Journal of Multidisciplinary Care (JMDC)
doi: 10.34172/jmdc.1319 2024;13(1):44-54 http://jmdc.skums.ac.ir

Systematic Review

Effectiveness of non-pharmacological methods on pain intensity due to venipuncture in children: A systematic review and meta-analysis

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Abstract

Background and aims: Therapeutic procedures, including the placement of intravenous catheters, are among the most common sources of pain for children. Various methods exist to reduce pain during venipuncture in children, including non-pharmacological methods, but there is no consensus on the most effective approach. The aim of this study is to evaluate the effectiveness of non-pharmacological methods on pain intensity during venipuncture in children.

Methods: This systematic review and meta-analysis were conducted based on English and Persian articles published in the databases of PubMed, Web of Science, Scopus, CINAHL, ScienceDirect, Google Scholar, Irandoc, Iranmedex, SID, and Magiran between 1911 and 2023, using the keywords Venipuncture, Children, Pain, and their MeSH equivalents in all possible combinations. Data analysis was performed using STATA 11 software.

Results: Out of 6963 studies obtained from the initial search, 17 eligible articles were included in the meta-analysis. The results of the random effects model showed that among non-pharmacological methods, the pain score of children in the distraction intervention group was 1.72 points lower than that of children in the comparison group, placing it in the strong effectiveness category. Furthermore, distraction interventions were found to be more effective in children under 8.5 years old, with bubble-blowing interventions proving to be the most effective among all. The findings in other groups also showed that acupressure and educational booklet reading interventions performed by the child on a teddy bear were more effective than distraction interventions.

Conclusion: Non-pharmacological interventions seem to be an easy, accessible, and cost-effective method for nurses to manage pain associated with venipuncture according to children's age.

Keywords: Venipuncture, Pain, Children, Systematic review, Meta-analysis

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Received: August 3, 2024
Accepted: August 11, 2024
ePublished: October 7, 2024

Introduction

Pain is a subjective concept defined as an unpleasant feeling and emotional experience associated with actual or potential tissue damage, or as injuries of this nature. This concept is the most common cause for patients seeking care at healthcare facilities, the most prevalent clinical complaint, and a form of self-protective behavior (1). While pain is an unpleasant experience, it serves a defensive mechanism indicating that tissue injury has occurred or is occurring (2). In this context, studies have reported that, in some cases, the main reason for adults not seeking medical attention despite illness is the presence of painful medical experiences in the first decade of life (3,4). Additionally, alongside leaving long-term effects on individuals, pain in acute conditions can lead to numerous physiological problems such as pupil dilation, sweating, increased heart rate, elevated blood pressure, and skin rashes, which, if not promptly managed, can result in chronic cardiovascular, respiratory, and gastrointestinal issues; prolonged hospitalizations; excessive absenteeism from school; or even death (5). Other harmful effects of pain on a child's life include interference with normal functioning, inability to fulfill family, social, and professional roles, and regression to previous developmental stages (6).

In addition to pain resulting from illness, patients may also experience pain during many invasive diagnostic and therapeutic procedures. In fact, diagnostic and therapeutic procedures are recognized as some of the most stressful medical events (3). Some common procedures include

venipuncture, intra-arterial catheterization, blood sampling, urinary catheterization, lumbar puncture, placement of a nasogastric tube, joint aspiration, bone marrow aspiration, central venous catheterization, and tracheostomy (7,8).

One age group that frequently visits hospitals for diagnostic and therapeutic procedures is children. Children exhibit different reactions to pain, and older age groups may show more pronounced responses (9). Among these procedures, intravenous catheterization is one of the painful invasive procedures and is commonly performed in children's hospitals; the pain associated with it is recognized as the most common source of procedural pain in children (7). Furthermore, reports indicate a high level of stress related to pain and fear associated with medical procedures in the pediatric age group, with acute stress behaviors during venipuncture reported to be between 28% and 83% (10). Therefore, attention to children's pain experiences has increased significantly over the past two decades, and pain reduction in children has become a key focus in pediatrics (11). Most children describe such procedures as the most stressful and frightening experiences during their hospital stay (12).

Acute pain in young children leads to a noticeable increase in heart rate by about 15-20 beats per minute, an increase in respiratory rate by approximately 10-15 breaths per minute, a decrease in arterial oxygen saturation to around 90%, and a disruption of the ventilation-perfusion balance (13). In such situations, they cry, feel scared, and refuse to cooperate. Therefore, the management of pain in children is recognized as one of the most crucial aspects of patient health and recovery (14).

Various methods exist for pain relief, each with its specific advantages; however, it is very important to find a solution that is both more effective and cost-efficient for clinical application. To achieve this goal, several pharmacological and non-pharmacological methods have been proposed (7). Non-pharmacological methods are considered optimal strategies for improving children's experiences during painful procedures. For example, the findings of the study by Kaheni et al demonstrated that computer video games had a significant effect on reducing the intensity of procedural pain during venipuncture in children aged 3-6 years (15). Bagnasco et al also showed that watching a movie during venipuncture reduced the pain intensity in the intervention group compared to the control group (16). The results of the study by Bagheriyan et al indicated that engaging in regular breathing exercises and bubble-making reduced the pain intensity associated with venipuncture in school-aged children, with no significant difference in pain reduction between the two groups observed (17).

