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The effect of buzzy and cold spray on pain, anxiety, and fear of children during venipuncture in pediatric emergency department in Turkey; A randomized controlled study

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ABSTRACT

Purpose: It was aimed to evaluate the efficacy of Buzzy and cold spray in reducing pain, anxiety, and fear of children during venipuncture in the emergency department (ED).
Methods: This study is an experimental, parallel-group (intervention-control), randomized controlled, single-blind design. The study was conducted with 161 children aged 5–12 years in pediatric ED. Data were collected by the 'Personal Information Form', 'Wong Baker-Facial Expression Rating Scale', 'Child Anxiety Statement Scale', and 'Child Fear Inventory'. Data were analyzed with descriptive statistics, Mann Whitney *U* test, Kruskal Wallis H test, and Intraclass Correlation.
Results: Descriptive features of the children were homogeneous. 'Wong Baker-Facial Expression Rating Scale', 'Child Anxiety Statement Scale', and 'Child Fear Scale' score averages of the children in the control group were higher than the children in the Buzzy group and the cold spray group ($p < 0.001$). The pain scores of the Buzzy group were higher than those in the cold spray group ($p < 0.001$). The anxiety and fear mean scores of the children in the Buzzy and cold spray groups were similar ($p > 0.05$).
Conclusion: It was determined that Buzzy and cold spray were more effective than standard care in reducing the level of pain, anxiety, and fear in children ages 5–12 years during venipuncture in the pediatric emergency. The cold spray was more effective in reducing pain than Buzzy.
Practice implications: Nurses can use Buzzy and cold sprays to manage the fear, anxiety, and pain associated with venipuncture.

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Introduction

Pain, anxiety, and fear are frequently seen in children who apply to the emergency department (ED) due to episodic diseases, acute injuries, and exacerbation of chronic disorders (Krauss et al., 2016; Pancekauskaitė & Jankauskaitė, 2018). In addition to the child's illness, needle interventions applied in pediatric ED may increase the level of pain and stress experienced by the child (Dumoulin et al., 2019; Litwin et al., 2021). These interventions are often intravenous access and blood sampling (Cozzi et al., 2021). Anticipatory fear caused by injections can increase the level of pain and then cause emotional distress. This situation causes a cycle that causes pain, fear, and anxiety levels to increase during needle procedures (Cavender et al., 2004; Dumoulin et al., 2019). Many models have been developed showing that fear and anxiety play a role in the development of pain and disability (Hasenbring et al., 2014). The fear-avoidance reaction mechanism and fear-avoidance concept are cognitive theories in which the perception of pain as detrimental (catastrophizing) causes subsequent fear of pain or pain-related behaviors in conditions of acute pain. The avoidance-endurance model describes how dysfunctional patterns of cognitive, emotional, and behavioral responses to pain contribute to the development of pain (Hasenbring et al., 2014). The presence of anxiety leads to maladaptive emotion processing, which contributes to the maintenance of pain in the long term (Hasenbring et al., 2014). If the pain and fear are not managed effectively, post-traumatic stress symptoms may occur in children and may cause children to develop negative attitudes towards medical practices (Potts et al., 2019). These negative attitudes that can develop in children may lead to avoidance of medical care and needle interventions in the future.

Pediatric ED can be stressful environment for children and their families due to the chaotic environment, loud noises, bright lights, unpredictable waiting times, and painful/fearful procedures (Litwin et al.,

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2021). These factors in ED increase children's perception of pain and fear. Pain management in ED is considered one of the indicators of the quality of care and can be used as a marker to evaluate care in the emergency department (Abdolrazaghnejad et al., 2018). Accordingly, specific guidelines and protocols have been developed for pain assessment at all ages and in clinical situations, as well as pharmacological strategies for effective pain management in ED. Despite all available guidelines, protocols, and pharmacological interventions pediatric pain is often underestimated by a health professional and insufficiently manage (Benini et al., 2020). Rapid patient circulation in pediatric ED, the urgency of medical conditions, insufficient number of staff, time constraints and, the inadequacy of trained staff for pain and fear management in children cause inadequate evaluation and management of pain, anxiety and fear in children during needle procedures (Baxter et al., 2011). For this reason, it is an important responsibility of the emergency care team to apply easy-to-use, inexpensive and fast-acting methods for the management of pain, anxiety and fear during venipuncture, which is the most common experience of children in ED (Baxter et al., 2011; Benini et al., 2020; Semerci et al., 2020). It is predicted that the use of these methods during venipuncture in chaotic ED will effectively provide pain, anxiety, and fear management in children.

