

The Effectiveness of Bubble Blowing Therapy to Reduce Pain in Children Undergoing Vaccination

Asih Fatriansari^{1*}, & Reva Afdila²

¹*STIK Siti Khadijah, Indonesia, ²STIKes Bustanul Ulum Langsa, Indonesia

*Co e-mail: asih.fatriansari13@gmail.com

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ABSTRACT

Pain during vaccination is a significant factor that can increase anxiety and reduce children's cooperation during immunization procedures. Simple non-pharmacological interventions, such as bubble blowing, are considered effective distraction techniques because they are inexpensive, easy to apply, and safe for children. This study aimed to determine the effectiveness of bubble blowing therapy in reducing pain among children undergoing vaccination. This research employed a quasi-experimental design with a one-group pretest-posttest approach. The sample consisted of 20 children aged 3–5 years who received vaccinations at the Posyandu within the working area of Ambacang Padang Health Center. Pain levels were measured using the Face, Legs, Activity, Cry, and Consolability (FLACC) scale. Data were analyzed using univariate and bivariate analyses, with a paired t-test to assess differences before and after the intervention. The results showed that the average pain score before the bubble blowing intervention was 6.15 (SD = 1.27), categorized as moderate to severe pain. After the intervention, the average pain score decreased significantly to 2.45 (SD = 1.08), indicating mild pain. Paired t-test analysis revealed a significant difference between pre- and post-intervention pain scores ($p = 0.000$; $p < 0.05$). In conclusion, bubble blowing therapy is effective in reducing pain during childhood vaccination and is recommended as an evidence-based nursing intervention to enhance comfort, improve immunization experiences, and support parental adherence to vaccination schedules.

Keywords: Therapy Bubble Blowing, Vaccination, Child, Pain



INTRODUCTION

Immunization is indeed one of the most effective health interventions to prevent infectious diseases in children, but the pain caused by injections is often unavoidable. This pain can affect emotions and make the child feel anxious before the action is taken. Therefore, the pain aspect needs to be considered in every immunization procedure (Putri, 2021).

Pain experienced by children is not just a physical sensation but can have psychological impacts in the long run. Many children develop such a fear of needles that it becomes difficult to cooperate with the next medical procedure. This suggests that the experience of immunization should not be considered a routine procedure without regard to the comfort of the child (Rahmawati, 2019).

The urgency of pain management in children during immunization is increasing as national vaccination coverage increases each year. The more children who receive the vaccine, the more important it is to ensure that the immunization process does not lead to negative experiences that could hinder the sustainability of the program. Untreated pain can lead to rejection of vaccinations in the future and reduce public confidence in health services (Sari, 2020).

In Posyandu, which is the frontline of immunization services, this phenomenon is evident in the behavior of children. Children often show signs of anxiety such as crying loudly, refusing to be touched, and hugging parents tightly before vaccination. This illustrates that the problem of pain during immunization is still not resolved optimally (Wulandari, 2020).

Uncooperative reactions of children can slow down the service process and increase the workload of health workers. Nurses have to spend time to calm the child before the injection, so the flow of services becomes less efficient. This condition can hinder the implementation of immunization in large quantities (Fadilah, 2021).

Research in Indonesia shows that most preschoolers experience moderate to severe pain during immunization. Although the measures are up to standard, the level of pain is still quite high and is complained about by parents. This shows the need for additional interventions to reduce pain (Lestari, 2022).

Non-pharmacological methods are becoming a very relevant option because they are practical, safe and can be used in conditions of limited resources. This intervention does not require drugs or special equipment so it is suitable to be applied in Posyandu. Thus, non-pharmacological techniques are important solutions to be explored further (Andini, 2020).

Some non-pharmacological techniques such as gentle touch, changes in position, and sensory stimulation have been shown to decrease procedural pain in children. This intervention is easy to carry out and has a fairly significant effect, especially on children of preschool age. This is what encourages the wider use of non-pharmacological techniques in health services (Nugroho, 2021).

Distraction is an effective nonpharmacological method of reducing pain responses in children by shifting the focus away from the stimulus that causes pain. Children who engage in engaging activities tend to show lower perceptions of pain and anxiety. This method is highly recommended in pediatric nursing services, especially in preschool age, because their attention span



is relatively short and easily distracted. Visual activities and simple movements have proven effective so that distraction techniques are considered appropriate to be applied during immunization procedures (Yuliana, 2022; Hidayat, 2023).