Since non-pharmacological methods are safe and reliable approaches and are considered independent nursing interventions, they should be selected based on the child's age, culture, cognitive abilities, behavioral factors, and the type of pain the child is experiencing (18). On the other hand, considering that pain relief is one of the responsibilities of nurses, they must possess the necessary knowledge regarding the assessment and diagnosis of pain levels, as well as complementary therapies and non-pharmacological pain relief methods (19). However, the results of studies have not provided precise solutions regarding the use of non-pharmacological methods for pain relief in children aged 3 to 18 years. Given that systematic reviews help in determining, evaluating, and summarizing the results of various studies, they provide information about the effectiveness of interventions, there is a need for systematic studies in this regard. Therefore, this study was conducted with the aim of determining the effectiveness of non-pharmacological methods on the intensity of venipuncture pain in children aged 3 to 18 years through a systematic review and meta-analysis.

Materials and Methods

This research is a systematic review and meta-analysis that conducted a methodical search to retrieve published and unpublished studies related to the effectiveness of non-pharmacological methods on the intensity of pain resulting from venipuncture in children.

Search strategy

To find the relevant studies, databases such as PubMed, Web of Science, Scopus, CINAHL, ScienceDirect, Google Scholar, and also Persian databases including IranMedex, IranDOC, Scientific Information Database (SID), and Magiran, as well as the reference lists of included articles and key journals, were reviewed from 1991 to July 2023. Due to the lack of sensitivity of internal databases to search operators AND and OR, and to maximize the comprehensiveness of the search in national databases, a broad search was conducted using the keywords "Venipuncture," "Children," "pain," and their Persian equivalents, as well as MeSH terms and all potential combinations (using the operators AND and OR). The search strategy was based on the PICOS formula: Population: children, Intervention: non-pharmacological methods, Comparison group: with a comparison group, Outcome: pain intensity, and Study Design: randomized clinical trials with a control group. The research population included all studies that utilized non-pharmacological interventions to reduce the intensity of pain caused by venipuncture in children.

Selection of studies

The screening of studies was conducted independently by the researchers without knowledge of each other's results. The findings were then double-checked, and any discrepancies were resolved through discussion and consultation. In cases of disagreement, a third party (the supervising professor) was referred to for discussion and input.

Data extraction

All stages of article selection were carried out by two

independent researchers (F-B, A-K). In the event of a disagreement, a third researcher (S-P) was consulted. In the first phase of the search from the specified databases, a total of 6996 studies were identified. After removing duplicates, 4673 studies remained. In the second phase, by reviewing titles and abstracts, 114 relevant studies were extracted. In the third phase, after reviewing the full texts of the studies and conducting a quality assessment of the articles, 96 studies were excluded due to poor quality and study design. Ultimately, considering the inclusion and exclusion criteria, 19 studies with 1780 eligible participants were included in the systematic review, which are listed in Table 1. Among the 19 studies, 17 studies that assessed pain intensity using four numeric rating scales (score ranging from 1 to 100, score ranging from 0 to 10, score ranging from 0 to 5, and score ranging from 1 to 6) were included in the meta-analysis. Figure 1 illustrates the selection method of studies for the analysis. The inclusion criteria encompassed all types of clinical trial studies in both Persian and English that evaluated the effect of non-pharmacological interventions on pain intensity during venipuncture in children aged 3 to 18 years, using a validated pain assessment tool. If necessary, and in case of specific questions or ambiguities in the information from the articles, necessary inquiries were made to the corresponding author via email or phone.

To store and organize the articles, EndNote software was used, and for the quality assessment of the articles, the Consolidated Standards of Reporting Trials (CONSORT) checklist was employed. Nine indicators assessed in the quality evaluation included: description of the study design, eligibility criteria, description of the study setting and timeframe, adequacy of sample size, concealment mechanism, allocation, presence of a control group, explanation of how the experimental study was conducted, statistical analysis, and baseline and demographic information (37).

Data entry and analysis were performed using STATA 11 software. Studies were categorized based on the pain assessment tool scoring system, which included four types of categorization (1-100, 0-5, 0-10, and 1-6), and based on the pain control interventions (distraction techniques, acupressure, reading educational booklets and performing them on a teddy bear by the child, cold application, and touch) as well as the pain assessors (child, nurse). This classification was done across several groups using a random effects meta-analysis model. Subsequently, the mean and standard deviation of the pain scores were extracted from each study. To express the differences between the two groups, the standardized mean differences (SMD) index was utilized, with a positive value of this index and a significance level of less than 0.05 indicating a significant effect of the intervention performed.

Heterogeneity was assessed using the I^2 statistic. In the present study, the likelihood of publication bias was examined using a funnel plot, as well as based on statistical tests such as Egger's and Begg's tests, and the metabias directive. A significance level of less than 0.05 in these tests indicated the presence of publication bias in

