The Effect Of Pacifier Use (Non-Nutritive Sucking) On Pain Intensity In Premature Babies Undergoing IV Infusion In The NICU And Perina Room Alia Hospital Jakarta

Irmawati[1], Hanik Rohmah Irawati[2]

Sekolah Tinggi Ilmu Kesehatan Pertamedika

Article Info	ABSTRACT
Keywords: Pacifier (Non-Nutritive Sucking), Pain intensity, Premature babies	Premature babies are susceptible to various health complications due to immaturity of the organ system, so they need intensive care, namely NICU. Babies will experience pain due to invasive procedures. This pain can be treated with non-pharmacological methods, namely Non-Nutritive Sucking (NNS) in the form of pacifiers. This study aims to determine the effect of pacifier use (non-nutritive sucking) on pain intensity in premature babies who have an IV in the NICU and Perina Alia Hospital Jakarta. This study used a quasi-experimental method with a post-test-only non-equivalent control group approach. The study sample consisted of 34 respondents divided into intervention and control groups, each with 17 respondents. The sampling technique used purposive sampling. The pain scale measurement instrument used NIPS (Neonatal Infant Scale). The average pain intensity of the intervention group was 1.65 and the control group was 4.24. Data analysis used the independent T-test. The results of the study obtained a p value = 0.001 (a <0.05) meaning that there is an effect of pacifier use (Non- Nutritive Sucking) on pain intensity in premature infants who underwent IV in the NICU and Perina Alia Hospital Jakarta. Pacifiers are recommended as an independent nursing intervention in reducing pain intensity in infants who underwent IV.
	Corresponding Author: Irmawati Sekolah Tinggi Ilmu Kesehatan Pertamedika irmafitsa@gmail.com

INTRODUCTION

Preterm birth, defined as delivery occurring before 37 weeks of gestation, affects approximately 15 million neonates globally each year, representing 11% of all births. According to the World Health Organization (WHO), prematurity is classified into three categories based on gestational age: extreme prematurity for babies born before 28 weeks, very premature birth for those born between 28 and 32 weeks, and moderate prematurity for those born between 32 and 37 weeks. In contrast, full-term births occur between 37 and 40 weeks of gestation (Howson et al., 2012; Garnica-Torres et al., 2021). Various factors contribute to preterm birth, including maternal age, with pregnancies in women over 35 years, especially during a first pregnancy, significantly increasing the risk of premature delivery (Palu, 2013).

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The United Nations Children's Fund (UNICEF) highlights preterm birth as the leading cause of death among children under five years old, with an estimated 15 million premature births worldwide annually. Unlike full-term infants, premature babies belong to a high-risk group due to the immaturity of their organ systems, such as the lungs, heart, kidneys, liver, and digestive system (Krisnandi, 2009). Premature birth presents significant challenges, as fetuses weighing less than 2500 grams and born before 37 weeks often have underdeveloped vital organs, including the brain, heart, lungs, and kidneys, making it difficult for them to grow and develop optimally (Sujiyatini, 2009). Premature infants face risks such as low birth weight, long-term health issues, hypertension, type 2 diabetes, and hypoglycemia due to insufficient glycogen and fat reserves, which are typically developed during the third trimester of pregnancy (Mitanchez, 2007).

Over the past few decades, the mortality rate of the youngest and smallest premature babies has increased by about 2%. This has led to an increase in the number of neonates with severe morbidity and complications up to prematurity (Hovgesen, et al., 2022). Premature babies are one of the causes of infant mortality, especially in the first month of life (Ministry of Health of the Republic of Indonesia, 2018). The incidence of premature babies is still an issue that must be considered together, premature babies are at high risk of mortality and morbidity during their growth (Nurlaila, et al., 2015).

Premature infants may experience neonatal complications necessitating specialized care. Premature infants typically necessitate neonatal intensive care, specifically in the NICU (Neonatal Intensive Care Unit), which is designed for managing high-risk neonates. The NICU is outfitted with advanced technology and staffed by healthcare professionals trained in the care of vulnerable infants (Stanford Children's Health, 2021). In 2019, Indonesia ranked fifth globally with a preterm birth rate of 675,700 (WHO, 2019). In Indonesia, preterm ranks second as a cause of death for newborns aged 0-6 days, accounting for 32.4%, and fourth for infants aged 7-28 days, comprising 12.8% (Trisa, 2019).