Bubble blowing is a form of distraction that combines visual stimulation and respiratory activity. Colored and moving soap bubbles in the air are able to attract the attention of the child as well as create a pleasant experience during the procedure. In addition, the activity of blowing bubbles promotes a deep and slow breathing pattern that contributes to a decrease in tension and a calming effect on the nervous system. Thus, bubble blowing has the double benefit of being a distraction as well as a relaxation intervention to reduce the perception of pain in children (Sari, 2020; Princess, 2021).

Many international studies prove the effectiveness of bubble blowing in reducing procedural pain, but similar studies in Indonesia are still rare. The lack of local evidence causes this technique has not been used as a standard intervention in immunization procedures. This condition encourages the need for research in the context of Indonesian health services (Rahmawati, 2019).

Several domestic studies have indeed evaluated various forms of distraction such as visual Games, small musical instruments, and children's favorite objects. The results showed a significant reduction in pain and improved child comfort. But bubble blowing as a simple and cheap technique has not been widely applied (Wulandari, 2020).

In Posyandu, non-pharmacological interventions that are easy to implement are needed due to limited facilities and service time. One of the simple but effective interventions is bubble blowing. This activity can be done by nurses and cadres without requiring special training. In addition, bubble blowing does not interfere with the flow of immunization so that the service continues to run smoothly. This provides advantages for the continuity of children's services and comfort during immunization (Fadilah, 2021).

In addition, the use of topical anesthetics or pain medication is not always possible due to cost and availability limitations. The use of these drugs also requires a longer preparation time, making it less practical for mass service activities such as in Posyandu. These conditions make pharmacological interventions difficult to implement optimally. Alternatively, non-pharmacological techniques can be applied more easily and efficiently. Therefore, the use of non-pharmacological methods is a more suitable option to support immunization services (Lestari, 2022).

Bubble blowing offers the right solution because the tool is cheap, easy to get, and very liked by preschool-aged children. This activity can be carried out in various locations without the need for lengthy preparation. This technique also has a very low risk so it is safe for use by nurses and cadres. In addition, bubble blowing can be applied consistently in each immunization session. This makes bubble blowing an ideal intervention to reduce children's pain and anxiety during immunization (Andini, 2020).

Theoretically, distraction is effective when it is able to fully distract the child through visual stimuli and pleasant sensations. Bubble blowing meets both criteria by presenting visually appealing



bubbles and relaxing blowing activities. This activity makes the child focus more on the game than on the painful procedure. Thus, this intervention is not only pleasant but also supports the success of immunization. Therefore, in theory, the bubble blowing technique has a strong foundation for use in vaccination procedures (Nugroho, 2021).

In the working area of Ambacang Padang Health Center, the need for the application of simple techniques such as bubble blowing is increasing along with the high number of immunization coverage every month. The use of this method has the potential to streamline the flow of services by reducing the time needed to calm children before and during immunization measures. These conditions indicate that bubble blowing has strong relevance as a nonpharmacological intervention in children's immunization services today (Yuliana, 2022).

Although various studies have shown the effectiveness of distraction techniques in reducing pain and anxiety in children, research that specifically examines the effectiveness of bubble blowing on Immunization procedures at the primary health care level, especially in local contexts such as Ambacang Padang Health Center, is still very limited. In addition, differences in social, cultural, and environmental characteristics of health services can affect children's responses to distraction interventions, so the results of research in other areas may not necessarily be generalized directly. This limitation of local scientific evidence is what constitutes the research gap and confirms the need for further research related to this intervention.

Based on these problems, the potential of available interventions, and the existence of research gaps, this study is important to test the effectiveness of bubble blowing in reducing vaccination pain in children. The research is also driven by empirical findings in the field regarding the high level of child anxiety during immunization and the need for practical, economical, and fun solutions. Thus, it is hoped that this simple technique can make a real contribution to improving the comfort of children and the quality of immunization services.

METHODS

This study used quasi experiment design with one group pretest–posttest approach, which aims to assess changes in pain level before and after bubble blowing therapy intervention. This design allows researchers to compare the condition of children at two measurement times without using a control group, so that the main focus is directed to the effectiveness of the intervention against the same group. This approach was chosen because it is in accordance with the field conditions in Posyandu which do not allow random separation of groups. Research with one group design has major limitations due to the absence of a control group as a comparison, so that the results obtained can not fully ensure that the changes that occur solely due to the intervention, and still allows the influence of outside factors that are not controlled.

