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The Effect of Shotblocker Use on Pain Scores in Infants Undergoing Intramuscular Immunization at Jatinangor Primary Health Center

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Abstract: Pain caused by immunization procedures often leads to anxiety, fear, and even trauma in children, potentially affecting their adherence to the immunization schedule. Shotblocker is a simple device based on the Gate Control Theory, which reduces pain perception through tactile stimulation. This study aimed to determine the effect of Shotblocker use on pain scores among two-month-old infants receiving intramuscular immunization. A quasi-experimental design with a posttest-only control group was employed on 80 infants, divided into an intervention group (with Shotblocker) and a control group (without Shotblocker). Pain was assessed using the FLACC scale. The results showed that the mean pain score in the intervention group was 3.57 (SD = 0.879), while in the control group it was 6.48 (SD = 0.727). An independent sample t-test indicated a significant difference between the groups ($p < 0.05$). These findings demonstrate that Shotblocker significantly reduces pain intensity in infants following intramuscular immunization. Shotblocker may serve as a safe and effective non-pharmacological tool to improve pediatric comfort.

Keywords: FLACC scale; immunization; shotblocker

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Introduction

Immunization is a key public health intervention aimed at preventing infectious diseases and reducing morbidity and mortality in children. In Indonesia, most vaccines are administered through intramuscular injection, which is considered effective in inducing an immune response. However, this procedure is frequently associated with pain due to tissue injury and activation of nociceptors at the injection site (Guyton & Hall, 2010; Prawirohardjo, 2014).

Pain during immunization is not only a physiological response but also has broader consequences, particularly in infants and young children. Exposure to repeated painful procedures at an early age can lead to increased sensitivity to pain, behavioral distress, and negative emotional responses such as fear and anxiety, which may persist and influence children's cooperation during subsequent healthcare procedures (Wong, 2009; Smeltzer & Bare, 2011). In the Indonesian context, this issue remains significant, as a considerable proportion of children still experience moderate to severe pain during immunization procedures (Irawan, 2018; Ilmiasih, 2021).

The impact of immunization-related pain extends beyond the child to the parents. Parental perception of their child's pain plays an important role in decision-making regarding immunization. Concerns about pain and discomfort are frequently reported as reasons for delaying or refusing immunization, which may contribute to suboptimal immunization coverage (Wieland, 2019; WHO, 2015). Data from Jatinangor Primary Health Center in 2024 showed that the coverage of basic immunization reached only 64.99%, which is still below the national target. Preliminary findings in this setting indicate that parental concern regarding pain during immunization is one of the contributing factors to incomplete immunization.

Considering these consequences, effective pain management during immunization is essential. In clinical practice, various non-pharmacological approaches have been developed to reduce injection-related pain, including breastfeeding, distraction techniques, and tactile stimulation (Wong, 2009; Hockenberry & Wilson, 2011). These methods are considered safe, practical, and suitable for use in infants. However, in many primary healthcare settings, including community health centers, the implementation of such interventions remains inconsistent, and immunization procedures are often performed without specific pain management strategies.

One of the non-pharmacological methods that can be applied is the use of a shotblocker. This device is a simple plastic tool with blunt projections that is placed on the skin around the injection site. Its mechanism is based on the

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Gate Control Theory, which explains that mechanical stimulation can activate large-diameter nerve fibers and inhibit the transmission of pain signals to the central nervous system (Melzack & Wall, 1959). In addition to its physiological mechanism, the shotblocker may also provide a distraction effect, which can help reduce the perception of pain during the injection process (Hockenberry & Wilson, 2011).

Previous studies have reported that the use of shotblocker is effective in reducing pain during intramuscular injections (Cobb & Cohen, 2009; Çelik & Khorshid, 2015). However, most of these studies have been conducted in hospital settings or involve older children and adult populations. Evidence regarding its use in infants, especially in primary healthcare settings, is still limited. In Indonesia, the use of shotblocker in routine immunization services has not been widely implemented, despite its potential advantages as a simple and low-cost intervention.

This condition indicates a clear gap between the availability of effective non-pharmacological pain management methods and their application in primary healthcare practice. Furthermore, there is still limited empirical evidence regarding the effectiveness of shotblocker use in infants within the context of Indonesian primary healthcare services. Therefore, research in this area is necessary to provide evidence-based recommendations that are relevant to local healthcare settings.

Based on this background, the present study aims to determine the effect of shotblocker use on pain scores in two-month-old infants undergoing intramuscular immunization at Jatinangor Primary Health Center.

Method

This study employed an analytical quantitative approach with a quasi-experimental posttest-only control group design. The objective was to examine the effect of shotblocker use on pain scores among two-month-old infants receiving intramuscular immunization. Respondents were divided into two groups: an intervention group that received the shotblocker during injection and a control group that did not.

Pain assessment was conducted immediately after the immunization procedure using the FLACC scale (Face, Legs, Activity, Cry, Consolability), which is widely used for assessing pain in infants and non-verbal children. The assessment was carried out through direct observation by trained observers. Prior to data collection, the observers received training on the use of the FLACC scale to ensure a consistent understanding of the scoring criteria and to minimize subjectivity in pain assessment.

