The Effect of Swaddle Bath in the Thermoregulation and Quality of Sleep among Infants

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Abstract: Provision of routine newborn care, specifically bathing has a significant impact to maintaining effective thermoregulation and improving quality of sleep among infants. Thermoregulation is the ability to balance heat production and heat loss in order to maintain body temperature with certain normal range. On the other hand, rocking an infant to sleep is being done to provide warmth and security. This study determined the effect of swaddle bath in the thermoregulation and quality of sleep among infants in the community. This quantitative, quasi-experimental, pre-posttest research design compared Swaddle and Conventional Bath on the thermoregulation and quality of sleep among 36 infants using a self-made research tool adapted from the Brief Infant Sleep Questionnaire (BISQ). A purposive sampling design was used; eighteen participants were assigned in the experimental group and another eighteen in the control group. Weighted mean measured the average difference on the temperature and quality of sleep of the experimental group before and after receiving the Swaddle Bath. T-test evaluated the significant difference between the temperature and quality of sleep of both groups. The study showed that there is a significant difference on the thermoregulation of the infants before and after the bath in the swaddle bath group. Moreover, there is a significant difference between the swaddle and conventional group in terms of the average number of wakefulness and duration to put the infant to initial sleep. Overall, swaddle bath is effective in maintaining thermoregulation and improving quality of sleep among infants.

Keywords: *swaddle bath; conventional bath; infant; thermoregulation; sleep pattern*

1. INTRODUCTION

Mothers have great responsibility in the provision of care to their infants specifically in helping them adapt and survive in the extrauterine environment. Thermoregulation and quality of sleep plays a big role on infant's survival.

One of the factors that might affect these is the provision of routine newborn care, specifically bathing. Initial conventional bathing is usually provided early in the neonatal period to decrease the transmission of communicable diseases via blood and body fluid contact. Aside from its significance of preventing cross contamination of body fluids between the newborn and the health care provider, it is also noted to influence successful extra uterine transition and parental bonding (Sarkar, Basu, Agrawal, & Gupta. 2010). Despite such advantages, studies have shown that standard newborn baths increase infant and parental stress, decrease thermoregulation and impair self-regulation of the newborn (Loring et al., 2012; Sarkar et al. 2010).

To ensure infants' successful transition to extra uterine life, provision of supportive care to reduce infant thermal and developmental stress during the initial bath is necessary. In the study of Quraishy, Bowles, and Moore (2013), swaddle bathing was recognized as an evidence-based bathing practice for newborn infants. This consists of bathing an infant while swaddled in a flexed, midline position. The swaddled infant is immersed into a tub of water to the level of the infant's shoulders. Each limb is separately unwrapped, gently washed, rinsed, and re-swaddled keeping the infant in a contained position throughout the bath. Swaddled bathing has been known to help infants to become calm and peaceful (Quraishy, Bowles, & Moore, 2013).

Several studies also support the claim of using swaddle bath to maintain stable thermoregulatory status among infants. In the study conducted by Swapna et al. (2017) among 60 stable preterm infants during hospitalization, results revealed that swaddle bath was found to be relatively effective in maintaining thermal stability for prolonged period of time and reduces crying duration. Moreover, another study considered swaddle bathing as a low-stress and appropriate bathing method for premature infants as evidenced by significantly less mean temperature loss among swaddle-bathed newborns compared to the conventionally bathed newborns (Edraki, Paran, Montaseri, Nejad, & Montaseri, 2014).

Swaddle bath is also known to have a significant impact in promoting effective sleep pattern among infants, as evidenced by reduce behavioral stress signs such as absence of extended limbs, back arching, splayed fingers saluting across the face, hiccupping, fussing and crying. Infants are also observed to either remain in light sleep/semi dozing or are awake; maintaining a quiet alert state (Sarkar et.al. 2010).

The objective of this study is to determine the effect of swaddle bath on the temperature and quality of sleep among infants in the

community setting since previous studies were conducted among preterm infants in the hospital setting.

2. METHODOLOGY

The researchers adopted a quantitative, quasi-experimental pre-posttest research design to compare the relative outcomes of swaddle bath and conventional bath on the thermoregulation and quality of sleep among infants. The participants were assigned into two groups wherein the experimental group received Swaddle bath and the control group received conventional bath. The infant's temperature and quality of sleep were assessed before the baths and after the baths.

The research locales of this study are the chosen barangays in Sampaloc, Manila. Prior to data gathering, Barangay 401 was used for pilot testing. Barangay 432, 458 and 429 are the areas chosen for the actual data gathering.