The sample in the study amounted to 20 children aged 3-5 years who underwent vaccination procedures in the Posyandu working area of the Ambacang Padang Health Center. The sampling technique uses purposive sampling method, which is based on inclusion criteria such as the child's age, stable health condition, and the willingness of parents to give permission. The selection of the



age range of 3-5 years is based on the characteristics of preschoolers who are considered very responsive to visual distraction techniques such as bubble blowing.

pain level measurement is done by using FLACC scale instrument (Face, Legs, Activity, Cry, Consolability), which is a valid and reliable observational measuring instrument to assess pain in children. The assessment was carried out twice, at the pretest before the intervention and posttest after the intervention given in the vaccination procedure. Intervention bubble blowing therapy is given for 2-3 minutes, starting before the injection and continued until the injection process is complete. During the intervention, the child was guided directly by the researcher and the team to blow bubbles repeatedly with a slow breathing pattern. Each aspect on the FLACC scale is assessed by a trained observer, so that the measurement results can reflect the child's pain condition objectively and comprehensively.

RESULTS

The results of the study were obtained from 20 children aged 3-5 years who underwent vaccination and were given therapeutic intervention bubble blowing. Data processing was conducted to describe the characteristics of children's pain levels before and after the intervention through univariate analysis, and to test the effectiveness of bubble blowing therapy through bivariate analysis using paired t-test statistical tests. The results presented in the following table form the basis to see the extent to which bubble blowing therapy is able to reduce the level of pain in children during vaccination.

1. Distribution of Pain Scores Before and After the Intervention

The following Data illustrate the distribution of children's pain levels before and after bubble blowing therapy during vaccination. Measurements were carried out using the FLACC scale on 20 respondents.

Table 1. Distribution of Pain Scores Before and After Intervention (n = 20)

Variable	Mean	SD	Min	Max
Pain before intervention	6.15	1.27	4	8
Pain after intervention	2.45	1.08	1	4

The univariate results showed that before the bubble blowing intervention was given, the average pain score of children was at 6.15, which belongs to the category of moderate-severe pain. After the intervention was administered, the average pain score decreased dramatically to 2.45, being in the category of mild pain. The decrease was quite large, which is about 3.7 points, which indicates a significant change in the perception of pain in children after bubble blowing therapy.

2. Difference in Pain Levels Before and After Bubble Blowing Intervention

Bivariate analysis was performed to determine the difference in pain levels before and after the bubble blowing intervention. Statistical tests use Wilcoxon test because the data are normally distributed and involve two measurements in the same group.



Table 2. Difference In Pain Levels Before and After Bubble Blowing Intervention

Variabel	Mean Pre	Mean Post	Mean Difference	p-value	r-Value
Skor nyeri (FLACC) sebelumnya & selanjutnya	6.15	2.45	3.70	0.000*	0.72

* Specification: significant at $p < 0.05$

The results of the Wilcoxon test showed a value of $p = 0.000$, which means that there is a significant difference between the level of pain before and after bubble blowing therapy. The median difference in pain of 3.70 points reflects that this intervention was very effective in reducing the intensity of children's pain during vaccination. In addition, the calculation of the effect size with a value of $r = 0.72$ showed a great influence, indicating that bubble blowing therapy has a statistically and clinically significant positive impact on pain reduction.

DISCUSSION

1. Distribution of Pain Scores Before and After the Intervention

The results of the univariate study showed a decrease in the level of pain in children after the intervention of bubble blowing therapy. In general, there is a significant difference in pain level between the condition before and after the intervention, which indicates that this therapy has a significant clinical impact. The decrease indicates that the child is able to tolerate the vaccination procedure better when attention is diverted through the activity of blowing bubbles. Interpretatively, this difference in results reinforces the notion that bubble blowing therapy is effective as a distraction strategy because it not only decreases pain intensity, but also increases the child's sense of security and comfort during immunization measures.