Table 1. Characteristics of selected studies for meta-analysis

First Author, Year	Country	Age	Sample size (number of groups)	Type of interventions	Tool (Scale)	Evaluator
Maghsoudi, 2015 (20)	Iran	3-6	90 (3)	Distraction of thought bubbling	Face tool (0-10)	Child
Moadad, 2017(21)	Lebanon	4-12	50 (2)	Distraction of thought (Buzzy)	Face tool (0-10)	Nurse-Child
Bagheriyan, 2011 (17)	Iran	6-12	60 (3)	Distraction of thought (bubbling)	Numerical grading tool (10-0)	Child
Razaghi, 2012(22)	Iran	5-10	120 (3)	Distraction of thought (bubbling)	Face tool (0-10)	Child
Canbulat, 2015 (23)	Turkey	7-12	176 (2)	Buzzy	Face tool (0-10)	Child
Sadeghi 2012 (24)	Iran	4-6	60 (2)	Distraction of thought (softball squeeze)	Face tool (0-10)	Nurse
Safari, 2014, (25)	Iran	6-12	60 (2)	Touching	Face tool (0-10)	Child
Foroogh Ameri, 2016 (26)	Iran	6-12	120 (3)	Acupressure	Numerical grading tool (10-0)	Child
Wang, 2008 (27)	China	8-9	300 (3)	Distraction of thought (film)	Face tool (0-10)	Child
Abazari, 2014 (28)	Iran	6-12	86 (2)	Acupressure	Face tool (0-10)	Nurse
Nikfarid, 2008 (29)	Iran	3-12	90 (3)	Cold compress (ice)	Face tool (0-10)	Child
Shahabi, 2007 (30)	Iran	6-12	46 (3)	Distraction of thought (music)	Face tool (0-5)	Child
Pourmovahed, 2008 (31)	Iran	6-12	90 (3)	Distraction of thought (music)	Face tool (0-5)	Child
Tunç-Tuna, 2015 (32)	Turkey	9-12	60 (2)	Reading the educational booklet and performing on a teddy bear	Face tool (0-5)	Child
Lim, 2007 (33)	Korea	3-6	54 (2)	Distraction of thought (fil,)	Face tool (0-5)	Child
Alavi, 2011 (34)	Iran	5-12	32 (3)	Distraction of thought (bubbling)	Usher (0-5)	Child
Vosoghi, 2011 (35)	Iran	3-6	72 (2)	Distraction of thought (bubbling)	Usher (1-6)	Child
Mahdipour Raberi, 2010 (36)	Iran	5-12	72 (3)	Distraction of thought (bubbling)	Usher (0-100)	Child
Erdogan, 2021 (7)	Turkey	7-12	142 (3)	Buzzy Distraction cards Virtual reality	Wong-Baker FACES Visual Analog Scale	Child, parent, and researcher

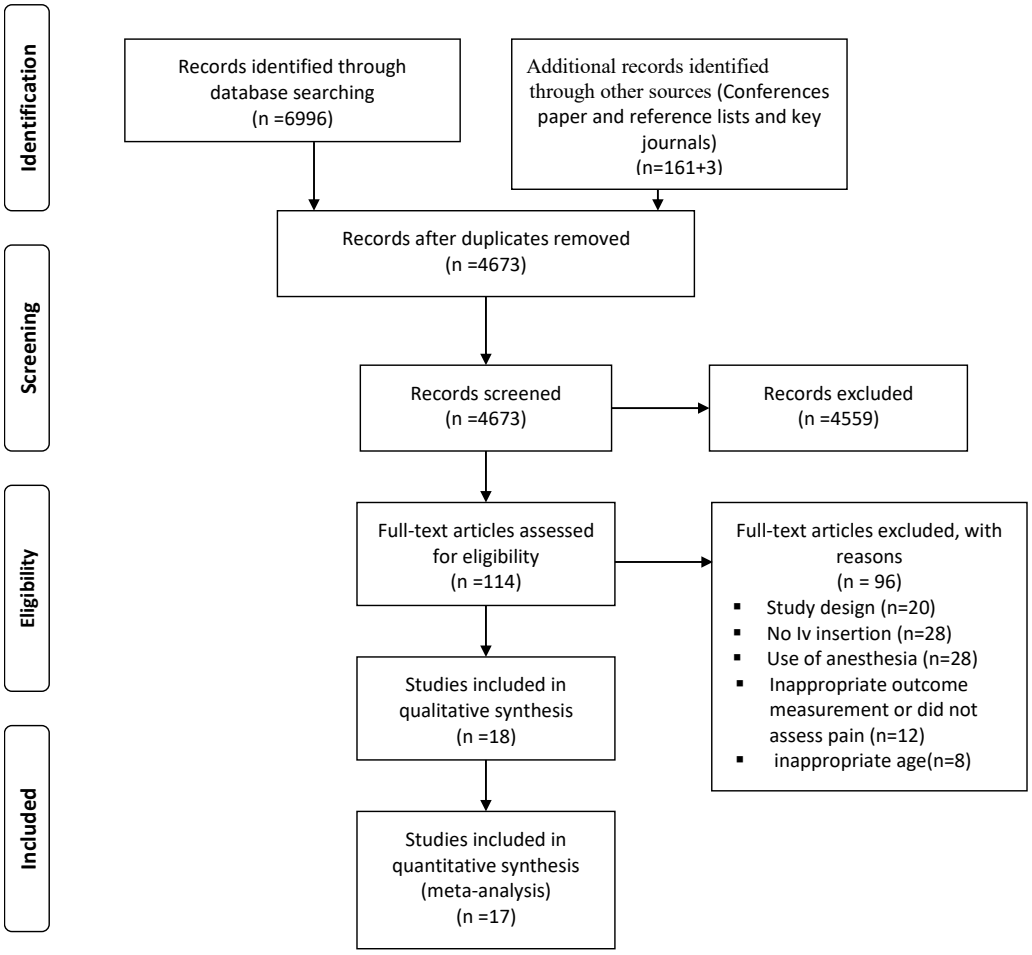

Figure 1. Flowchart of the method of selecting studies to enter the meta-analysis based on PRISMA guidelines

the study. To assess the impact of each individual study on the overall results, sensitivity analysis was performed.