During care in the NICU or Perina, infants frequently encounter numerous procedures that may induce tension or pain, including the placement of an intravenous line. An observational study on infant pain in the NICU at Peking Medical Hospital by Wang et al. (2019) confirmed that the establishment of an IV is the predominant method for administering intravenous fluids. Furthermore, premature infants frequently undergo invasive procedures, with heel puncture and intravenous access being the most prevalent (Duerden et al., 2018; Shrestha & Adhikari, 2012; Çiftci & Yayan, 2022). Numerous procedures, including heel blood sampling, vaccination, intramuscular injection, venous intervention, gavage tube placement, changing clothes, and postural drainage, induce pain in neonates. These interventions adversely affect physiological parameters, duration of hospitalization, and growth trajectories, while diminishing comfort levels (Derebent & Yiğit, 2006; Çiftci & Yayan, 2022).

Frequent exposure to pain can have negative effects on infants. Neonates/term infants when compared to preterm infants have complex characteristics in terms of responding to pain stimuli, where term infants are more expressive and have a stronger ability to rebel compared to preterm/premature infants. This condition makes it difficult for health workers

to perform invasive actions that result in repeated stabbing (Theresia Anita Pramesti, et al., 2018).

Reducing pain and enhancing the comfort of newborns are key responsibilities of neonatal nurses. Painful procedures in the NICU should ideally be consolidated into a single session whenever possible, minimizing the number of interventions. Pain should be assessed early and managed with appropriate methods, both pharmacological and non-pharmacological (Çiftci & Yayan, 2022). While pharmacological treatments are commonly used, non-pharmacological approaches such as breastfeeding, skin-to-skin contact, music therapy, therapeutic massage, swaddling, and fetal positioning have also proven effective (Mangat et al., 2018).

Non-pharmacological pain management has the advantage of lower risks and easier implementation, especially for premature infants. Among these methods, sucrose and non-nutritive sucking (NNS) are the most studied and are recommended by national and international guidelines for reducing pain from single procedures in premature infants. A recent systematic review highlighted the effectiveness of sucrose and NNS in providing analgesia and comfort during painful procedures (Gao et al., 2018). This aligns with findings from Pinelli and Ve Symington (2005) and Ozkan et al. (2022), which indicate that NNS is a non-pharmacological intervention that offers psychological comfort and a calming effect. NNS has also been shown to mitigate the pain and stress associated with medical procedures and the neonatal intensive care environment.

NNS, first described by Wolff in 1968, refers to sucking movements without nutritional intake. Wolff's study involved 40 term and low-risk infants on their fourth day of life, using a pacifier connected to a pressure transducer and polygraph writer. He characterized NNS as repetitive, rhythmic mouth movements with a specific pause-suck pattern, consisting of 6–12 suck cycles and an intra-burst frequency of about 2 Hz (Martens et al., 2020). NNS techniques include using gloved fingers, pacifiers, or empty breasts (Medeiros et al., 2011; Ozkan et al., 2022).

Pacifiers, commonly used to soothe newborns between feedings, are also effective tools for acute pain relief, though this is not widely recognized by parents or practitioners. Numerous randomized controlled trials (RCTs) have confirmed the efficacy of NNS in alleviating pain during routine procedures such as heel pricks, vaccinations, and venipunctures, as measured by various pain assessment tools. A 2015 systematic review identified NNS as one of the most effective and rapid non-pharmacological pain relief methods for neonates. However, significant heterogeneity in the findings ($I^2 = 72\%$ for preterm infants and $I^2 = 90\%$ for term neonates regarding pain reactivity) and the reliance on low-quality evidence limit the certainty of these conclusions (Vu-Ngoc et al., 2020).