To improve the consistency of measurements, the assessment procedure was standardized across all observation sessions. Observers followed the same guidelines in evaluating each component of the FLACC scale. However, formal inter-rater reliability testing was not conducted in this study. Therefore, efforts to maintain consistency were primarily achieved through training and the use of standardized observation procedures.

Given that the FLACC scale is based on behavioral observation, the possibility of observer bias cannot be entirely eliminated. This limitation was addressed by ensuring that observers adhered strictly to the predefined scoring criteria during data collection

The study was conducted from March to April 2025 in the working area of Jatinangor Primary Health Center, Sumedang District, which includes six village health posts (Poskesdes) and one auxiliary health center (Pustu). The study population consisted of all two-month-old infants scheduled to receive the DPT-HB-Hib vaccine within the area. A quota sampling technique was used, with a total sample of 80 infants, comprising 40 infants in each group. Inclusion criteria included being two months of age, residing in the study area, registered in the Maternal and Child Health (MCH) handbook, and parental consent to participate. Infants with certain medical conditions or neurological disorders were excluded.

Data were collected through observation of pain-related behaviors using the validated FLACC scale instrument. Immunization procedures were carried out directly by the researcher in accordance with the standard operating procedures for intramuscular immunization and the Z-track technique to ensure procedural consistency. All procedures were conducted under the supervision of the community midwives assigned to each location.

Data analysis was performed using SPSS version 26. Univariate analysis was used to describe the characteristics of the respondents. The Kolmogorov–Smirnov test was used to assess data normality, and data with a normal distribution were analyzed using the independent samples t-test. This study obtained ethical approval, and all participants' parents provided written informed consent prior to participation.

Results and Discussion

The results of this study showed a clear difference in pain scores between infants who received intramuscular immunization using a shotblocker and those who did not. In the intervention group, the mean pain score was 3.57 (SD = 0.879), with scores ranging from 2 to 6. In contrast, the control group had a higher mean pain score of 6.48 (SD = 0.727), with a range of 5 to 8.

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The difference in mean scores between the two groups was 2.91 points, indicating a substantial reduction in pain among infants in the intervention group. The relatively narrow range and small standard deviation in both groups suggest that the distribution of pain scores was consistent, with no extreme variation among participants.

From a clinical perspective, the mean score in the intervention group falls within the mild to moderate pain category, while the control group is within the moderate to severe pain category based on the FLACC scale classification. This indicates that the use of a shotblocker not only reduces pain statistically but also shifts the pain category to a lower clinical level.

These findings demonstrate that the application of a shotblocker during intramuscular immunization is associated with a meaningful reduction in pain intensity in two-month-old infants.

Table 1. Pain Score Distribution Based on Intervention and Control Groups

Group	N	Mean	Sd
Intervention	40	3.57	.879
Control	40	6.48	.727

Respondent Characteristics Based on Nutritional Status and Exclusive Breastfeeding

The characteristics of respondents in this study showed that most infants in both groups had normal nutritional status, with 92.5% in the intervention group and 87.5% in the control group. Only a small proportion fell into the categories of undernutrition or at risk of being overweight. Additionally, the majority of respondents received exclusive breastfeeding, amounting to 75% in the intervention group and 70% in the control group.

Good nutritional status influences a child's pain threshold, as thicker subcutaneous tissue can reduce sensitivity to nociceptive stimuli (Wong, 2009). The World Health Organization (2015) also noted that exclusive breastfeeding triggers the release of beta-endorphins, which have analgesic effects and help increase pain tolerance. Thus, nutritional status and breastfeeding practices can serve as protective factors against pain experienced during immunization.

Pain Scores in the Intervention Group

Pain measurements using the FLACC scale showed that the intervention group, which received the shotblocker, had a mean pain score of 3.57 (SD = 0.879), with a minimum score of 2 and a maximum of 6. According to FLACC scale interpretation, this score falls into the category of mild to moderate pain.

The effectiveness of the shotblocker can be explained by the Gate Control Theory proposed by Melzack and Wall (1959), which states that mechanical pressure from the shotblocker's protrusions stimulates A-beta fibers, closing the pain gate in the dorsal horn of the spinal cord. This is consistent with Hockenberry and Wilson (2011), who emphasized that tactile stimulation before injection can significantly reduce perceived pain. Furthermore, the applied pressure reduces the release of inflammatory mediators such as prostaglandin E2 (PGE2) and nitric oxide (NO), which play a role in nociceptor sensitization (Guyton & Hall, 2010).

Pain Scores in the Control Group

In the control group, the mean pain score was 6.48 (SD = 0.727), with scores ranging from 5 to 8. This falls under the category of moderate to severe pain. All respondents in this group received immunization using the Z-track and air lock techniques without any additional pain relief measures.