The use of pharmacological and non-pharmacological methods is very important in the management of pain, anxiety, and fear due to needle interventions in children (Binay et al., 2019; Canbulat et al., 2015; Krauss et al., 2016). It is stated that the cooling and cold methods, which are easy to use, provide short-term effects, reduce the pain, anxiety and fear in children during needle interventions with moderate evidence (Çetin & Çevik, 2019; Erdogan & Ozdemir, 2021; Griffith et al., 2016). One of these methods is Buzzy® (MMJ Laboratories, Atlanta, GA, USA), it is reported to be effective in reducing pain, fear, and anxiety during venipuncture in children with its feature of combining external cold application and vibration (Ballard et al., 2019; Bergomi et al., 2018; Erdogan & Ozdemir, 2021; Yılmaz et al., 2020). The Buzzy® device produces vibrations and cooling sensations that may increase the creation of symptoms happen, an endogenous opioid that prevents the transmission of pain signals to the brain. Buzzy ®'s effect is based on the Gate Control Theory, which states that when the nociception gates are closed, no pain is experienced (Melzack & Wall, 1965). Another effective cold method is using cold spray (Ghasemi et al., 2022). Vapocoolant spray is an effective cooling method for reducing pain, anxiety, and fear during needle interventions (Mace et al., 2020;Rüsch et al., 2017 ; Zhu et al., 2018). The vapocoolants include several chemicals, including ethyl chloride and 1,1,1,3,3-pentafluoropropane/1,1,1,2-tetrafluoroethane (Rüsch et al., 2017; Zhu et al., 2018) The Vapocoolant spray is an agent in the form of a volatile liquid compound that acts by decreasing the temperature of the surface it is applied to. With the cooling on the surface, the speed of movement of the stimuli between the nerve fibers reduces and a decrease in the feeling of pain is observed (Rüsch et al., 2017; Zhu et al., 2018.

Most of the studies revealed that cold spray and Buzzy device are effective to reduce pain (Ballard et al., 2019; Bergomi et al., 2018; Rüsch et al., 2017; Zhu et al., 2018), so there is limited results effect of these methods on anxiety and fear related the needle interventions. As far as the authors know, no studies are available comparing the effectiveness of Buzzy and cold spray in reducing pain, anxiety, and fear during venipuncture in children. In this context, this study, it was aimed to evaluate the efficacy of Buzzy and cold spray in reducing pain, anxiety, and fear of children who were aged 5–12 years during venipuncture in the emergency department.

Research hypotheses

Within the scope of this research, the following hypotheses were evaluated.

H1: The level of fear in the Buzzy and cold spray groups was lower than in the control group during the venipuncture.

H2: The level of anxiety in the Buzzy and cold spray groups was lower than in the control group during the venipuncture.

H3: The level of pain in the Buzzy and cold spray groups was lower than in the control group during the venipuncture.

H4: The level of pain, anxiety and fear in the Buzzy group was lower than in the cold spray group during the venipuncture.

Method

Study design

This study was in an experimental, parallel-group (intervention-control), and randomized controlled design. It was aimed to evaluate the efficacy of Buzzy and cold spray in reducing pain, anxiety, and fear of children who were aged 5–12 years during venipuncture in the emergency department in Turkey. The study design and implementation were based on the principles in the CONSORT list (Consolidated Standards of Reporting Trials) (Fig. 1) (Boutron et al., 2017).

