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Effect of Facilitated Tucking on Physiological and Behavioural Responses of Neonates Undergoing BCG Vaccination

Roshni Rani[1,*], Nandini Mannadath[2], Senthilkumar Thavasiappan[3]

[1]Department of Paediatrics, Western Health, Melbourne, Victoria, Australia.
[2]Department of Nursing, College of Health and Sport Sciences, University of Bahrain, Sakhir, Southern Governorate, Bahrain.
[3]Department of Medical Surgical Nursing, Lourde College of Nursing, Kannur, Kerala, India.
roshroshni1703@gmail.com[1], nmannadath@uob.edu.bh[2], ns9605@gmail.com[3]

Abstract: Pain in newborns is a ubiquitous phenomenon; they are routinely subjected to pain, including routine immunisation, and it is important to make them comfortable during painful procedures. Hence, a study was undertaken to evaluate the effectiveness of facilitated tucking on the physiological and behavioural responses of neonates undergoing BCG vaccination at a selected hospital in Thrissur. It was a quasi-experimental study; a quantitative approach, based on Kolcaba's Comfort Theory. After obtaining informed consent from the primary caregivers, 60 neonates (30 in each group) who attended the immunisation OPD at Aswini Hospital for BCG vaccination were selected using nonprobability purposive sampling. The primary caregiver collected the neonate's demographic data, and the investigator facilitated tucking only for the experimental group during BCG vaccination. The physiological and behavioural responses of neonates were assessed immediately before and at 1 minute after BCG vaccination in both the experimental and control groups. The results indicate that the facilitated tucking intervention was effective in reducing pain (U = 25.00) and physiological responses (HR, SPO2; t = 13.826, -4.699, respectively). There is no correlation between the behavioural (pain) and physiological responses (HR, SPO2) in neonates, with r = 0.097 and 0.002, respectively.

Keywords: Responses of Neonates; Facilitated Tucking; Physiological Response; Behavioural Response; BCG Vaccination; Paediatric Pain; Neonatal Pain; Tissue Damage; Assessment Strategies.

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1. Introduction

1.1. Background of the Study

Neonates undergo diverse physiological and behavioural adaptations to acclimatise to extrauterine existence [1]. They also have to go through a lot of painful but medically essential tests and treatments, like heel pricks, venepunctures, and immunisations [2]. Pain is an unpleasant sensory and emotional experience linked to existing or potential tissue injury. Pain is

[*]Corresponding author.

subjective. Pain is a sensation that affects both the senses and the mind [3]. To get both qualitative and quantitative information regarding pain, you need to use a variety of assessment methods. Children's pain comes from a lot of different long-term problems, like headaches, muscle, bone, or joint discomfort, or stomach pain, and it needs to be managed [4]. But the medical profession hasn't put as much focus on pain management for kids as it has for adults and older people. Every year, 1.5 to 3 million kids have surgery, and many of them don't get enough pain management. In 20% of cases, the pain becomes chronic. In a study, the researcher reported an average of 134 unpleasant operations occurring within the initial two weeks of life for each of the 124 preterm newborns examined, all with a gestational age of 27–31 weeks [5]. In a study including 151 neonates, an average of 14 ± 4 unpleasant treatments were documented throughout a 24-hour period during the initial 14 days of life. Critically unwell and premature infants may undergo over 700 unpleasant operations before to release from the NICU. The highest exposure was also seen in the first several days after admission and in newborns who needed help breathing [6]. There has been a lot of interest in assessing pain in newborns over the past ten years. Facial expressions, bodily movement and tone, crying, state/sleep, and whether the person can be easily comforted are all behavioural signs of pain [7]. The primal face of pain (PFP) is thought to be a universal and common facial expression of suffering that is hardwired and present at birth. The PFP aligns with prior studies of pain expression in neonates, typified by mouth opening, forehead furrowing, and eye closure.