NNS functions to reduce pain by means of a sucking mechanism that can activate the non-opioid endogenous system in newborns, which functions to produce analgesics and reduce pain in newborns. By stimulating orotactile and mechanoreceptors in the mouth to encourage the pain transmission pathway or non-selective transmission (Hooper, 2015). NNS operates based on the gate control theory and its effect stops when the sucking mechanism

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is stopped, namely by blocking non-selective impulses of peripheral ascending nerve fibers or stimulating afferent nerve fibers.

A total of 226 premature babies were born in the NICU and Perina rooms of Alia Hospital Jakarta from January to March 2024, patients who entered the NICU and Perina rooms with various diagnoses. Based on these data, 141 babies underwent invasive procedures, and in premature babies there were 88 babies who underwent invasive procedures. In babies who will be given an IV, the baby often cries and struggles due to the puncture, so that the crying thwarts the puncture so that the babies get repeated punctures. Based on this background, the researcher wants to conduct a study on the Effect of Pacifier Use (Non Nutritive Sucking) on Pain Intensity in Premature Babies Who Have Infusions in the NICU and Perina Rooms of Alia Hospital Jakarta.

METHOD

This study used a quasi-experimental design, which examines an intervention on a group of people with or without a comparison group, but does not randomize the assignment of subjects to treatment or control groups. This research employs a post-test-only non-equivalent control group design methodology. A post-test-only non-equivalent control group design refers to a methodology that involves administering a pretest prior to treatment and a posttest subsequent to treatment for each group. This design closely resembles the post-test only control group in pure experimental research. This design does not include randomization by the researchers (Dharma, KK, 2017). The study population comprised premature infants receiving treatment in the NICU at Perina Alia Hospital, Jakarta, totaling 141 patients from January to March 2024, with an average of 43 patients per month. The researchers employed purposive sampling, an approach characterized by specific considerations. The study sample comprised 17 premature infants in the intervention group who received infusion via the pacifier method (NNS) and 17 premature infants in the control group who received infusion without the pacifier method (NNS). This study included devices including pacifiers, specifically sterile silicone nipples administered to the infant's mouth during infusion, and observation sheets with patient demographic data such as gender, age, and weight. Subsequent to data collection, it underwent analysis through univariate and bivariate methods.

RESULT AND DISCUSSION

Univariate Analysis
Respondent Characteristics
Respondent data characteristics consisting of gestational age, gender, and baby weight.
  a) Gestational Age
Table 5.1 Frequency Distribution Based on Gestational Age of Respondents in NICU and PERINA Alia Hospital Jakarta in June-July 2024 (n=34)

Gestational Age	Frequency (n)	Percentage (%)
28-32 weeks	19	55.9
33-36 weeks	15	44.1
Total	34	100

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Based on table 5.1, it shows that of the 34 respondents who had a gestational age of 28-32 weeks, there were 19 babies (55.9%) and respondents with a gestational age group of 33-36 weeks, there were 15 babies (44.1%).

b) Gender

Table 5.2 Frequency Distribution Based on Gender of Respondents in NICU and PERINA Alia Hospital Jakarta in June-July 2024 (n=34)

Gender	Frequency (n)	Percentage (%)
Man	14	41.2
Woman	20	58.8
Total	34	100

Based on table 5.2, it shows that of the 34 respondents, 20 were female (58.8%) and 14 were male (41.2%).

c) Weight

Table 5.3 Distribution of Respondents' Weight Frequency in NICU and PERINA Alia Hospital Jakarta in June-July 2024 (n=34)

Weight	Frequency (n)	Percentage (%)
1000 – 1500 grams	13	38.2
1501 - 2000 grams	15	44.1
2001 - 2500 grams	6	17.7
Total	34	100

Table 5.3 shows that the characteristics of respondents with a body weight of 1501-2000 grams were 15 babies (44.1%), the number of body weights of 1000 - 1500 grams was 13 babies (38.2%), and the number of body weights of 2001-2500 grams was 6 babies (17.7%).

Table 5.4 Average Pain Intensity in Premature Babies Undergoing Infusion with Pacifier Use (Non Nutritive Sucking) (Intervention Group) in the NICU and Perina Room of Alia Hospital Jakarta (n=17)

Pain scale	Mean	SD	Min - Max
Intervention group	1.65	0.606	1 - 3

Based on table 5.4, it shows that 17 respondents in the intervention group after being given the use of a Pacifier (Non-Nutritive Sucking) obtained an average pain intensity score of 1.65 which according to Abidin (2021) on a pain scale is classified as mild pain (0-2), with a minimum value of 1 and a maximum of 3 with a standard deviation of 0.606.