A purposive sampling design was used based on the following inclusion and exclusion criteria:

Inclusion Criteria:

1. Infants whose umbilical cord falls off.
2. Infants with postnatal age of 1-11 months
3. Infants with stable physiological parameters
   - Heart rate (120-160 beats/min)
   - Respiratory Rate (30-60 breaths/min)
   - Oxygen Saturation (95-99%)
4. Infants whose parents had read, understand and signed the informed consent

Exclusion criteria:

1. Infants with parents who are not willing to participate
2. Infants who have heart disease, respiratory disease, hyperthermia, fever, cough and colds and other diseases.

There were 36 infants included in the study, wherein eighteen (18) of them were assigned in the experimental group and another eighteen (18) in the control group.

Before the actual data gathering, the researchers secured an informed consent along with the information sheets among the mothers of the infants. This ensured full cooperation and understanding of the intervention provided to their infants.

Several tools were used as instruments: self-made questionnaire, observation sheet and sleep diaries. The self-made research questionnaire measures the quality of sleep of the infant from 9am to 9pm. It is adapted from the Brief Infant Sleep Questionnaire (BISQ) which is correlated

significantly with sleep measures derived from actigraphy and sleep diaries. It has two parts: (I) demographic data, and (II) quality of sleep assessment measured in terms of day-time sleep duration, average number of daytime waking per day, duration of wakefulness, and duration to put the infant to initial sleep in the morning. All these parameters are measured in hours and minutes. The said tool had undergone validity and reliability testing using Shapiro-Wilk Test which is more appropriate when dealing with small sample size (less than 50 samples). This is used to test the assumption of normality of data.

Observation sheet is used from 9 AM to 5 PM to record the sleep duration (actual time from the start to the end of sleep), infant's temperature 10 minutes before and after the bath and infant's physiological parameters (heart rate, respiratory rate and oxygen saturation). The observation sheet was used before and after the bath (conventional and swaddle bath).

Sleep diaries were also given to the mothers to observe their infants' quality of sleep from 5 PM to 9 PM. Mothers were instructed to record the duration of sleep (actual time from the start to the end of sleep).

The data gathered from the observation sheets and sleep diaries were combined and recorded in the self-made questionnaire.

A letter of request for permission to conduct the study from the College of Allied Health Department of Nursing was secured prior to conducting the study. The researchers also gave a letter address to National University (NU)- Community Extension (COMEX) office asking for assistance in choosing the communities to be included. Letters of permission were given to the Barangay Chairman of the identified communities.

During the actual implementation of the study, there were a total of 36 infants who were assigned into two groups. The experimental group received the swaddle bath while the control group received the conventional bath. Informed consent were secured from the mothers of the selected infants. Each infant was observed for two consecutive days.

The first six infants' quality of sleep was observed on the first day in which no intervention was given to them. On the second day, these infants were then bathed and quality of sleep and thermoregulation 10 minutes before and after the bath were assessed. Quality of sleep was assessed from 9 AM to 9 PM using observation sheet and sleep diary.

Prior to starting the observation, the physiological parameters (pulse rate, respiratory rate and oxygen saturation) were assessed. Ten minutes before and after the bath, the researchers assessed the infant's axillary temperature using digital thermometer. The researchers observing the infants after the baths are blinded on the type of baths received. To maintain intervention fidelity, infants who were bathed had the same clothing and materials used during the study. Same group of researchers provided the bath to all infants.

The researchers encoded the data on the Microsoft Excel and organized the data in frequency distribution. Weighted mean was used to measure the average difference on the temperature and quality of sleep of the experimental group before and after receiving the Swaddle Bath. T-test evaluated the significant difference between the temperature and quality of sleep of the experimental and control group before and after the bath.

Prior to conducting the study, the researchers secured an informed consent from the mothers of the selected infants. This is done to make certain that the respondents are fully knowledgeable about the study and to assure cooperation from the participants willingly. Patient confidentiality was also strictly maintained throughout the whole process of the study. This study will involve no risks nor discomforts on the part of the participants. Potential benefit might include identification of alternative intervention that will improve the quality of sleep and sustain normal thermoregulation status of the infant. No financial inducements will be offered to the mother of selected infants that might influence their participation in the study. Names of the participants will not be mentioned in any way during and after the course of the study to ensure privacy. Furthermore, an alphanumeric coding will be used to preserve anonymity among the respondents which will serve as a tracker for the researcher. Participation in this study will be voluntary. Mothers of the infants may choose not to participate and may withdraw their consent to participate at any time. They will not be penalized in any way should they decide not to participate or to withdraw their consent at any given point while the research is being conducted. Completed questionnaires were made confidential by keeping them individually in a brown envelope and will be under the safekeeping of the researcher.