Several non-pharmacologic interventions, such as assisted tucking, are effective in the management of mild to moderate pain in infants. A nurse or parent holds the baby in a side-lying, flexed foetal posture during assisted tucking [8]. This position lets the baby move their own body, which may help them deal with pain better. Adding synchronous skin contact to postural support may create a synergistic impact in pain control [9]. "Facilitated eight tucking" makes the heart rate go down a lot [10]. The time it took for the first quieting and the total sobbing time were both cut down by a lot. This intervention did not affect oxygen saturation. A systematic literature review on the effectiveness of non-pharmacological interventions for pain management in a cohort of 40 intubated and ventilated preterm neonates, gestational age 23 to 32 weeks, indicated that facilitated tucking during endotracheal suctioning resulted in significant pain relief [11]. Non-pharmacologic therapies are quite helpful for many surgeries on babies and children. Facilitated Tucking is one of the easiest and cheapest ways to make someone feel like they are in the womb without using drugs. Facilitated tucking occurs when a baby is resting on their side or back and their arms and legs are gently held in a flexed, midline posture close to their trunk [12]. It makes the baby feel safer and more at ease, with a controlled response. It helps with self-regulation by lowering the physiological reaction, such a longer heart rate increase, that makes the pain and tension worse. A systematic evaluation was performed across various databases, including Ovid, Blackwell Synergy, ScienceDirect, PsycINFO, and CINAHL, to assess the effectiveness of assisted tucking as a non-pharmacological intervention for pain management in newborns. The search yielded 15 papers; 5 articles met the requirements for the systematic review, and 14 outcomes were statistically significant: heart rate, increase in oxygen saturation, sleep-wake state, Premature Infant Pain Profile scores, and newborn infant pain ratings.

The study stated that the analysed clinical trials yield significant preliminary findings indicating that assisted tucking may be advantageous for both preterm and term newborns in mitigating their responses to painful treatments [13]. Health care professionals must enhance the quality of life as delineated by the patient and family by delivering suitable comfort management, being knowledgeable about and implementing treatments that alleviate pain and trauma, periodically evaluating comfort, and involving the patient and parents in treatment decisions and the overall process [14]. By including non-drug treatments like assisted tucking within regular care events, it may be possible to lower the stress levels of babies. When the stress levels of babies are diminished, they may exhibit enhanced stability in their autonomic and motor systems [15]. A randomised controlled trial was performed to evaluate the efficacy, dosage effects, and safety of sucrose for alleviating procedural pain, utilising validated individual pain indicators and composite pain scores [16]. The effective amount of sucrose was inconsistent, ranging from 0.012 to 0.12 g, making it unable to determine an appropriate dose for preterm and/or term newborns [17]. The researchers determined that sucrose is both safe and effective for alleviating procedural pain associated with isolated painful events, such as heel lance and venepuncture. Neonatal nurses are very vital for keeping newborns healthy. Nurses do a lot of different things, and they help with the most painful ones. One of the hardest things for nurses who work in neonatal care units is to manage pain well during invasive operations in newborns. Nurses must augment their knowledge, employ suitable evaluation instruments and methodologies, foresee unpleasant situations and respond appropriately, adopt a multimodal strategy for pain management, and champion effective pain relief in newborns [18].

1.2. Statement of the Problem

A research to assess the efficacy of assisted tucking on the physiological and behavioural reactions of infants receiving BCG vaccination in a designated hospital.

1.3. Objectives of the Study

- To assess the physiological and behavioural responses of neonates in experimental and control groups undergoing BCG vaccination.

- To evaluate the effect of facilitated tucking in terms of variations in physiological and behavioural responses of neonates in experimental and control groups undergoing BCG vaccination.
- To correlate the physiological and behavioural responses of neonates in experimental and control groups undergoing BCG vaccination.
- To associate physiological and behavioural responses of neonates in experimental and control groups undergoing BCG vaccination with selected demographic variables.

1.4. Hypotheses

- **H1:** There is a significant difference in the mean physiological response score of neonates in the experimental and control groups undergoing BCG vaccination.
- **H2:** There is a significant difference in the mean behavioural response score of neonates in the experimental and control groups undergoing BCG vaccination.
- **H3:** There is a significant correlation between the physiological and behavioural responses of neonates in the experimental and control groups undergoing BCG vaccination.
- **H4:** There is a significant association between the selected demographic variables and physiological and behavioural responses of neonates in the experimental and control groups undergoing BCG vaccination.