Table 5.5 Average Pain Intensity in Premature Babies Who Underwent Infusion Installation without Pacifier Use (Non Nutritive Sucking) (Control Group) in the NICU and Perina Alia Hospital Jakarta (n=17)

Pain scale	Mean	SD	Min - Max
Control Group	4.24	0.664	3 - 5

Based on table 5.5, it shows that 17 respondents in the control group who were not given a pacifier (Non-Nutritive Sucking) had an average pain intensity score of 4.24, which

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according to Abidin (2021) on a pain scale is classified as moderate pain (3 - 4), with a minimum value of 3 and a maximum of 5 with a standard deviation of 0.664.

Bivariate Analysis

Bivariate analysis was employed to assess the impact of pacifier use (nutritive sucking) on pain intensity in premature infants undergoing intravenous procedures, aiming to ascertain the disparity in pain intensity between the intervention and control groups. Following the intervention, the Independent-Sample T Test was employed with a significance level of 5%. containing the subsequent stipulations: An effect is there if the p-value is less than 0.05, and no effect is present if the p-value is more than 0.05, as indicated by the following data:

Table 5.6 Analysis of the Effect of Pacifier Use (non-nutritive sucking) on Pain Intensity in Premature Babies Who Underwent Infusion in the NICU and PERINA Alia Hospital Jakarta June-July 2024 (N=34)

Pain Scale	Mean	Standard Error	pValue
Difference Intervention and control groups	2,588	0.218	0.001

Table 5.6 shows the results of the analysis of the effect of Pacifier Use (non-nutritive sucking) on the Intensity of Pain in Premature Babies Who Have Infusions in the NICU and PERINA Alia Hospital Jakarta. The difference in the average pain intensity of the intervention and control groups is 2.588 with a standard error value of 0.218. The p value result is 0.001, so it can be concluded that the average pain intensity of the intervention and control groups after the intervention was given there was a significant difference (0.001 <0.05) meaning that H0 was rejected and Ha failed to be rejected. This means that there is an effect of Pacifier Use (non-nutritive sucking) on the Intensity of Pain in Premature Babies Who Have Infusions in the NICU and PERINA Alia Hospital Jakarta.

Discussion

Univariate Analysis

a. Respondent Characteristics

1) Gestational Age

The findings of this study delineate the features of respondents according to gestational age, revealing that among 34 patients, a majority, 55.9% or 19 patients, had a gestational age of 28-32 weeks. This outcome contrasts with the research by Fika Novianti and Awaliyah (2020) titled The Effect of Pacifier Use During IV Line Installation on Vital Signs of Premature Babies in the NICU Room of RSAB Harapan Kita Jakarta, which indicated that all respondents (100%) or 30 participants had a gestational age of 35 weeks. In the research conducted by Pramesti et al. (2018), titled "Provision of Non-Nutritive Sucking (Pacifier) Towards Neonatal Pain Response Undergoing Infusion Installation," it was demonstrated that both the treatment and control groups consisted of neonates with a gestational age classified as term, specifically between 37 and 40 weeks. The researcher's analysis revealed a higher prevalence of respondents with a gestational age of 28-32 weeks. This observation aligns with the researcher's experience in the NICU and Perina rooms, where numerous infants were delivered at this gestational age due to maternal complications, including toxemia gravidarum (preeclampsia and eclampsia), a history of prematurity (antepartum hemorrhage, malnutrition,

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and sickle cell anemia), maternal health issues (hypertension, heart disease), trauma during pregnancy, maternal age below 20 or above 35 years, and insufficient pregnancy spacing.