Study setting

The study was carried out in the pediatric emergency department of a hospital in Istanbul, Turkey between April 2022, and June 2022. The pediatric emergency service is a level 3 center that takes care of children under the age of 18 and has an annual patient volume of approximately 17,000 children.

Sample size

The research population consisted of children aged 5–12 years and their parents who applied to the pediatric emergency unit between April 2022 and June 2022.

Statistical power, type I error, effect size, and study design were considered in calculating the sample size. The study was planned to have a power of at least 80% and a type I error rate of 5%. Since there is no similar study evaluating the effects of using buzzy and cold spray on the level of pain, anxiety, and fear during venipuncture in children, the effect size of the study was aimed to be medium (0.25) to determine the sample size. Based on medium effect size (f: 0.25), 80% (1 – β error) power and 95% (α error) confidence level, it was calculated that the sample size should consist of a total of 159 children (G*Power 3.1.9.4). Considering the dropout out rate, the number of samples was increased by 10% and it was decided to include 60 children in each group and conduct the research with 180 children in total.

The inclusion criteria were being in the 5–12 age group, having no cognitive problems, not taking sedative/anticonvulsant/analgesic drugs, having no life-threatening illness/condition, having no disease-causing chronic pain, being treated 3-level (red-yellow-green) triage system in the yellow area.

The exclusion criteria were having a cognitive problem, taking sedative/anticonvulsant/analgesic drugs, having a life-threatening disease/condition, having a disease-causing chronic pain, having a fever of 38 °C and above, and the child and his family are not willing to participate in the study.

Randomization

The patients who met the sample selection criteria were randomly divided into 3 groups: the Buzzy group (group 1), the Cold Spray (group 2), and the control group (group 3), using a computer-based program (www.random.org). Assignment to the intervention and control groups was made by an independent statistician and a blinded