2. Materials and Methods

An evaluatory approach was used in this study, with the investigator aiming to assess the effectiveness of facilitated tucking on the physiological and behavioural responses of neonates undergoing BCG vaccination. The present study used a quasi-experimental design. The diagrammatic representation of the design, Control Group O1 O2, Experimental group O1 X O3:

- **O1** – Pre-test physiological and behavioural response score (control group).
- **O2** - Post-test physiological and behavioural response score (control group).
- **O1** – Pre-test physiological and behavioural response score (experimental group).
- **X** – Treatment given (facilitated tucking).
- **O3** – Post-test physiological and behavioural response score (experimental group).

The independent variable was the facilitated tucking given to the neonates undergoing BCG vaccination. The dependent variables are the physiological and behavioural responses of the neonates undergoing BCG vaccination. The researcher selected the tool for the present study by reviewing the literature and consulting with nursing experts and faculty in child health nursing and neonatology:

- The researcher developed the demographic proforma for the present study.
- The standard pain scale, NIPS, was selected to assess behavioural responses (pain), and the Pulse oximeter to assess physiological responses (HR, SPO2).

Ethical clearance for the study was obtained from the Institutional Ethical Committee before the data collection. A brief description of the study's goals and methodology was provided to the mother or primary carer, and informed consent was obtained. Human rights were upheld, human dignity was maintained, and the option to leave school at any time was granted. The Data Collection process includes.

Phase I: Neonates receive BCG vaccination every Wednesday and Saturday at the immunisation OPD of the Selected Hospital, Thrissur. The previous day, the investigator obtained a list of neonates admitted to the ward and scheduled to receive the BCG vaccination.

Phase II: The researcher chose 30 samples for the experimental and control groups using the non-probability purposive sampling technique. The investigator evaluated the neonate's demographic performance using information from the primary care provider and the case files. Wednesday-received BCG samples were kept as an experimental group until the sample size was reached, whereas Saturday-received samples were kept as a control group. The investigator evaluated the behavioural and physiological reactions of newborns receiving BCG vaccination in the 54 experimental and control groups just before vaccination; this assessment was considered a pretest observation (O1). A pulse oximeter was used to measure the neonates' physiological responses (heart rate and oxygen saturation [SpO2]), and the Neonatal Infant Pain Scale (NIPS) was used to measure their behavioural responses (pain). The NIPS has seven maximum and lowest scores, and its parameters include state of arousal, facial expression, crying, breathing pattern, arms, and legs.

Phase III: The BCG vaccination was administered by the same staff nurse to the experimental group on the same day the investigator performed facilitated tucking, which involves placing the newborn in an in-utero position with their arms and legs bent to the middle of their trunk.

Phase IV: Using the same instrument, the researcher reassessed the physiological and behavioural responses of neonates in the experimental group (facilitated tucking) and control group (no facilitated tucking) following the administration of the BCG vaccine at the first minute to determine the efficacy of facilitated tucking. The outcome determined the study's viability and practicability.

3. Results

Table 1 summarises the demographic characteristics of the neonates in both the control and experimental groups. The control and experimental groups have equal numbers of males and females, indicating a balanced gender representation.