2) Gender

The study results indicate that among 34 patients, a greater proportion were female, comprising 58.8% or 20 individuals. This study aligns with the research by Atik Pramesti and Suryaningsih (2021) titled The Effect of Non-Nutritive Sucking on Pain During Invasive Procedures in Neonates, indicating that the majority of responders were female (65%). A study by Astuti et al. (2016), titled "Pacifiers are Effective in Reducing Infant Pain During Venous Blood Collection After Kangaroo Method Care and Pacifier Administration," revealed that nearly all participants (79%) were male, comprising 22 individuals, while females accounted for 6 participants (21%). According to the researcher's analysis, the majority of respondents during the study were female, because during pregnancy the mother consumed a lot of vegetables, and at the time of the study many parents hoped that their baby would be a girl so that during their pregnancy they did a lot of counseling with obstetricians on how to make the baby born according to expectations, namely a baby girl.

3) Weight

The results of this study show a description of the characteristics of respondents based on body weight that out of 34 patients, there were more babies weighing 1501-2000 grams by 44.1% or as many as 15 babies. In the study of Astuti (2019) with the title of the study Overview of Low Birth Weight Infants at the Wates Kulon Progo Yogyakarta Hospital, it showed that the BBLR category (1500-2500 grams) was 311 respondents (90.9%), the BBLSR category (1000-1500 grams) was 17 respondents (5.0%) and a small part was in the BBLER category (<1000 grams) as many as 14 respondents (4.1%). According to the researcher's analysis, there are more babies weighing 1000-1500 grams because many babies are born prematurely, where the mother's gestational age is 28-32 weeks due to pregnancy complications so that the baby must be born immediately, which causes premature babies and low birth weight (BBLR).

Average Pain Intensity in Premature Infants Undergoing Infusion with Pacifier Use (Non Nutritive Sucking) (Intervention Group) in the NICU and Perina Room of Alia Hospital Jakarta

The study found that the average NIPS pain score for patients in the intervention group who received pacifier treatment (Non-Nutritive Sucking) was 1.65, with a minimum score of 1, a maximum of 3, and a standard deviation of 0.606. These findings differ from the research conducted by Pramesti et al. (2018), titled "The Provision of Non-Nutritive Sucking (Pacifier) to the Pain Response of Neonates Given IVs," which reported an average pain score of 6.20 in the treatment group with a sample size of 20 neonates. Pain in neonates is defined as an unpleasant emotional and sensory experience resulting from injury or disruptions in body tissues. Addressing this requires effective management tailored to the unique physiological and psychological responses of infants.

According to the researcher's analysis, the average value of NIPS (Neonatal Infant Pain Scale) Pain after being given the treatment of using Pacifiers (Non Nutritive Sucking) is 1.65 where the value is included in the pain intensity with a mild or non-pain category. It is obtained because the use of pacifiers is very effective in reducing pain, because sucking can activate

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the non-opioid endogenous system which functions to produce analgesics. Thus, the average value of 1.65 shows that the use of pacifiers can have an impact on low pain intensity in premature babies after being given this treatment.

Average Pain Intensity in Premature Babies Who Underwent Infusion Installation without Pacifier Use (Non Nutritive Sucking) (Control Group) in the NICU and Perina Alia Hospital Jakarta

The study revealed that the average NIPS pain score for the control group, who did not receive pacifier treatment (Non-Nutritive Sucking), was 4.24, with a minimum score of 3, a maximum of 5, and a standard deviation of 0.664. These findings differ from those of Dyah Dwi Astuti et al. (2016) in their study titled "Pacifiers Are Effective in Reducing Infant Pain During Venous Blood Sampling." Astuti's research indicated that the average pain score for neonates in the control group was 8.94, while in the intervention group, it was 5.08. Neonates, or newborns in the early stages of life, are in a critical period of growth and adaptation to the transition from intrauterine to extrauterine life. Managing pain responses in neonates can be effectively addressed through non-pharmacological pain management techniques.

According to the researcher's analysis, the average NIPS pain intensity data in the control group was 4.24, which is a moderate pain category. In infants who do not use a pacifier when the infusion is installed, the pain level will be very high and the infant does not have a diversion from the pain, so that the non-opioid hormone does not work, where this hormone is an anagesic that functions to reduce pain. The effect of the puncture is that the baby will cry and struggle, which will increase the trauma effect on the infant and the risk of repeated punctures. The effect of the crying will greatly affect the baby's vital signs such as tachycardia and oxygen desaturation, because the baby has no diversion from the pain.