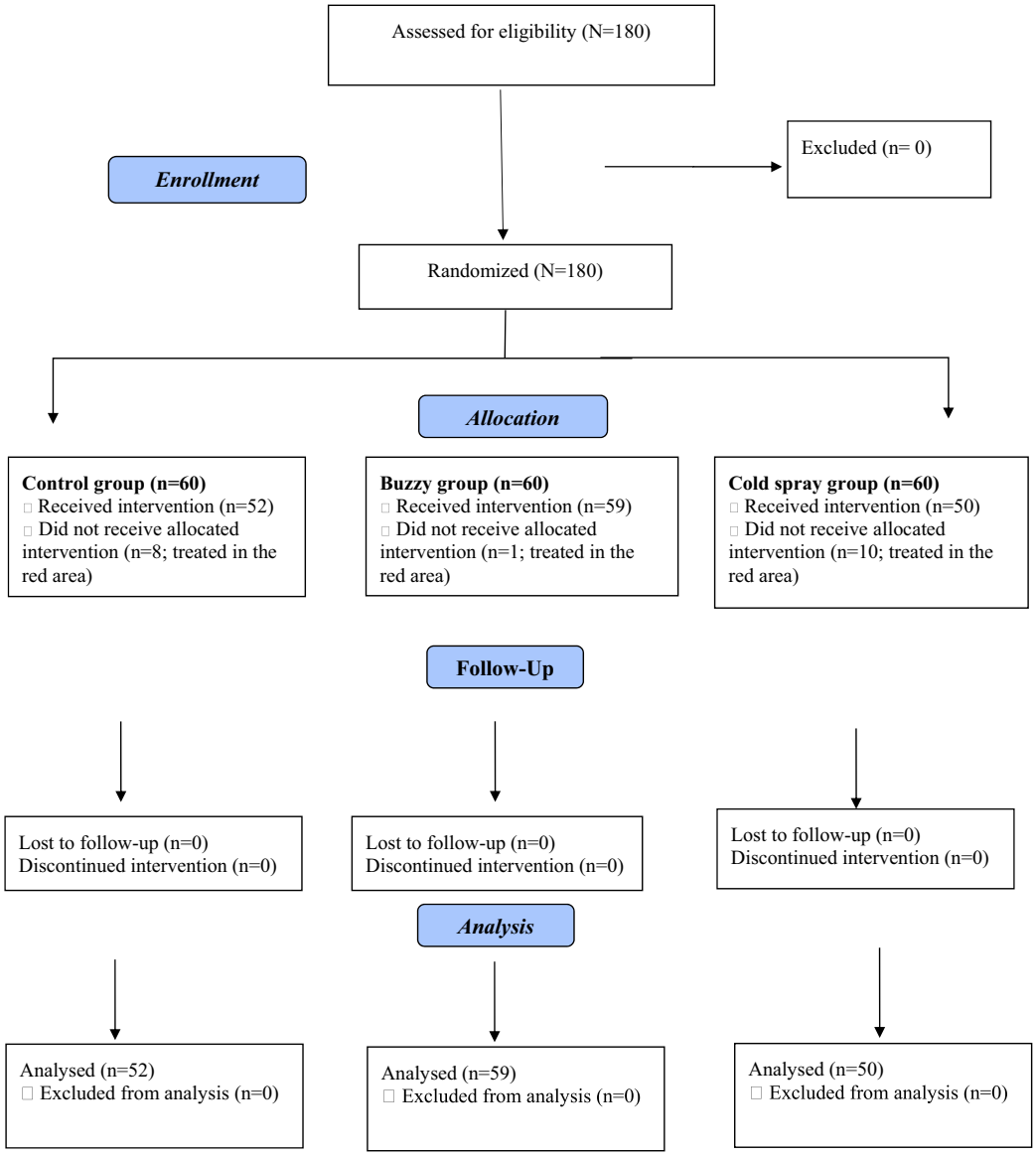

Fig. 1. CONSORT flow diagram.

technique was used to avoid bias and ensure confidentiality. Therefore, selection bias was controlled by making random assignments and hiding the randomization.

In the study, the participant was blinded, while the researcher was not blinded. Blinding was not possible because the researchers were aware of the intervention. The data were coded as 'A', 'B,' and 'C' by the researcher and the data were transferred to the computer. In addition, the analysis of the coded data was performed by an independent statistician to avoid bias in the evaluation of the data. Children were included in the study by evaluating their compliance with the inclusion criteria according to the order of admission to the hospital. 9 children in the control group, 10 children in the cold spray group, and 1 child in the Buzzy group were excluded from the study because they were treated in the red zone in the pediatric emergency department. For this reason, the research was completed with 161 children.

Data collection tools

Data were collected through the 'Personal Information Form', the Wong Baker-Facial Expression Rating Scale, the 'Child Anxiety Statement Scale', and the 'Child Fear Inventory'.

Personal information form

The form was created by the researchers. It includes 5 questions (age, gender, experience of needle intervention, numbers of needle intervention, Body Mass Index-BMI) including the descriptive characteristics of the children.

Wong baker-facial expression rating scale

The scale consists of six facial expressions. Facial expressions are scored as "No pain = 0", and "Unbearable pain = 10" (Foundation, 2016) Children are asked to report show a face that expresses their pain by showing facial expressions. It is a self-reported measurement tool. The scale is suitable for the assessment of pain in children aged 3–18 years (Hockenberry & Wilson, 2009). The scale is a reliable measurement tool for assessing the severity of pain in children (Ball et al., 2017) and it is suitable for clinical use in terms of its psychometric properties (Stinson et al., 2006). The scale has been translated into many languages, including Turkish (Foundation, 2016).

Child fear inventory (CFI)

The scale was developed by McMurtry et al. (2011) to measure children's fear (McMurtry et al., 2011). The Turkish validity and reliability of

this scale was performed by Özalp Gerçeker et al. (Gerçeker et al., 2018). In this method, the child is shown a picture containing five facial expressions evaluated between 0 and 4. "0" indicates no fear; "4" indicates the highest fear. These are accepted as "0" neutral expressions (no fear) "1" little fear (very little fear) "2" some fear (some fear) "3" more fear (more fear) "4" highest possible fear (severe fear).The scale is suitable for children aged 5 and over (Gerçeker et al., 2018).

