sponge bathing could increase the heart rate and decrease the oxygen saturation level of infant premature [15]. His research results showed the clinical stabilization of vital marks (e.g., decreased heart rate and increased oxygen saturation), and the comfort of babies based on behavioral observations, regardless of the type of bath whether conventional or swaddle bath.



### 4.2.3. The Oxygen Saturation Level

The results of the research obtained there was significant difference in oxygen saturation of infants premature between conventional bath and swaddle bath. In the results of this study the average oxygen saturation (SpO<sub>2</sub>) of premature infants before being bath 98 and after being bath 98. That means there was no change SpO<sub>2</sub> although it was already swaddle bath. It showed that swaddle bath was safe for premature infants. The negative stress in premature infants affects growth and development and also leads to decreased oxygen saturation [16, 17]. It was supported by other research results where it was indicated that swaddle bath effectively maintains the level of SpO<sub>2</sub> newborn babies within normal limits and lowers the stress experienced during bathing [10].

The behavior of nurses with infant premature was factor that affects of stress. All treatment actions lead to increased neonatal stress, especially when babies were bath. The results of the study proved that supportive and protective behavior of nurses significantly reduced the stress levels of premature infant and helped the infant to cope with stress in a more positive and calm way with the process of bathing [18, 19].

## 5. Conclusion

The results of the study gained that the premature infant that was no significant difference in vital signs before and after being swaddle bath. It means that swaddle bath was safer and effectively done in premature infants because it did not affect the change in temperature, heart rate and oxygen saturation. The average of the body temperature of premature infants after being bath was not decreased, thus increased slightly. Swaddle Bath could maintain the premature infant's body temperature. Similarly, the heart rate and oxygen saturation (SpO<sub>2</sub>) of premature infants before and after swaddle bath were still no change.

The findings recommended that Swaddle Bath was safe and effective bathing technique for premature infants in perinatology and NICU. Future research could further explore the influence of swaddle bath on physiological and behaviors changes in premature infants more comprehensively and other condition of infants such as hyperbilirubinemia and low birth baby.

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## Conflict of Interest

We declare no conflict of interest for this study.

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