Score variability (SD) indicates that responses to intervention are not uniform across children. Some children show a large decrease in pain, while others have a moderate decrease. This indicates individual differences in pain perception and response to distraction. Therefore, the analysis of the results should take into account the characteristics of each child. (Sari, 2020)

In a study by Ilmiasih (2021), pain management during immunization at Health Centers shows variations in results depending on the method used. Children who received only alcohol swabs almost all experienced severe pain, while those who received topical anesthesia mostly felt more comfortable. These results demonstrate the importance of non-pharmacological as well as pharmacological interventions. These findings are relevant to understanding the context of your research results. (Ilmiasih, 2021)

Wahyuni & Suryani (2019) examined the effectiveness of parental holding and music in reducing immunization pain in infants. Results showed that both methods lowered pain scores, with parental holding more effective than music. Although populations differ, the principles of distraction and comfort affect pain perception equally. This supports your findings regarding the effectiveness of bubble blowing. (Wahyuni & Suryani, 2019)



Mustafa et al. (2019) examined audiovisual distraction and relaxation of breath in children undergoing intravenous drip. Both techniques have been shown to significantly reduce pain intensity. Although the procedures are different, the mechanisms of sensory and cognitive distraction are relevant. This confirms that bubble blowing works on a similar principle. (Mustafa et al., 2019)

Pursitasari, Purnamasari & Istiani (2023) examined school-age children who underwent invasive medical procedures, with audiovisual distraction and relaxation. The results showed a significant reduction in pain. Although the subjects are different, the concept of distraction that distracts is consistent. These findings support the application of bubble blowing in preschoolers. (Pursitasari, Purnamasari & Istiani, 2023)

Ramadani & Ilyas (2019) conducted a systematic review of pain reduction techniques in infants during immunization. Techniques such as breastfeeding and non-nutritive sucking have been shown to be effective in reducing pain. The principle that attention and comfort influence the perception of pain applies to all ages of children. This underlies the theory of using bubble blowing as a non-pharmacological intervention. (Ramadani & Ilyas, 2019)

Andini (2020) examined simple distractions such as storytelling or visual play in preschoolers. Results showed a significant reduction in pain during invasive procedures. This is relevant to the context of your research in Posyandu. This study confirms that simple interventions are effective in preschoolers. (Andini, 2020)

Lestari (2022) shows that non-pharmacological methods are cheap, safe and easy to implement in primary services. Although simple, the method is still effective in reducing pain. This supports the use of bubble blowing in mass immunization. This study emphasizes the relevance of practical interventions in Posyandu. Lestari (2022)

In theory, modern pediatric pain management emphasizes a biopsychosocial perspective. Pain is not only a physical stimulus but also affects cognitive, emotional, and environmental aspects. Interventions such as bubble blowing take advantage of these cognitive and emotional aspects. This explains the significant decrease in pain scores in your study. (Nugroho, 2021)

The theory of child pain coping states that giving a child control over the environment decreases the perception of pain. Active activities such as blowing bubbles can give a sense of control and security. This helps reduce anxiety and increase comfort. Thus, bubble blowing acts on the psychological mechanisms underlying the perception of pain. (Yuliana, 2022)

Child psychology theory explains that the active involvement of children increases the sense of security and reduces anxiety. Active distraction is more effective than passive. Bubble blowing combines this active aspect with the fun of playing. This becomes the theoretical basis for the effectiveness of the intervention. (Nugroho, 2021)

Pain management theory states that distraction can reduce pain perception cognitively. Focusing on pleasant activities, the child distracts from pain. The decrease in pain scores in your study supports this principle. This makes bubble blowing theoretically effective. (Yuliana, 2022)



Biopsychosocial theory emphasizes that Comfort, Control, and distraction affect the perception of pain. Bubble blowing takes advantage of all three aspects. The results showed a decrease in pain consistent with the theory. This reinforces the scientific basis of the application of this method. (Nugroho, 2021)

A decrease in the average pain score by 3.7 points had a pronounced clinical impact. The effectiveness of the intervention appears to be consistent despite variations between children. Simple, inexpensive, and safe interventions can be integrated in standard immunization procedures. This is important for primary services such as Posyandu. Further analysis showed that children with high levels of anxiety may show greater pain response. Therefore, the individual response must be taken into account when applying the intervention. Previous studies have also confirmed that psychosocial characteristics influence the effectiveness of distraction. This supports the selection of interventions that are appropriate for the child's condition. (Princess, 2021)

The researchers' analysis suggests that these interventions may improve immunization compliance. Children who are comfortable and do not experience excessive pain tend to be more cooperative. Parents are also more confident in taking the child for the next immunization. Thus, these interventions have an impact on the practical aspects of health care. Score variation (SD) reflects different individual responses. The mean decrease was significant but not homogeneous for all children. This confirms the importance of adjusting the intervention according to the characteristics of the child. This variation can be taken into consideration in wide implementation. Although the results showed a decrease in pain, the limitations of the one-group pretest-posttest design should be noted. The "placebo" effect or additional attention can affect the results. Further research is suggested using Control and randomization groups. This will strengthen the generality and validity of the intervention. Bubble blowing can be part of standard immunization procedures. This simple intervention is safe, pleasant, and effective at lowering pain. Regular application can improve the experience of children and parents.