According to Smeltzer and Bare (2011), the Z-track technique is effective in preventing vaccine leakage but does not modulate the nervous system or pain perception. As a result, infants in this group exhibited more pronounced pain responses, such as prolonged crying and restlessness, due to the lack of sensory inhibition in the nociceptive pathways.

Comparison of Pain Scores Between Intervention and Control Groups

Prior to hypothesis testing, a normality test was conducted using the Kolmogorov–Smirnov test. The results indicated that the data in both the intervention and control groups were normally distributed ($p > 0.05$), thus fulfilling the assumption for parametric testing.

An independent samples t-test was then performed to compare pain scores between the two groups. The analysis showed a statistically significant difference in mean pain scores between infants who received immunization using a shotblocker and those who did not ($p < 0.001$).

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The mean difference in pain scores between the two groups was 2.91, indicating that infants in the intervention group experienced lower pain levels compared to those in the control group. This finding suggests that the use of a shotblocker provides a meaningful reduction in pain intensity during intramuscular immunization.

These findings are consistent with the theory proposed by Hockenberry and Wilson (2011), which states that tactile stimulation can act as a sensory distraction to reduce pain responses, particularly in infants with limited coping mechanisms. In addition, the results support the Gate Control Theory by Melzack and Wall (1959), which explains that mechanical stimulation can inhibit the transmission of pain signals to the central nervous system.

Clinical Implications and Study Limitations

The findings of this study indicate that the use of a shotblocker is effective in reducing pain intensity in infants undergoing intramuscular immunization. The observed reduction in mean pain scores suggests that this intervention is not only statistically significant but also clinically meaningful, as it shifts the level of pain from moderate–severe in the control group to mild–moderate in the intervention group. This is particularly important in infant populations, where repeated exposure to pain may influence future behavioral responses to healthcare procedures.

From a clinical perspective, the shotblocker offers a practical and feasible approach for pain management in primary healthcare settings. Compared to other non-pharmacological interventions, such as breastfeeding or distraction techniques, the shotblocker is relatively simple to apply, does not require additional time or resources, and can be easily integrated into routine immunization procedures. Its use may contribute to improving the overall quality of immunization services, including enhancing infant comfort and potentially increasing parental acceptance of immunization programs.

The effectiveness of the shotblocker observed in this study is consistent with the Gate Control Theory proposed by Melzack and Wall, which explains that mechanical stimulation can inhibit the transmission of pain signals to the central nervous system. This finding is also in line with previous studies that reported a reduction in pain intensity with the use of tactile stimulation during injection procedures (Hockenberry & Wilson, 2011; Cobb & Cohen, 2009; Çelik & Khorshid, 2015). Compared to these studies, the present research provides additional evidence specifically in infants within a primary healthcare setting, which remains relatively underreported.

However, several limitations should be considered when interpreting the results of this study. First, the use of quota sampling may introduce selection bias, as the participants were not randomly selected. Second, the absence of randomization in group allocation may affect the internal validity of the study and limit causal inference. Third, pain assessment was conducted using the FLACC scale, which relies on observer judgment and may be subject to observer bias, despite efforts to standardize the assessment through prior training. In addition, this study was conducted in a single primary healthcare center, which may limit the generalizability of the findings to other settings with different population characteristics and service conditions.

Another limitation is the use of a single measurement instrument without additional physiological or behavioral indicators to support the assessment of pain. Future studies are recommended to include larger and more diverse samples, apply randomized designs, and incorporate multiple measurement approaches to strengthen the validity of the findings. Further research comparing the effectiveness of shotblocker with other non-pharmacological interventions, such as breastfeeding, sucrose administration, or distraction techniques, would also provide a more comprehensive understanding of pain management strategies in infant immunization.

Conclusion

This study demonstrates that the use of a shotblocker is associated with a significant reduction in pain scores among two-month-old infants undergoing intramuscular immunization. Infants in the intervention group generally experienced lower pain intensity, categorized as mild to moderate, compared to those in the control group, who experienced moderate to severe pain. These findings indicate that the application of tactile stimulation through a shotblocker can contribute to reducing pain perception during immunization procedures.

The results support the use of simple, non-pharmacological approaches as part of pain management strategies in pediatric immunization services. In this context, the shotblocker may be considered a practical and feasible option for use in primary healthcare settings, particularly due to its ease of application and non-invasive nature.

However, these findings should be interpreted with caution. Given that this study was conducted in a single primary healthcare setting with a quasi-experimental design, the generalizability of the results remains limited. Further research involving larger sample sizes, randomized designs, and multiple healthcare settings is needed to strengthen the evidence regarding the effectiveness of shotblocker use in infant immunization.

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Authors' Contribution

All authors contributed equally to every aspect of this research, from the initial study design and data collection to the analysis, interpretation, manuscript preparation, and critical revisions. All authors have read and approved the final version for submission.

Conflict of Interests Statement

The authors declare no conflict of interest.

Data Availability

The dataset presented in the study is available on request from the corresponding author during submission or after publication.

Informed Consent

Written informed consent was obtained from the participants.

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