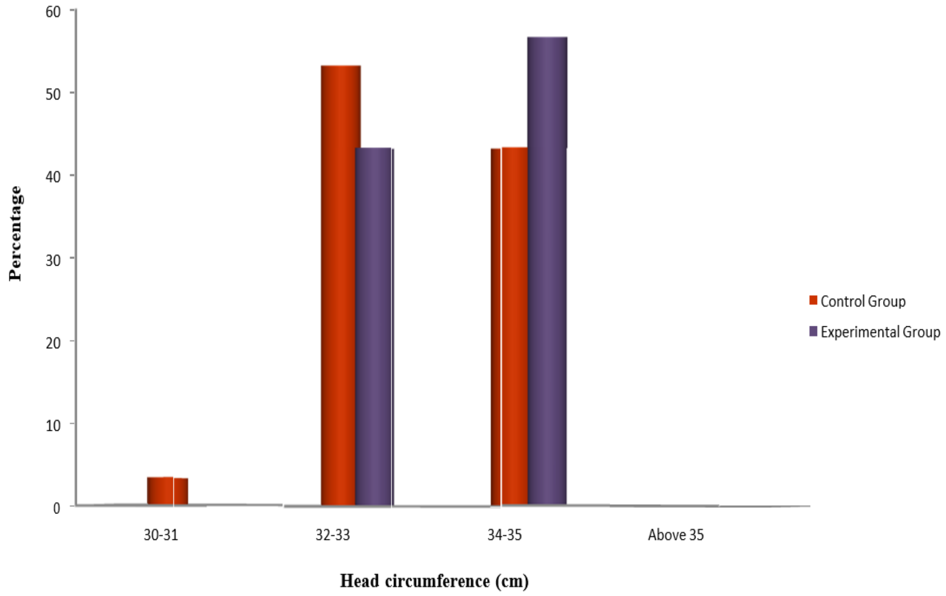

Figure 1: Percentage distribution of neonates by head circumference

The age distribution across the groups is also quite similar (Figure 1).

Table 1: Demographic characteristics of neonates in control and experimental groups

Characteristics	Experimental Group (n=30) No. (%)	Control Group (n=30) No. (%)
Gender		
Male	15 (50)	15 (50)
Female	15 (50)	15 (50)
Postnatal Age (Days)		
1-2	15 (50)	12 (40)
3-4	7 (23.3)	11 (36.7)
5-6	8 (26.7)	7 (23.3)
Type of Delivery		
Vaginal	17 (56.7)	18 (60)
LSCS	13 (43.3)	12 (40)
Birth Weight in Grams		
2000 – 2500	7 (23.3)	8 (26.7)
2501 – 3000	12 (40)	12 (40_
3001 – 3500	11 (36.7)	10 (33.3)
Gestational Age in Weeks		
36-37	8 (26.7)	5 (16.7)

38-39	18 (60)	20 (66.7)
≥40	4 (13.3)	5 (16.7)

Most participants in both groups fall within the 1–2-day postnatal age range, followed by 3-4 days and 5-6 days (Figure 2).

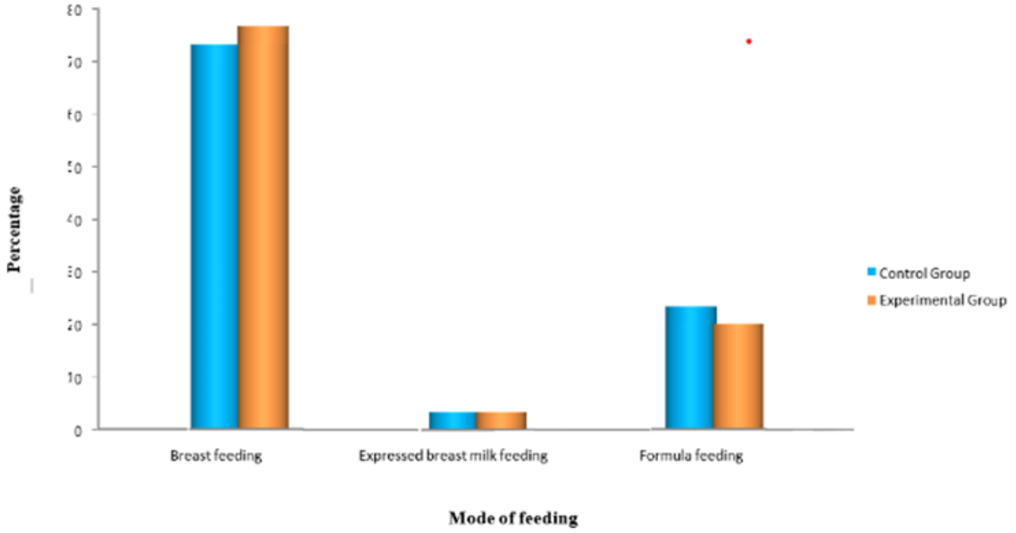

Figure 2: Percentage distribution of neonates by mode of feeding

The study compared two groups of newborns based on their delivery method, birth weight, and gestational age (Figure 3).