3. RESULTS AND DISCUSSION

The demographic profile of the infants was obtained in terms of age and gender. The results revealed that most of the participants belong to the age of 3 months old (19.4%) and 10 months old (16.7%). In terms of gender, majority of the infants included in the study are male which comprises 63.9% of the total population

In terms of baseline data on physiologic parameters of infants, Table 1 shows that the infants' mean heart rate prior to bath is $\bar{x}$ = 140.44 or 140-141 beats/min which is within the normal range of 120-160 beats/minute. The mean respiratory rate is $\bar{x}$ = 46.05 or 46-47 breaths/min which is within the normal range of 30-60 breaths/minute. The table also shows that the infants' oxygen saturation has a mean of $\bar{x}$ = 98.11 or 98-99% which is within the normal range of 95-100%. (Pillitteri, 2010). Bathing with unstable physiological parameters can cause danger to the infants. Specifically, presence of hypothermia can be manifested by

respiratory depression, cardiac dysrhythmias and shivering (Cheshire, 2016).

Table 1
Weighted Mean Physiological Parameters of Infants in terms of Heart Rate, Respiratory Rate and Oxygen Saturation

Physiological parameters	*Weighted mean (n= 36 infants)*
Heart Rate	140.44 bpm
Respiratory Rate	46.05 bpm
Oxygen Saturation	98.11%

Problem 1. What is the body temperature of the infant for the control and experimental group before and after the bath?

The Table 2 shows the temperature of the infants belonging to the control and experimental group before and after the bath. The average temperature of the infants belonging to the control group before the bath noted is $\bar{x}$ = 36.61°C and $\bar{x}$ = 36.56 °C after the bath. Interestingly, infants who belong to control group has a slightly higher mean temperature than the experimental group by .02°C before the bath, however, after the bath, the experimental group had a slightly higher mean temperature than the control group by .25°C. Since infants in the experimental group had a maintained normal body temperature which is from $\bar{x}$ = 36.59°C before the bath, it became $\bar{x}$ = 36.81°C after the bath. It can be said that Swaddle bath is an appropriate type of bathing for infants maintaining thermoregulation.

Table 2
Weighted Mean Temperature of the Control Group and Experimental Group Before and After the Bath

Experimental group: Swaddle bath (n= 18 infants)		*Control group: Conventional bath (n= 18 infants)*	
Before the bath (^{0}C)	After the bath (^{0}C)	Before the bath (^{0}C)	After the bath (^{0}C)
36.59	36.81	36.61	36.56

According to the study of Edraki, et.al. (2014) among 50 premature infants hospitalized in Neonatal Intensive Care Unit (NICU),

infants who were Swaddle bathed had less temperature loss as compared to those who received Conventional bath. This claim is supported in the study of Swapna et.al. (2016) among 60 preterm infants, revealing a high statistically significant difference in thermal stability at 10th minute & at 30th minute after bath between group A (with swaddle bath) and group B (with conventional bath) at $p<0.001$ level.

Problem 2. What is the level of quality of sleep between the control and experimental group before and after the bath?

Table 3 shows the quality of sleep of infants both in the experimental and control group measured in terms of duration of sleep, duration of wakefulness, average number of wakefulness and duration to put the infant to initial sleep

Table 3
Weighted Mean Quality of Sleep of the Control Group and Experimental Group Before and After the Bath

Parameters for measuring the quality of sleep of infants	*Weighted Mean of each parameter*			
	Experimental group: Swaddle bath (n= 18 infants)		*Control group: Conventional bath (n= 18 infants)*	
	Before the bath	*After the bath*	*Before the bath*	*After the bath*
Duration of sleep	7 hrs and 5 mins	8 hrs and 2mins	5 hrs and 22 mins	6 hrs and 50 mins
Duration of wakefulness	4 hrs and 41 mins	4 hrs and 17 mins	6 hrs and 37 mins	5 hrs and 7 mins
Average number of wakefulness	9.11	7.89	8.72	8.33
Duration to put the infant to initial sleep	24 mins	17 mins	41 mins	19 mins

The average duration of sleep of the infants belonging to the experimental group before the bath noted is $\bar{x}$ = 7 hours and 5 minutes and $\bar{x}$ = 8 hours and 2 minutes after the bath. On the other hand, the control group has an average duration of sleep of $\bar{x}$ = 5 hours and 22 minutes before the bath and $\bar{x}$ = 6 hours and 50 minutes after the bath. Interestingly, infants who belongs to experimental group has a higher mean duration of sleep than the experimental group by 1 hour and 43 minutes before the bath, however, after the bath, the experimental group still had a higher mean temperature than the control group by 1 hour and12 minutes.