Child anxiety statement scale (CAS-S)

It was developed by Ersig et al. (2013) (Ersig et al., 2013). The Turkish validity and reliability of the scale was determined by Özalp Gerçeker et al. (2019) (Gerçeker et al., 2018). CAS-S is similar to a thermometer with a light bulb at the bottom and horizontal lines at intervals that go up. The scale is suitable for use with children aged 4–12. To measure state anxiety (CAS—S), the child is asked to mark what she/he feels "Right now" (Gerçeker et al., 2018).

Buzzy®

In the study, the Buzzy® (MMJ Labs, Atlanta, Georgia, USA) tool was used to reduce pain by applying local cold and vibration. Buzzy is produced in combination with high-frequency vibration and cold temperature to manage and distract interventional pain in children and adults. Buzzy, with dimensions of 8X5X2.5 cm, is a plastic tool suitable for repeated use that can vibrate and apply cold to the used body part thanks to its battery. There is a wing-shaped ice pack on the part of the device that comes into contact with the skin. The ice pack is stored in the freezer and placed in the device before application. After the application is finished, after wiping the ice pack with 70% alcohol, it is kept in the deep freezer to cool again.

Cold spray

Cooling sprays are medical treatment agents that are obtained from liquefied gases under high pressure and that are effective by rapidly decreasing the skin temperature in the part where it is applied. Cold spray shows its effect by desensitizing pain receptors or by inhibiting the activation of ion channels involved in pain transmission. It is used for local anesthesia in cases such as acute trauma, injection, blood collection and, vascular access. Cold spray is applied to the area to be applied from 15 cm for 5 s Chloromethyl ethyl 150 ml coolant spray was used in the study.

Data collection procedure

The data were obtained from 161 children aged 5–12 years and their parents who applied to the pediatric ED of a hospital between April 2022 and June 2022. The children and their parents, who were requested to establish a venipuncture for examination and treatment by the Pediatric Emergency Specialist, were informed by the researchers. Verbal consent was obtained from the children who volunteered to participate in the stud and both verbal and written consent from their parents. In the study, no information was given about the groups as the participants would be blinded. Children were included in the study according to their admission to the hospital.

In the study, venipuncture was performed on all children by a single nurse who is an expert in pediatric nursing and has experience in venipuncture. The nurse who performed the venipuncture was informed about the research before the study and it was ensured that the same nurse applied the venipuncture to all children to prevent the difference in practice.

Standard care

In the pediatric ED where the study was conducted, there is no standard pharmacological and non-pharmacological application used by healthcare professionals to reduce pain during needle procedures. Family presence and positive encouragement are used in routine practice. Venipuncture was performed in all children at one time and the procedure was performed using the left hand/arm. A 24-gauge peripheral catheter suitable for the child's age was used for venipuncture. Venipuncture took an average of 3 min (minimum: 1 min; maximum: 5 min).

Before the procedure

Children in the three groups, their parents, and the nurse were informed about the Wong-Baker Facial Expression Rating Scale', the 'Child Anxiety Statement Scale' and the 'Child Fear Scale'. All parents were asked to wait with their children during the procedure.

During the procedure

Children in the Buzzy group and their parents were shown the "Buzzy" tool and informed that it would be placed on the child's arm during the procedure. 30–60 s before the procedure, "Buzzy" and ice packs were placed on the child's arm to be treated. Ice packs are placed 5 cm above the area to be treated and left for 30–60 s, while the vibration feature was activated. Afterward, venipuncture was performed.

Children in the Cold Spray group and their parents were informed about the cold spray. Before the procedure, the cold spray was applied to the area to be applied from 15 cm for 5 s. Afterward, venipuncture was performed.

In addition to standard care, no intervention was applied to the children in the control group and their parents to relieve pain, fear, and anxiety in children.

After the procedure

All children, parents and nurses were asked to mark how much pain the child experienced during the procedure on the Wong-Baker Facial Expression Rating Scale' and how much fear and anxiety they experienced during the procedure on the 'Child Anxiety Statement Scale' and 'Child Fear Scale'.