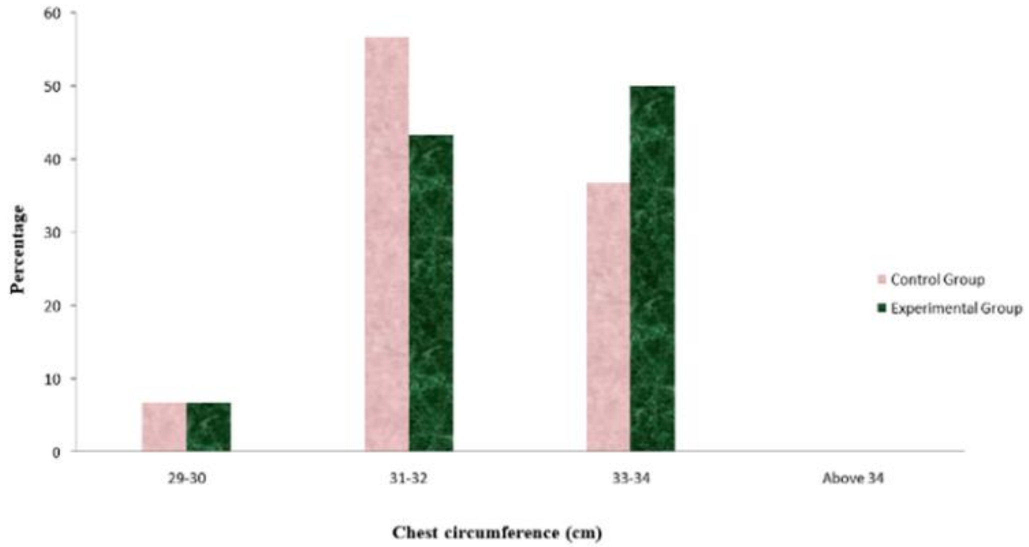

Figure 3: Percentage distribution of neonates by chest circumference

Both groups had similar proportions of vaginal and LSCS deliveries. Birth weight and gestational age were also comparable between the groups, with most newborns falling within the normal ranges. Overall, the demographic characteristics of the two groups were well-matched, providing a solid foundation for further analysis. Figures 1 to 3 show the lengths, head circumferences, and chest circumferences of newborns in two groups. The control group had a slightly higher proportion of newborns with lengths greater than 54 cm compared to the experimental group. Both groups had similar head circumference distributions, with most newborns falling within the 32-35 cm range. The chest circumference of newborns in the experimental group was slightly larger than that of newborns in the control group. Overall, the physical measurements of the newborns in both groups were within normal ranges.

Table 2: The t-test for the mean difference between the pretest behavioural scores (pain score) of the control and experimental group

No.	Group	N	Mean Rank	Sum of ranks	U - value
1	Control	30	29	870	405^{NS}
2	Experimental	30	32	960	

N = 60, NS - Not Significant

Table 2 shows that the U-value for the mean ranks and sums of ranks for the pain scores of the control and experimental groups is 405, which is not significant. It implies that there is no true difference in the mean pain scores between the control and experimental groups before BCG vaccination. It reveals that both the control and experimental groups are homogeneous.

Table 3: Effectiveness of facilitated tucking on post-test behavioural scores (pain) of neonates in control and experimental groups

Heart Rate	N	Mean Rank	U – value	P- value
Control	30	29.00	25.000	0.000**
Experimental	30	32.00		

*N = 60, **Significant at the level of < 0.01*

Table 3 identifies that the Mann-Whitney U test value is 25.000 and it is highly significant (P=0.000**). This implies that facilitated tucking was effective for reducing pain in neonates. Thus, it can be concluded that facilitated tucking can be an effective non-pharmacological intervention for reducing pain responses in neonates. The U-value for the mean ranks and sums of ranks for the pain scores of the control and experimental groups is 405, which is not significant. It implies that there is no true difference in the mean pain scores between the control and experimental groups before BCG vaccination. It reveals that both the control and experimental groups are homogeneous.