Results

Out of 114 studies whose full texts were reviewed, a total of 19 studies with 1,780 eligible participants were ultimately included in the systematic review (Figure 1), which were critically appraised using the CONSORT tool (Table 1). Among the 19 studies, 17 were included in the meta-analysis. The interventions in these studies included 12 studies on distraction techniques (17,20-22,24,27,30,31,33-36), 2 studies on acupressure (26,28), 1 study on cold therapy (29), 1 study on touch (25), and 1 study on reading educational booklets by the child and performing them on a teddy bear (32). The studies were divided into five groups based on the type of interventions, the assessment tools, and the assessors.

Group 1

This group includes studies that utilized the distraction technique as the intervention, with a 0-10 scoring scale, and the pain assessor was the child. The results in Figure 2 indicate that the strength of the relationship or the efficacy of the distraction technique intervention in this group is quite strong (SMD: -0.91, 95% CI: -1.55 to -0.27).

Group 2

Figure 3 illustrates the studies that involved interventions other than distraction techniques (cold therapy, acupressure, touch, and a combination of vibration and cold) with assessment tools based on a 0-10 scale, where the pain assessor was the child. The results of this figure indicate that the efficacy of acupressure is the strongest with strength of relationship of 3.20, while cold therapy shows no effect with strength of relationship of 0.09. As shown in Figure 3, the standard mean difference for the acupressure intervention was -3.20 (95% CI: -3.87 to -2.53) compared to the cold therapy intervention, which was 0.09 (95% CI: -0.41 to 0.60).

Group 3

Figure 4 combines studies that assessed pain scores using all types of interventions, employing a 0-10 scale, with the pain assessor being a nurse. The results of this figure indicate that the efficacy of acupressure is stronger, with strength of relationship of 2.25 compared to distraction techniques. As shown in Figure 4, the standard mean difference for the acupressure intervention was -2.25, 95% CI: -2.79 to -1.71, compared to the Distraction Techniques interventions, which had a standard mean difference of -0.64, 95% CI: -1.03 to -0.25.

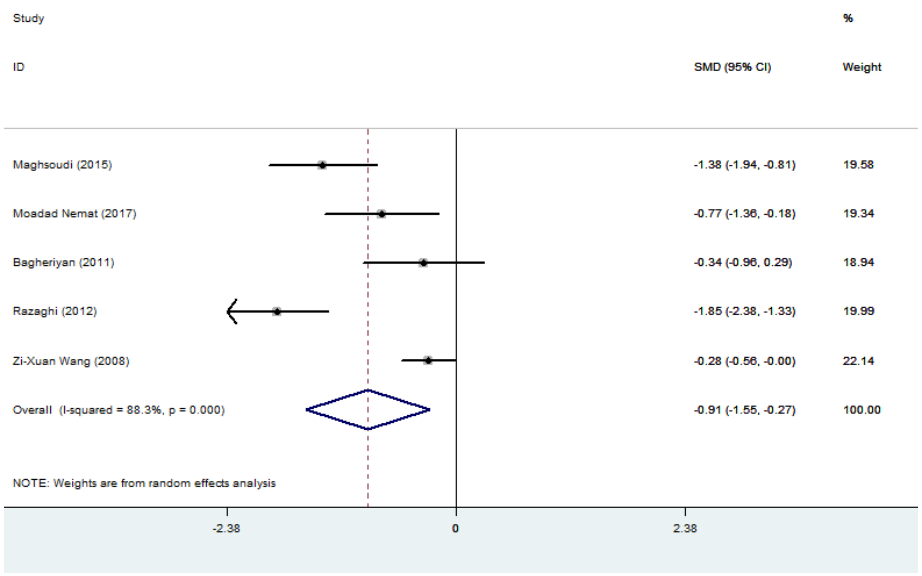

Figure 2. Forest plot of the standardized difference of the averages of think distraction with pain assessor (child) and 0-10 tool scale with random effect analysis