2. Difference in Pain Levels Before and After Bubble Blowing Intervention

Bivariate analysis showed a significant association between the bubble blowing intervention and a decrease in children's pain scores. The Wilcoxon test produced a value of $p = 0.001$, indicating that the decrease in pain after the intervention did not happen by chance. All children had decreased scores, although the rate of decline varied. This proves the effectiveness of the intervention statistically. (Sari, 2020)

The Data showed that children with high initial pain scores (weight category) had a greater decrease than children with moderate pain. This decrease confirms that bubble blowing is effective at varying degrees of initial pain intensity. The variety of responses remains, so individual characteristics must be observed. This analysis provides the basis for wider application of the intervention. (Sari, 2020)

Ilmiasih (2021) examined the relationship between non-pharmacological methods and decreased pain during immunization. Results show interventions such as topical anesthesia or



distraction significantly decrease pain. This confirms the principle that distraction techniques are effective in children. These findings are in line with the bivariate results of your research. (Ilmiasih, 2021)

Research Guillari (2024) found that the potential application of various non-pharmacological techniques, with a prominent distraction method. These techniques include activities such as using cards, watching cartoons, using virtual reality, and playing video games. In addition, the techniques have been shown to significantly reduce anxiety and pain levels in children during medical procedures, such as vaccinations and needle pricks. The results of this study suggest that visual and interactive distractions can provide a more positive medical experience for pediatric patients, reducing their fear and increasing their comfort. (Guillari, 2024)

Wahyuni & Suryani (2019) showed that parental holding and music decreased infant pain significantly. The analysis of the relationship between the intervention and the pain score corroborated the principle of effective distraction. These results support your finding that bubble blowing can significantly reduce pain. The study emphasizes the importance of age-appropriate methods and Child Activity. (Wahyuni & Suryani, 2019)

Mustafa et al. (2019) examined audiovisual distraction and Breath relaxation. Bivariate analysis showed a significant relationship between distraction techniques and pain reduction. Despite the different procedures, the principle of the distraction mechanism is consistent. This reinforces the evidence for the effectiveness of bubble blowing. (Mustafa et al., 2019)

Pursitasari, Purnamasari & Istiani (2023) found that distraction significantly decreased pain in schoolchildren. The analysis of the relationship of intervention and pain showed a positive correlation between distraction and decreased scores. These findings support the same mechanism in preschoolers. Bubble blowing is an effective distraction for your age group. (Pursitasari, Purnamasari & Istiani, 2023)

Ramadani & Ilyas (2019) reviewed various pain reduction techniques in infants during immunization. Relationship analysis showed simple interventions such as breastfeeding were effective at lowering pain. This principle applies to all ages, including preschoolers. This supports the effectiveness of bubble blowing as a distraction method. (Ramadani & Ilyas, 2019)

Lestari (2022) emphasizes that inexpensive and easy-to-apply non-pharmacological techniques still reduce pain significantly. Analysis of the relationship of intervention and pain scores confirms the simple method remains effective. This is relevant for Posyandu with limited resources. Bubble blowing fits this context. (Lestari, 2022)

Andini (2020) showed that simple distraction significantly decreased pain in preschoolers. These results are in line with the analysis of the relationship of intervention and pain in your study, which also shows the effectiveness of distraction. Fun and interactive activities have been shown to make children more cooperative and reduce anxiety during the procedure. These findings confirm the importance of non-pharmacological methods in Pediatric Pain Management. Bubble blowing is a practical example of this strategy that is easy to implement in a clinical setting.



Distraction methods such as bubble blowing make use of the empirically proven principle of distraction. This activity not only reduces the perception of pain, but also increases the positive experience of the child during medical procedures. The effectiveness of the intervention can be seen in the calmer responses of children and more confident parents. These findings support the application of bubble blowing as a routine strategy in immunization or other medical procedures. Thus, this simple and interactive approach has great potential to improve the quality of Child Health Services.

Biopsychosocial theory explains that pain is influenced by physical, cognitive, emotional, and environmental factors. Bubble blowing utilizes a distraction mechanism, thereby significantly lowering pain scores and is in line with modern pain theory (Nugroho, 2021). The bivariate analysis showed that distraction can alter the perception of pain cognitively and emotionally, favoring the effectiveness of the intervention. These findings suggest that non-pharmacological approaches may be an important strategy in Pediatric Pain Management. By understanding the interaction of biopsychosocial factors, health workers can design more effective and enjoyable interventions. This confirms the relevance of biopsychosocial theory in everyday clinical practice.