Table 4: Effectiveness of facilitated tucking on the mean posttest physiological score (HR) of neonates in the control and experimental groups

Heart Rate	N	Mean	SD	t – value	P value
Control	30	156.7	6.045	13.826	0.000**
Experimental	30	136.13	5.482		

*N = 60, **Significant at the level of < 0.01*

Table 4 proves that the mean post-test heart rate was 156.7 and 136.13, respectively. The Table also identifies that the t value 13.826 is highly significant (P=0.000**). This implies that facilitated tucking was effective in reducing the heart rate in neonates during painful procedures. Thus, it can be concluded that facilitated tucking affects neonates' physiological responses. Table 4 proves that the mean post-test heart rate was 156.7 and 136.13, respectively. The Table also identifies that the t value 13.826 is highly significant (P=0.000**). This implies that facilitated tucking was effective in reducing the heart rate in neonates during painful procedures. Thus, it can be concluded that facilitated tucking affects neonates' physiological responses.

Table 5: Effectiveness of facilitated tucking on the mean posttest physiological score (SPO2) of neonates in the control and experimental group

SPO2	N	Mean	SD	t - value	P value
Control	30	88.97	2.141	-4.699	0.000**
Experimental	30	91.57	2.144		

*N = 60, **Significant at the level of < 0.01*

Table 5 reveals that the mean posttest SPO2 was 88.97 and 91.57, respectively. The Table also shows that the t-value of -4.699 is highly significant (P = 0.000**). This implies that facilitated tucking was effective in reducing the physiological responses in neonates during painful procedures.

Table 6: Correlation between behavioural responses (pain) and physiological responses (HR) of neonates in the control and experimental group undergoing BCG vaccination

No.	Variables	N	r - Value
1	Behavioural Response Score	60	0.097^{NS}
2	Physiological Response Score		

NS - Not Significant

Table 6 indicates that there is no correlation between behavioural (pain) and physiological responses (HR), as the r-value is 0.097 and not significant. It can be concluded that, for the given samples, an increase in pain score was not associated with an increase in heart rate.

3.1. Association of the Variables of the Study

The results imply a significant association between pretest behavioural response scores (Pain) and neonate sex in both the experimental and control groups (Table 7).

Table 7: Association between behavioural responses (pain) and sex of neonates in the control and experimental group

Variable	Control Group			Experimental Group		
Sex	n	χ^2	P–value	n	χ^2	P–value
Male	15	0.682	0.049*	15	0.144	0.045*
Female	15			15		

**Significant at the level of < 0.05*

It implies that there is a significant association between pretest behavioural response scores (Pain) and gestational age in the control group, but none in the experimental group (Table 8).

Table 8: Association between behavioural responses (pain) and age of neonates in the control and experimental group

Variable	Control Group			Experimental Group		
Gestational age (weeks)	n	χ^2	P–value	n	χ^2	P–value
a) 36–37	8	7.486	0.024*	5	1.531	0.465NS
b) 38–39	18			20		
c) ≥40	4			5		

N = 60, NS – Not significant at 0.05 Level.

The results show a significant association between pre-test behavioural response scores (Pain) and neonatal birth weight in the experimental group, but none in the control group (Table 9).

Table 9: Association between behavioural responses (pain) and weight of neonates in the control and experimental group

Variable	Control Group			Experimental Group		
Birth weight (kg)	n	χ^2	P–value	n	χ^2	P–value
2000–2500	7	0.823	0.662^{NS}	8	7.55	0.023*
2501–3000	12			12		
3001–3500	11			10		

*N = 60, *Significant at the level of P < 0.05*

3.2. Testing of Hypotheses

Testing the hypotheses, the following null hypotheses were framed:

- **H01:** There will be no significant difference in the mean physiological response score of neonates in the experimental and control groups undergoing BCG vaccination.

The analysis revealed a significant difference in the mean physiological response scores between the experimental and control groups, with t-values of 13.826 for physiological response (HR) and -4.699 for physiological response (SPO2), both highly significant at $P<0.01$. Hence, the null hypothesis H01 is rejected and the research hypothesis H1 is accepted:

- **H02:** There will be no significant difference in the mean behavioural response score of neonates in the experimental and control groups undergoing BCG vaccination.

From the results, it is clear that there is a significant difference in the mean behavioural response score between the experimental and control groups, as the obtained U-value of 25.000 for behavioural response (pain) is highly significant at $P<0.01$. Hence, the null hypothesis H02 is rejected and the research hypothesis H2 is accepted:

- **H03:** There will be no significant correlation between physiological and behavioural responses of neonates in the experimental and control groups undergoing BCG vaccination.