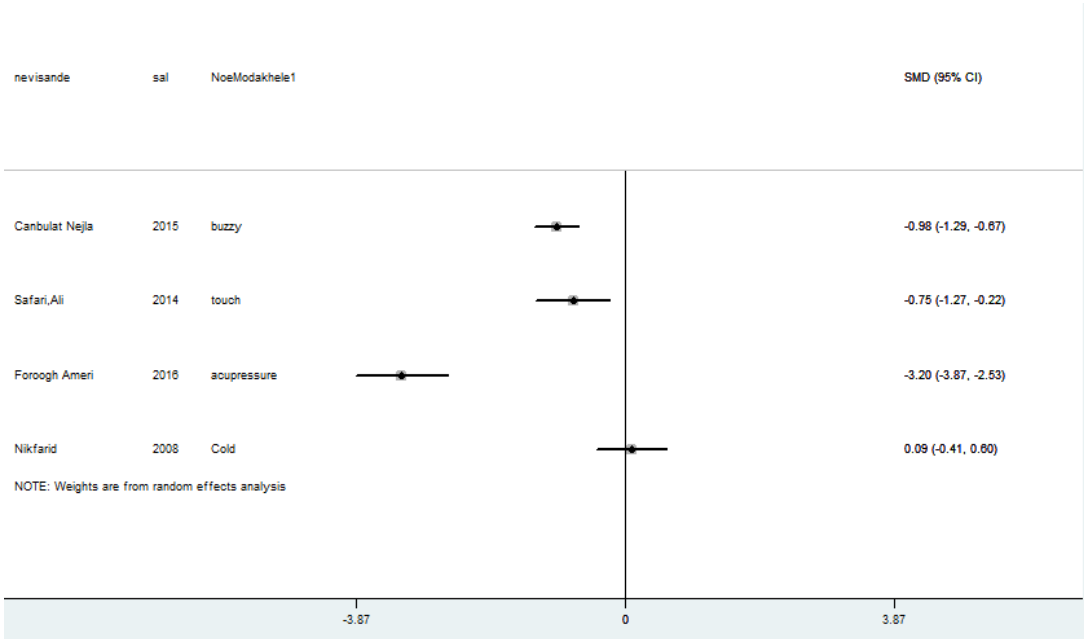

Figure 3. Forest plot of the standardized difference of the averages of interventions other than think distraction with pain assessor (child) and 0-10 tool scale with random effect analysis

Group 4

The following figure combines studies that included all types of interventions using tools with a 0-5 scale, where the pain assessor was the child. The results of Figure 5 indicate that the strength of the relationship or effectiveness of reading an educational booklet and demonstrating it on a teddy bear is significantly stronger than distraction interventions (such as bubble making, music, and films). As shown in Figure 5, the standard mean difference for the Reading the educational booklet by the child and demonstrating it on a teddy bear was -1.51, 95% CI: -2.08 to -0.93, compared to the Distraction Techniques interventions, which had a standard mean difference of -0.59, 95% CI: -1.23 to -0.05.

Group 5

Figure 6 presents a combination of studies that categorized pain qualitatively, determining outcomes between two groups: severe versus non-severe, in both the test and control groups. The results from this figure indicated that 36% of the occurrences of outcomes were attributable to the interventions used in children. The number needed to treat (NNT) in this group was calculated as 2.77, meaning that for every 3 children, 1 child responds to pain control interventions, resulting in a reduction in pain (NNT = 2.77).

Due to the limited number of studies in other groups,

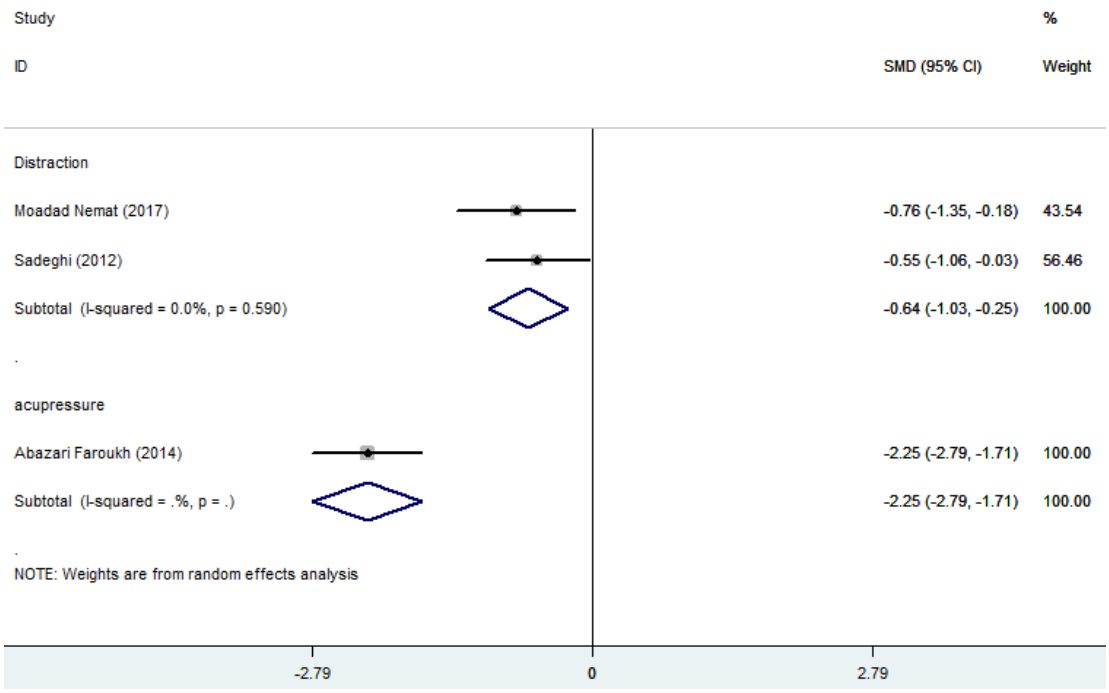

Figure 4. Forest plot of the standardized difference of the averages of all types of interventions with pain assessor (nurse) and instrument scale 0-10 with random effect analysis