In terms of the average duration of wakefulness, the control group has a higher mean duration of wakefulness than the experimental group by 1 hour and 56 minutes. before the bath while after the bath, the control group had the higher mean duration of wakefulness than the experimental group again by 1 hour and 50 minutes.

For the average number of wakefulness, the $\bar{x}$ = 9.11 was noted on the experimental group before the bath while on the control group, $\bar{x}$ = 8. 72 was noted. After the bath, $\bar{x}$ = 7.89 was noted on the experimental group and $\bar{x}$ = 8.33 was noted on the control group. The experimental group had a higher average number of wakefulness than the control group by .39 before the bath while after the bath, the control group had a higher average number of wakefulness than the experimental group by 0.44.

In the mean duration to put infant to initial sleep, the control group is higher than the experimental group by 17 minutes before the bath and by 2 minutes after the bath. The results imply that infants who were bathed conventionally takes a little more time to put to sleep than those who were swaddle bathed.

Swaddle bath reduces infant stress and agitation, provide comfort, promotion flexion and containment (Bowles, 2013). These following benefits of swaddle bath promotes a good quality of sleep in terms of duration since the infant is comfortable. Infants in the experimental group tends to have a higher duration of sleep as compared to the control group since these infants had a peaceful, calming bath which helps them improve their sleep.

Problem 3. Is there a significant difference on the temperature between the control and experimental group before and after bath?

It is shown in the Table 4 the difference in the thermoregulation between the control and experimental group before and after the bath. As seen on the table above, the findings revealed that there is a significant difference on the temperature of infants before and after the bath in the experimental group. On the control group, it was revealed that there is a non-significant finding.

Swaddle Bath is a method of bathing that starts from trunk to head of an infant. In the study of Hyun et al (2014), it was found out that infants who were bathed from trunk to head had a decreased heat loss due to evaporation and had maintained temperature within normal range as compared to those who were conventionally bathed.

In the study, infants in the control group had a decrease in temperature after bath by .5°C. Since the infants in the control group received Conventional bath which starts from head to trunk, this supports the previous study finding that this method is not effective in maintaining thermoregulation.

Table 4
Level of Significance in the Temperature of Control and Experimental Group Before and After the Bath

Indicators	*Bath*	*Mean*	*t value*	*p value*	*Decision*	*Remarks*
Swaddle Bath	Before	36.59	-5.442	< 0.000	Reject Ho	Significant
	After	36.81				
Conventional Bath	Before	36.61	1.966	0.066	Failed to reject Ho	Not Significant
	After	36.56				

This finding is supported in a study conducted by Swapna et al. (2017) among 60 stable preterm infants during hospitalization, results revealed that swaddle bath was found to be relatively effective in maintaining thermal stability for prolonged period of time. This is further confirmed in another study showing significantly less mean temperature loss among swaddle-bathed newborns compared to the conventionally bathed newborns (Edraki et al., 2014).

Given that the body's heat loss occurs as a result of evaporation, conduction, convection, and radiation processes, it can be concluded that immersing newborns in water has probably been effective in reducing heat loss through evaporation in both tub and swaddle bathing methods. (Ferrier, 2017). In the swaddle bathing method, covering and immersing the newborn can reduce heat loss through radiation, conduction and evaporation. This supports the reason why in control group the infants had a temperature loss after conventional bath (Edraki et al., 2014).

Table 4 also shows that there is a significant difference on the temperature of the experimental group before and after Swaddle bath. The results above show that the mean temperature of infants before Swaddle bath increased after the implementation of bath by .22℃.

Since infants in the experimental group were swaddle-bathed, infants mean temperature increased from 36.59℃ to 36.81℃ which revealed that there is a significant difference on the temperature before and after the bath. In swaddle bath, infant's body is covered with a soft thick towel which decreases chance of body heat loss.

In the study of Kuller (2014), it was found out that infants are comfortable when the entire infant's body except the head and neck are immersed into the warm water. The womb is a compact environment with clear boundaries offering security, which can be mimicked through the containment offered during swaddling. Immersion into warm water also simulates the uterine environment. Combining immersion into water and containment may therefore offer a familiar feeling and promote a calm and stress-free bathing experience (Hall, 2008).

Problem 4. Is there a significant difference in the quality of sleep between the control and experimental group before and after bath?

The Table 5 shows the difference in the quality of sleep of control and experimental group before and after the bath as measured in terms of duration of sleep, duration of wakefulness, average number of wakefulness and duration to put the infant to initial sleep. Based from the above data, specific results revealed a significant finding. These findings, therefore, confirmed that there was a significant difference on the duration of sleep in both groups before and after the bath.