The analysis shows that there is no significant correlation between the physiological and behavioural responses of neonates in the experimental and control groups, as the r-value for behavioural response (pain) and physiological response (HR) is 0.097. The r-value for behavioural response (pain) and physiological response (SPO2) is 0.002, which is not significant. Hence, the null hypothesis H03 is accepted, and the research hypothesis H3 is rejected:

- **H04:** There will be no significant association between the selected demographic variables and the physiological and behavioural responses of neonates in the experimental and control groups undergoing BCG vaccination.

After the analysis and interpretation of the data collected, it is identified that there is a significant association between selected demographic variables like sex, birth weight, gestational age, and mode of feeding and behavioural and physiological responses of the neonates in the experimental and control groups. Hence, the null hypothesis H04is rejected and the research hypothesis H4 is accepted.

4. Discussion

The study results showed a significant change in behavioural (pain) and physiological responses (HR, SPO2) in neonates across the experimental and control groups during BCG vaccination. Regarding the pretest pain score (behavioural responses) in both the control and experimental groups, 30 (100%) had a pain score of 0-2 (mild to no pain). About the post-test pain score (behavioural responses), in the control group, 17(56.66%) were having score >4 (severe pain) and 13(43.33%) were having score between 3-4 (mild to moderate pain) and in the experiment group, 15(50%) were having 0-2(mild to no pain) a 13(43.33%) were between 3-4 (mild to moderate pain) and two neonates (6.66%) were having score >4. Findings of the study are supported by a study examining facial activity, body movements, and physiological measures in 56 preterm and full-term newborns in response to heel lancing, along with a comparison of preparatory and recovery intervals. The impact of invasive procedures on preterm neonates has received little systematic attention.

Data analyses indicated that across all measurement categories, changes in behavioural and physiological measures were present, with the greatest reactions occurring during the lancing procedure, and that neonates with gestational ages as short as 25–27 weeks displayed high physiological responsivity to it. Heart rate measure was the physiological responsivity, which varied more with gestational age. The study identified a significant difference in the mean behavioural response score (pain), with a U-statistic of 25.000. The study results also revealed a significant difference in the mean physiological response scores (HR, SPO2) between the experimental and control groups, with t-values of 13.826 and -4.699, respectively. Hence, it is proven that facilitated tucking was effective in reducing the behavioural response (pain) and physiological responses (HR, SPO2) in neonates during painful procedures. The results of the study is supported by a prospective, randomized controlled trial study conducted in Taiwan among a convenience sample of 110 infants (gestational age 26.4 – 37 weeks) to compare the effectiveness of different combinations of non-nutritive sucking (sucking), oral sucrose, and facilitated tucking (tucking) with routine care on infants' sleep-wake states before, during, and after heel-stick procedures.

The results showed that infants receiving oral sucrose-tucking, sucking-oral sucrose, sucking-oral sucrose-tucking, and sucking-tucking experienced 77.3% ($p<0.001$), 72.1% ($p=0.008$), 51.5% ($p=0.017$), and 33.0% ($p=0.105$) fewer fussing or crying episodes, respectively, than those receiving routine care. The study concluded that the combined use of oral sucrose-facilitated tucking, sucking-oral sucrose, and sucking-oral sucrose-tucking more effectively reduced infant fussing or crying than routine care. The first hypothesis of the study states that there will be a significant difference in the mean physiological response score of the experimental and control groups. The results of the study reveal significant differences in the mean physiological response scores (HR, SPO2) between the experimental and control groups, with t-values of 13.826 and -4.699, respectively. Hence, the research hypothesis H1 is accepted. The second hypothesis of the study states that there will be a significant difference in the mean behavioural response score of the experimental and control groups. The study identified a significant difference in the mean behavioural response score (pain), with a U-statistic of 25.000. Hence, the research hypothesis H2 is accepted. The findings report no significant correlation between behavioural (pain) and physiological (HR) responses in neonates across the experimental and control groups (r = 0.097). The analysis also showed that there is no significant correlation between behavioural (pain) and physiological responses (SPO2) in neonates across the experimental and control groups (r = 0.002). The third hypothesis of the study was that there would be a significant correlation between physiological and behavioural responses of neonates in the experimental and control groups undergoing BCG vaccination. The study found no significant correlation between behavioural (pain) and physiological responses (HR, SPO2) in the experimental and control groups, with r-values of 0.097 and 0.002, respectively. Hence, the research hypothesis H3 is rejected. The results of the study reveal that there is a significant association between behavioural responses (pain) and the selected demographic variables like sex, gestational age, birth weight and mode of feeding.