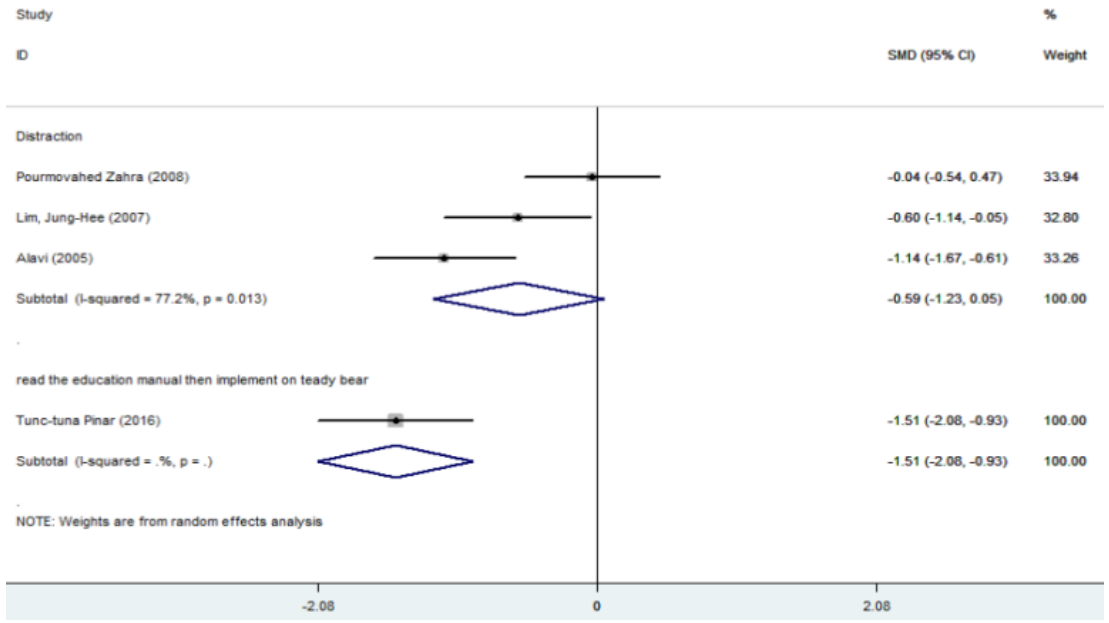

Figure 5. Forest plot of the standardized difference of the averages of all types of interventions with pain assessor (child) and 0-5 scale with random effect analysis

heterogeneity assessment was only conducted in group 1, where a meta-analysis was feasible. The heterogeneity assessment focused on pain control interventions, age, and pain measurement tools.

The assessment of heterogeneity based on pain control interventions indicated that due to the limited number of studies, the reduction in heterogeneity could not be justified, but it explained the variations in effect sizes. Specifically, bubble making was the most effective intervention (SMD: -1.20, 95% CI: -2.06 to -0.35), followed by the Buzzy device (which combines cold and vibration) (SMD: -0.77, 95% CI: -1.36 to -0.18), and then movies (SMD: -0.28, 95% CI: -0.56 to -0.00).

The heterogeneity assessment based on age justified the heterogeneity in such a way that distraction techniques were more effective in children younger than 8.5 years. As shown in Figure 6, the standard mean difference for those younger than 8.5 years was -1.34, 95% CI: -1.96 to -0.73, compared those older than 8.5 years, which had a standard mean difference of -0.91, 95% CI: -1.55 to -0.27.

The heterogeneity analysis based on pain measurement tools showed that this variable could not justify the reduction in heterogeneity due to the limited number of studies, but it did explain the variations in effect sizes.

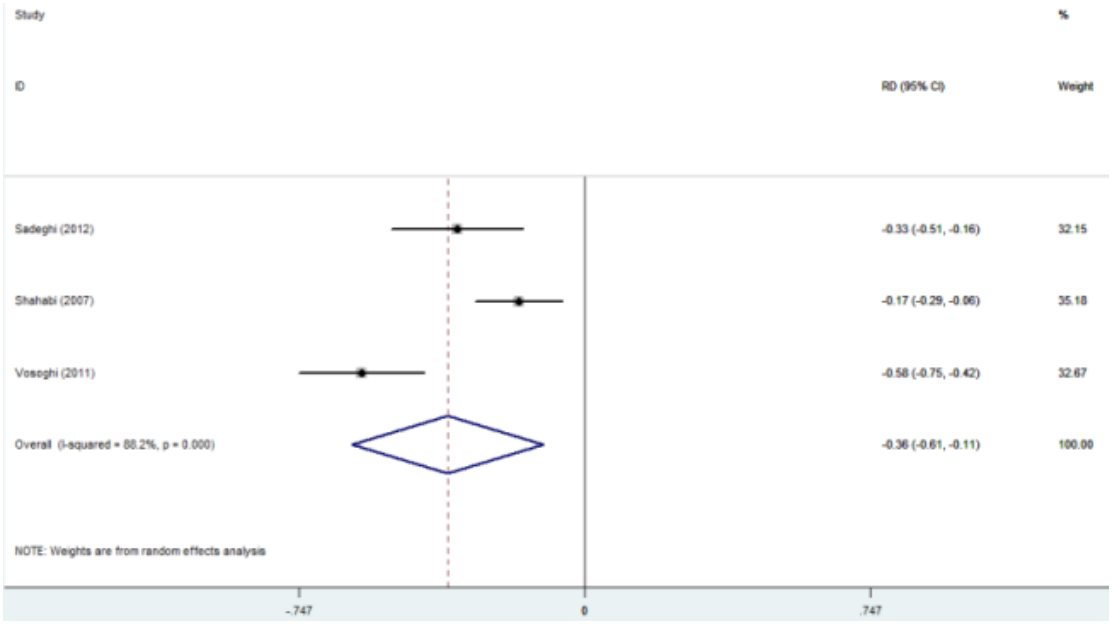

Figure 6. Forest plot of risk difference index based on qualitative data with random effect analysis

Specifically, the Wong-Baker faces tool (SMD: -1.34, 95% CI: -1.96 to -0.73) was found to be most effective for pain assessment, followed by the numerical rating scale (SMD: -0.34, 95% CI: -0.96 to -0.29), and then the visual tool (SMD: -0.28, 95% CI: -0.56 to -0.00).