Table 5
Level of Significance in the Quality of Sleep of Control and Experimental Group Before and After the Bath

Indicators	*Experimental group: Swaddle bath (n= 18 infants)*		*Control group: Conventional bath (= 18 infants)*	
	Before the bath	*After the bath*	*Before the bath*	*After the bath*
	Duration of Sleep			
Mean	7.08	8.04	5.37	6.84
t value	-3.700		-3.471	
p value	0.002		0.003	
Decision	Reject Ho		Reject Ho	
Remarks	Significant		Significant	
	Duration of Wakefulness			
Mean	4.68	3.90	6.62	5.11
t value	1.411		3.493	
p value	0.176		0.003	
Decision	Failed to reject Ho		Reject Ho	
Remarks	Not Significant		Significant	
	Average Number of Wakefulness			
Mean	9.11	7.89	8.72	8.33
t value	2.934		0.693	
p value	0.009		0.497	
Decision	Reject Ho		Retain Ho	
Remarks	Significant		Not Significant	
	Duration to put the infant to initial sleep			
Mean	0.40	0.28	0.69	0.32
t value	2.277		3.161	
p value	0.036		0.006	
Decision	Reject Ho		Reject Ho	
Remarks	Significant		Significant	

It is shown in the Table 5 the difference in the average number of wakefulness between the control and experimental group. Based from the above data, specific results revealed a significant finding and a non-significant finding. These findings, therefore, confirmed that there was a

significant difference on the duration of sleep in the experimental group while no significant difference on the control group before and after the bath.

It is also presented in the Table 5 the difference in the duration to put the infant to sleep between the control and experimental group. Based from the above data, specific results revealed a significant finding. These findings, therefore, confirmed that there was a significant difference on the duration of sleep in both groups before and after the bath. This result implies that both of the baths given to the infants helps in putting the infants to initial sleep easily.

One of the sleep concerns among infants is that breastfed babies tend to wake more often because breastmilk is more easily digested and so infants become hungry sooner (Pillitteri, 2010). Since most of the infants in the study are being breastfeed, they tend to have often wakefulness which is shown in the results of the study that even after the baths, in terms of duration of wakefulness, there is no significant difference in the experimental group while in the control group, there is no significant difference in the average duration of wakefulness

Table 5 also reveals that in the four parameters included in the quality of sleep, only the duration of wakefulness revealed a non-significant finding. On the other hand, the results gathered revealed that there is a significant finding on the duration of sleep, average number of wakefulness and duration to put the infant to sleep.

Swaddle Bath provides a calm bath to infants wherein infants tend to fall asleep right after the bath. It explains why in the results of the study, a significant difference in the duration to put the infant to sleep is evident after Swaddle bath with a mean duration from 0.40 to 0.28. Swaddle bath does not only provide relaxation and make the infants calm during their bath but also after the bath. In the study, infants' duration of sleep has a significant difference before and after the bath which shows that infants tend to have a calmer sleep after the bath since the mean duration of sleep improved from 7.08 to 8.04. Swaddle bath provides calmness to the infants since it mimics the womb environment which contributes to the quality of sleep among infants in the experimental group. Infants experience comforts that are similar to being in the uterus (Hall, 2008).

This is further supported in a study conducted by Kuller (2014), wherein infants are comfortable when the entire infant's body except the head and neck are immersed into warm water. Moreover, the study of Swapna et al. (2017) revealed that swaddle bath was found to be relatively effective in reducing stress among infants as evidenced by lesser crying duration among swaddle bathed preterm infants than conventionally bathed preterm infants. An advantage of this bathing method stated by Fern, Graves, and L'Huilleir, (2002), is improved state control (i.e. decreased crying and agitation in newborns).

4. CONCLUSION

Overall, swaddle bath is effective in maintaining thermoregulation and improving quality of sleep among infants. According to the researcher's acquired data, after the implementation of Swaddle bath, infant's temperature had a significant difference before and after the bath as compared to the Conventional bath with no significant difference. In terms of the quality of sleep among infants who received Swaddle bath, it was noted that there is a significant difference on the duration of time of sleep, average number of wakefulness and duration to put the infant to sleep. However, no significant difference on the duration of wakefulness was noted.

Since the researchers conducted the study in a small group, it is recommended for future researchers to have a large group when conducting this study. Moreover, determining the significant relationship between the age in months of infants and the thermoregulation and quality of sleep after the intervention can be taken into consideration. Since the researchers gathered infants aged one to eleven months to be part of the study, it is recommended that in the future, the swaddle bath should be provided to the participants on the same age in months.

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