The research also revealed a notable correlation between physiological responses (HR, SPO2) and specific demographic characteristics, including gestational age. The study results are corroborated by research including 65 neonates (37 female and 28 male) with gestational ages ranging from 28 to 42 weeks and ages from 25 to 120 hours, aimed at confirming gender differences in pain expression among preterm and term newborns. Healthy term neonates necessitated a capillary puncture for phenylketonuria screening, while clinically stable preterm infants required a capillary puncture for glucose measurement. The Neonatal Facial Coding System (NFCS) and the Neonatal Infant Pain Scale (NIPS) were assessed at the bedside prior to the puncture, at rest, during foot heating, during capillary puncture, and at 1, 3, and 5 minutes post-heel lancing. The results indicated a considerable disparity in mean NFCS scores over the six study periods for the entire cohort of neonates, as well as a notable interaction between NFCS score profiles in female and male newborns throughout the various study periods. There were no significant interactions between gestational age and time, or between gestational age and gender, for either NFCS or NIPS.

The study found that female neonates who had just been born showed stronger signs of pain on their faces than male neonates during the capillary puncture and for one minute afterward. Consequently, it was demonstrated that gender correlates with the expression of pain in neonates. The fourth hypothesis posits a strong correlation between the chosen demographic characteristics and the physiological and behavioural responses of neonates in both experimental and control groups receiving BCG immunisation. The study identified a strong correlation between specific demographic characteristics, including sex, birth weight, gestational age, style of feeding, and behavioural (pain) and physiological responses (HR, SPO2) in neonates within both the experimental and control groups. The research hypothesis H4 is therefore accepted.

5. Summary and Conclusion

The current study found that assisted tucking, when offered as a supportive measure, enhances the efficacy of pharmaceutical therapies during painful procedures such as immunisation. This combined approach helps reduce behavioural reactions that indicate pain and maintains critical physiological indicators, such as heart rate (HR) and peripheral oxygen saturation (SpO_2), within stable ranges. The results show that assisted tucking is a simple, non-invasive, and highly effective nursing intervention that can be used in routine neonatal care to reduce pain. The study's findings allow for numerous conclusions. First, neonates endure considerable pain during BCG vaccination, evidenced by heightened behavioural markers and alterations in physiological responses. Second, aided tucking—accomplished by placing the neonate in a flexed, in-utero-like position—was effective in diminishing pain responses. Neonates in the experimental group had significantly lower behavioural pain scores and steadier heart rate and oxygen saturation levels than those in the control group. This underscores the efficacy of supportive posture as an evidence-based approach for alleviating newborn pain. The research also showed a strong, favourable link between behavioural pain responses and physiological measures. As pain worsened, the heart rate tended to increase, and the oxygen saturation tended to decrease. This link underscores the need to observe both behavioural and physiological indicators when evaluating newborn pain. The study also found a significant link between how babies respond to pain and certain demographic factors, such as sex, birth weight, gestational age, and how they are fed. These results indicate that personal traits may affect newborns' perception and reaction to painful stimuli. The study endorses assisted tucking as a useful, simple, and implementable nursing technique for alleviating procedural pain in neonates, especially during BCG immunisation. It provides an effective, inexpensive way to make neonates more comfortable, stabilise their physiology, and enhance their clinical outcomes.

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Data Availability Statement: The data utilised in this study were accessed with formal approval from the Institutional Ethical Committee (IEC) of Lourde College of Nursing, which authorised the use of relevant study information.

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Ethics and Consent Statement: All procedures in this study complied with established ethical guidelines.

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