Publication bias was assessed using two methods: Begg's test and Egger's test, along with a funnel plot. The results indicate that this plot shows a heterogeneity pattern, and due to the limited number of studies, the effect indices have lower precision and are scattered towards the bottom of the plot (Figure 7). The results of Begg's test ($P=0.81$) and Egger's test ($P=0.27$) are not significant, indicating that publication bias is not substantial or is negligible.

Sensitivity analysis was performed using the leave-one-out cross validation. The results from this table indicate that removing any of the studies had no effect on the overall study results.

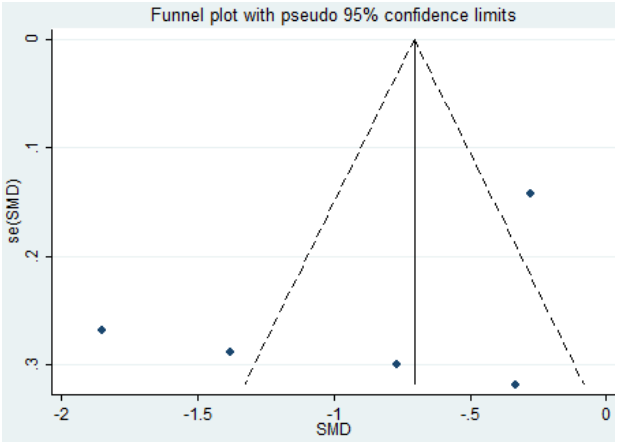

Figure 7. Funnel plot diagram for evaluation of publication bias

Discussion

The present study aimed to estimate the effectiveness of non-pharmacological methods on pain severity associated with venipuncture in children. A total of 19 relevant articles were reviewed, and ultimately, 17 articles were included in the meta-analysis. In this research, in line with the primary objective of the study, which was to "examine the effectiveness of non-pharmacological methods on pain severity from venipuncture in children," the data from the studies were categorized into different groups based on the type of intervention, measurement scale, and evaluator, and then analyzed accordingly.

For the first objective, the first group of interventions involved distraction techniques, with the measurement scale being 0-10 and the pain assessor being the child. This group included five studies in which distraction techniques were implemented: three studies utilized bubble-making, one study used films, and one study employed the Buzzy device (a device that combines cold and vibration). The results of the meta-analysis in this group indicated that the average pain score in children undergoing distraction techniques was lower compared to the control group, and the strength of the relationship or the effectiveness of the distraction intervention is classified as strong.

Additionally, to achieve the second objective of the research, which was to "determine the effectiveness of non-pharmacological methods on pain severity from venipuncture in children based on pain control interventions," heterogeneity analysis was conducted in the first group based on pain control interventions. However, this variable could not justify the reduction in heterogeneity due to the limited number of studies. Nevertheless, it accounts for the variations in effect sizes, emphasizing that bubble-making is the most effective intervention.

According to the first objective, studies that reported pain qualitatively were placed in the fifth group. In this group, the qualitative data were converted into a

dichotomous outcome (severe pain group vs. non-severe pain group) with ordinal rankings (mild, moderate, severe, and very severe). Two indicators, relative risk (RR) and relative difference (RD), were employed to analyze the effectiveness of the interventions. The RR indicator across three studies demonstrated that the effectiveness of distraction interventions (music, bubble-making, and squeezing a small soft ball) for reducing instances of severe pain is very strong. In fact, 96% of distraction interventions compared to the control group reduced severe pain. Additionally, the effect size of RD indicated that 36% of the occurrence of the outcome could be attributed to these distraction interventions. Overall, the results from these two groups showed that distraction interventions (music, bubble maker, film, Buzzy device, and squeezing a small softball) are effective in reducing pain severity during venipuncture in children, both in a 10-point scale and in qualitative ranks.

The findings of other studies also support this result. In the study by Güdücü Tüfekci and colleagues, where distraction involved colorful lights during blood draws, the intensity of pain, as assessed through interviews with children, was lower in the distraction intervention group compared to the control group (38).

However, Erdogan et al. conducted a clinical trial aimed at investigating the effects of three different non-pharmacological methods (Distraction cards, virtual reality, and Buzzy) on pain control during venipuncture in children. They found that the lowest pain score evaluated through the visual analog scale (1) was related to the Buzzy group, followed by the virtual reality group, and finally the distraction cards group compared to the control group. Based on the scoring from all evaluators (children, parents, and researchers), the lowest pain score assessed through the Wong-Baker Faces tool was also related to the Buzzy group, followed by the virtual reality group, and finally the distraction cards group compared to the control group (7).

In line with this finding, in the study by Inan and Inal conducted in 2019 to investigate three distraction techniques on the pain intensity experienced by children during venipuncture, the results indicated that distraction had a significant effect on pain intensity (39).

Interpreting these findings, it can be suggested that distraction techniques in children can divert their attention from painful procedures. Given that children often seek play and entertainment, and they fully focus on play or watching movies, distraction techniques may help them avoid concentrating on the painful procedure.

Continuing with the first objective, the second group consisted of interventions other than distraction techniques, with the pain scale assessed on a 0-10 scale by the child. This group included four studies that utilized non-pharmacological methods, aside from distraction techniques, including cold therapy, acupressure, touch, and Buzzy (a device that combines cold and vibration). The results from this group indicated that the efficacy of acupressure was the strongest, while cold therapy was found to be ineffective. However, the findings from the study by Fakhr Movahedi et al in 2006 showed that the scores for behavioral and subjective responses to pain in the cold intervention group (as evaluated by nurses) were significantly lower compared to the control group (40), which contradicts the results from this segment of the research.