Bivariate Analysis

The Effect of Pacifier Use (Non-Nutritive Sucking) on Pain Intensity in Premature Infants Undergoing IV Installation in the NICU and Perina Alia Hospital Jakarta was examined using the Independent T-Test. The analysis yielded a p-value of 0.001, which is less than the significance threshold of 0.05, leading to the rejection of H0. This indicates a significant difference in the average pain intensity between the intervention group and the control group. Therefore, it can be concluded that pacifier use (Non-Nutritive Sucking) significantly impacts pain intensity in premature infants undergoing IV installation in the NICU at Perina Alia Hospital Jakarta.

These findings align with research by Pramesti et al. (2018) on the impact of Non-Nutritive Sucking (NNS) using a pacifier on neonatal pain responses during IV installation. Their statistical analysis, also employing the Independent T-Test, showed a p-value of 0.000 (p < 0.005), indicating significant differences in pain responses between the treatment and control groups. This study further confirms the effectiveness of NNS in reducing pain responses in neonates undergoing IV installation. Similarly, research by Fika Novianti and Awaliyah (2020) on the effect of pacifier use during IV installation on vital signs in premature infants at RSAB Harapan Kita Jakarta reported consistent results. Their study found a p-value

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of 0.000 (p < 0.005), indicating a significant difference in vital signs between the intervention and control groups after IV installation.

Pacifiers are widely used to calm and comfort newborns between feedings, yet their potential as an effective tool for acute pain relief is often overlooked by parents and healthcare practitioners. Randomized controlled trials (RCTs) have demonstrated the efficacy of Non-Nutritive Sucking (NNS) in alleviating pain during routine procedures such as heel pricks, vaccinations, and venipunctures. Among non-pharmacological methods for neonatal pain relief, NNS stands out as one of the most effective and rapid analgesic techniques (Vu-Ngoc et al., 2020).

One way of pain management using non-pharmacological therapy that can be done on infants is using the Non Nutritive Sucking method. Non Nutritive Sucking can be done by giving a pacifier or pacifier to the baby's mouth to stimulate the baby's sucking reflex without giving breast milk or other nutrients (Nengrum and Istiqomah, 2024). The mechanism of action of the pacifier in reducing pain is by sucking it can activate the non-opioid endogenous system which will produce ananagesic which can reduce pain, with orotactile stimulation and mechanoreceptors in the mouth will encourage the pain transmission pathway or non-septic transmission. Non-nutritive sucking operates based on the gate control theory, and its effects stop when the sucking mechanism is stopped. By blocking non-septic impulses of peripheral ascending nerve fibers or stimulating afferent nerve fibers (Gibbins and Stevens, 2001).

According to the researcher's analysis, the use of pacifiers (non-nutritive sucking) can reduce the intensity of pain in premature babies who are given IV fluids. This can be seen from the results of research conducted by researchers. The difference in pain intensity can be seen from the data, namely the average pain intensity of the NIPS control group of 4.24, and the intervention group of 1.65. By giving a pacifier to a baby who is given IV fluids, the baby will feel comfortable because sucking will divert the pain from the needle prick. With orotactile stimulation, it will cause the effect of non-opioid hormones that work to produce an analgesic effect so that it can reduce pain. Thus, it can be concluded that the use of pacifiers (non-nutritive sucking) can reduce the intensity of pain in premature babies who are given IV fluids.

CONCLUSION

Based on the results of the study, it can be concluded that the characteristics of the respondents in premature infants in the NICU and Perina Alia Hospital Jakarta showed that the majority of gestational age was in the range of 28-32 weeks (55.9%), more than half were female (58.8%), and most weighed 1501-2000 grams (44.1%). The average intensity of NIPS pain in the intervention group after being given pacifier treatment (Non-Nutritive Sucking) was 1.65, while in the control group without pacifier treatment it was 4.24. This study shows a significant effect of pacifier use on reducing pain intensity in premature infants undergoing IV infusion in the NICU and Perina rooms, with a p value = 0.001 (α <0.05).

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