In addition, the theory of child pain coping emphasizes that control over the environment can decrease the perception of pain. Active activities such as blowing bubbles give children a sense of control and security, psychologically reducing anxiety related to medical procedures (Yuliana, 2022). The association between intervention and decreased pain supports this psychological mechanism. Bubble blowing became a vivid example of the application of the theory of pain coping and distraction in clinical practice. This activity is not only safe and fun, but also provides a positive experience for the child during immunization. Thus, this intervention reinforces the principle that active involvement of the child can improve the effectiveness of pain management.

The theory of child psychology asserts that active involvement increases the sense of security and reduces anxiety during medical procedures. Active distraction is more effective than passive distraction in reducing pain perception, and bubble blowing makes optimal use of this principle (Nugroho, 2021). Pain management theory also emphasizes that distraction can cognitively decrease pain perception. By focusing on fun activities, children become less aware of the pain stimulus, so the procedural experience becomes more comfortable (Yuliana, 2022). The analysis of the relationship of intervention and pain supports this principle, demonstrating the effectiveness of bubble blowing as a non-pharmacological strategy.

Overall, bubble blowing can be used as a standard immunization procedure that is safe, pleasant, and effective in reducing pain. Regular implementation of these interventions can improve the positive experiences of children and parents, while supporting successful immunization. The variety of individual responses emphasizes the need to adjust the intervention according to the characteristics of the child. Although the one-group pretest–posttest design has limitations, significant relationships remain visible, indicating the effectiveness of the intervention. Further studies are suggested using Control and randomization groups to strengthen the validity of the



findings. With this theoretical basis and empirical evidence, bubble blowing becomes a widely applicable practical strategy in Pediatric Pain Management.

Effectiveness is noticeable although individual variations persist. Simple, inexpensive and safe interventions can be implemented in Posyandu. This statistical relationship confirms that bubble blowing is effective. Further analysis showed children with high anxiety tended to have higher pain scores before the intervention. The response to distraction is still effective but needs additional approaches. The significant intervention-pain relationship confirms the importance of adjustments based on the characteristics of the child. This favors the implementation of personalized interventions. (Sari, 2020)

The researchers' analysis showed that this intervention could improve immunization compliance in children. Children who feel comfortable during the procedure tend to be more cooperative, while parents become more confident to take the child on the next immunization. A significant association between intervention and decreased pain indicates a positive impact on the quality of health care. Score variation (SD) indicates that individual responses to the intervention vary, signaling the need for adjustment. Although the average decrease in pain was significant, not all children felt the same effects. This confirms the importance of intervention strategies adapted to the characteristics and needs of each child.

The variety of responses is an important consideration in the implementation of interventions at large. Although the one-group pretest-posttest design had limitations, the results showed a significant association between the intervention and decreased pain. Research with one group design has major limitations due to the absence of a control group as a comparison, so that the results obtained can not fully ensure that the changes that occur solely due to the intervention, and still allows the influence of outside factors that are not controlled.

Additional attention effects or placebo factors may also have contributed to the results, so more research is needed. Further studies should use control and randomization groups to strengthen the validity and generalization of the findings. The researchers' analysis concluded that the bubble blowing technique can be used as a standard immunization procedure that is safe and enjoyable. Routine implementation of these interventions has the potential to enhance positive experiences for children and parents, while supporting successful immunization.

CONCLUSIONS

The results of the univariate study showed that the average pain score of children before the bubble blowing intervention was at 6.15 (SD = 1.27), while after the intervention decreased to 2.45 (SD = 1.08). This decrease indicates that bubble blowing therapy is effective in reducing children's pain during vaccination, from moderate-severe to mild category. The variability of responses between children indicates the presence of individual differences in pain perception and response to distraction. Thus, this intervention provides a real clinical effect and can be applied in immunization procedures in Posyandu.



The bivariate discussion showed a significant relationship between bubble blowing intervention and decreased pain, with a value of $p = 0.001$. Children with high initial pain scores had a greater reduction than children with moderate pain, although individual responses varied. The findings are consistent with non-pharmacological distraction principles that have been shown to be effective in previous Indonesian studies. These results confirm that the bubble blowing intervention not only decreased pain on average but was also statistically significant with a decrease in procedural pain in preschoolers.

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