In interpreting these findings, it could be suggested that methods such as cold therapy, touch, and Buzzy may not provide a playful aspect for children and might even increase the sensation of pain. Additionally, these methods may not have engaged the neural pathways in children, leading to less attention being paid to pain signals. One reason for the difference in findings compared to the aforementioned study might be that in the current study, the assessors were children, while in the Fakhr Movahedi et al study (40), the assessors were nurses, which could account for the discrepancy based on the type of assessor.

Also, in line with the first objective, the third group included studies where non-pharmacological interventions encompassed all methods (both distraction techniques and non-distraction techniques), and the pain scale was on a 0-10 scale with the pain evaluator being a nurse. This group consisted of three studies, with two studies involving distraction techniques that included squeezing a small soft ball and Buzzy, and one study focusing on acupressure interventions. The results from this group also indicated that the efficacy of acupressure was stronger than that of distraction techniques.

Studies conducted in groups of children and adults also support these findings. In this context, the results of the study by Shahmohammadi Pour et al in 2017, which aimed to compare acupressure at two points and local anesthesia on pain intensity during venipuncture in hospitalized children aged 6 to 12, with pain assessed by a nurse, showed that both intervention groups reported lower pain scores compared to the control group (41). Furthermore, a study conducted by Hosseinabadi et al in 2015, aimed at assessing the effectiveness of acupressure on pain and anxiety associated with venipuncture in adults, indicated that the pain score in the acupressure group was lower compared to the control group (42). Given the limited number of studies conducted on acupressure, the results from this group cannot be fully trusted, and there is a need for further research on acupressure.

Continuing with the first goal in the fourth group, which included all types of interventions (both distraction techniques and non-distraction techniques), the tool used was a 0-5 scale, and the pain assessor was a child. In this group, three studies focused on distraction techniques (bubble-making, music, and mobile phone use), and one study examined reading an educational booklet by the child and performing it on a teddy bear. The results from this group indicated that the effectiveness of reading the educational booklet by the child and performing it on the teddy bear was stronger than that of the distraction

techniques.

To achieve the second goal of the research, "to determine the effectiveness of non-pharmacological methods on pain intensity during venipuncture in children by age," heterogeneity analysis showed that distraction interventions were more effective in children younger than 8.5 years. In a systematic review and meta-analysis conducted by Birnie and colleagues in 2014, the study classified age into three groups: early childhood (2-5 years), middle childhood (6-11 years), and adolescence (11-19 years). The results indicated that the effect was significant for middle childhood (6-11 years), whereas this effect was not significant for early childhood or adolescence. In fact, distraction interventions were more effective for children aged 6 to 11 years (12) (43). In interpreting the findings of the present study, it can be said that considering bubble-making is one of the interesting and engaging activities for school-aged children and younger, it seems natural that children under 8.5 years would pay more attention to this type of play, and this attention could be effective in reducing their pain intensity.

To achieve the third goal of the research, which is to determine the effectiveness of non-pharmacological methods on pain intensity during venipuncture in children according to pain measurement tools, three studies used the Wong-Baker Faces tool, one study used a numerical rating scale, and one study used a visual tool. The findings from heterogeneity analysis based on pain measurement tools and variations in effect size indicated that the Wong-Baker Faces tool was more effective compared to the numerical rating scale and the visual tool. While many studies have utilized various pain measurement tools, among these tools, the aforementioned one has demonstrated greater efficacy, as the findings of the first goal groups, which involved child evaluators, also indicated that cases where the child personally assessed their pain had higher credibility compared to when a secondary individual conducted the evaluation. This tool is designed specifically for children, allowing them to report their pain by looking at facial expressions."

Conclusion

The findings of the current meta-analysis indicate that among non-pharmacological methods, cognitive diversion interventions, particularly bubble-making intervention, are effective in reducing pain intensity during venipuncture in children. Furthermore, these interventions have a greater impact on children less than 8.5 years of age. Therefore, attention to these findings can be significant for therapeutic groups, including nurses, as they are the first line of contact between the child and the treatment team. Additionally, the child will experience the first painful experience from the nurses during the insertion of the needle. Thus, since these methods are easy, accessible, and cost-effective, it is recommended that nurses consider these age-appropriate approaches to reduce pain intensity during nursing procedures.

Acknowledgments

This article is derived from the research project based on the Master's thesis in Nursing, Pediatric Nursing Specialty, and approval by Iran University of Medical Sciences. We would like to express our gratitude to all the researchers whose studies were utilized in the current meta-analysis, as well as to the Research and Technology Vice-Chancellor of Iran University of Medical Sciences for providing the search facilities.

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Competing Interests

The authors hereby declare that there is no conflict of interest regarding the present research.

Ethical Approval

Not applicable.

Funding

This article was supported financially by the Vice-Chancellor for Research and Technology of Iran University of Medical Sciences, Tehran, Iran.

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Cite this article as: Bagherzadeh F, Keshtkar A, Kiani K, Azizi-Fini I, Soroor Parvizy S. Effectiveness of non-pharmacological methods on pain intensity due to venipuncture in children: A systematic review and meta-analysis. Journal of Multidisciplinary Care. 2024;13(1):45-54. doi: 10.34172/jmdc.1319