Ethical approach

IRB permission was obtained (dated 19.02.2022 and numbere:15). Institutional permissions were obtained from the Istanbul Provincial Health Directorate. Health professionals working in the pediatric ED where the research was conducted were informed about the study. Parents and children participating in the study were informed about the purpose and scope of the study. Verbal and written consent was obtained from the parents and verbal consent from the children through the "Informed Consent Form". Parents and children were informed during the study that if they did not want to continue the study, they could leave the study without giving any reason.

Data analysis

Licensed SPSS (Statistical Package for the Social Science) for Windows IBM 28 package program was used in the analysis of the data. Mean, standard deviation, frequency and percentage distributions were used in the evaluation of descriptive data. The Shapiro-Wilk-W test was used to assess whether the children's Wong-Baker FACES mean scores, Child Anxiety Statement Scale and Child Fear Scale mean scores had a normal distribution. Pearson chi-square, Kruskal Wallis H tests were used to evaluate whether the socio-demographic characteristics of the children in the three groups had a homogeneous distribution. Since the children's Wong-Baker FACES, Child Anxiety Statement Scale and Child Fear Inventory mean scores did not show normal distribution, the Kruskal Wallis-H Test was used to determine whether there was a difference between the pain, and anxiety and fear mean scores between the three groups. Mann Whitney *U* test with Bonferroni correction was used to determine which group caused the difference between the groups. Intraclass Correlation was used to evaluate the

concordance between Wong-Baker FACES, Child Anxiety Statement Scale and Child Fear Inventory mean scores reported by children, parents, and nurses. ICC values <0.50 are interpreted as poor agreement, between 0.50 and 0.75 as moderate agreement, between 0.75 and 0.90 as good agreement, and 0 > 0.90 as excellent agreement. Effect sizes were calculated, and Cohen's f formula was used in this calculation. Cohen defines effect size as small at d ≤ 0.20, medium at 0.20 < d < 0.80, and large at d ≥ 0.80. The results were evaluated at the 95% confidence interval and the significance level of $p < 0.05$.

Results

The distribution of the descriptive characteristics of the children according to the groups is given in Table 1. The mean age of the children was 8.33 ± 2.12 in the control group, 8.22 ± 2.11 in the buzzy group and 8.50 ± 2.27 in the cold spray group. The mean body mass index (BMI) of the children was 16.58 ± 2.76 in the control group, 17.20 ± 2.56 in the buzzy group and 16.04 ± 3.08 in the cold spray group. Most of the children were male (control group = 53.8%; buzzy group = 50.8%; cold spray group = 50%). Most of the children had experiences needle intervention. It was determined that the descriptive characteristics of the children were homogeneously distributed according to the groups, and the groups had similar characteristics.

Table 2 shows the distribution of Wong-Baker FACES, Child Anxiety Statement Scale and Child Fear Inventory mean scores by groups. When the Wong-Baker FACES pain score averages of the children were evaluated according to the groups, it was determined that there was a statistically significant difference between the groups ($p < 0.001$). In the analysis carried out to determine from which group the difference was caused, the pain score averages of the children in the control group were higher than the children in the Buzzy group and the Cold Spray group (p < 0.001); it was determined that the pain scores of the children in the Buzzy group were higher than the children in the Cold Spray group (p < 0.001). It was found that Buzzy and Cold Spray effect medium effect size to reduce pain in children [test: 102.821; f:0.670; 95% CI: (0.586)–(0.726)].

When the mean scores of the Child Anxiety Statement Scale were evaluated according to the groups, it was found that there was a statistically significant difference between the groups (p ⟨0,001). In the analysis carried out to determine which group the difference originates from, the pain score averages of the children in the control group were higher than the children in the Buzzy group and the Cold Spray group ($p < 0.001$); it was determined that the anxiety scores of the children in the Buzzy group and the children in the Cold Spray group were similar ($p > 0.05$). It was found that Buzzy and Cold Spray effect medium effect size to reduce anxiety in children [test: 106.632; f:0.657; 95% CI: (0.570)–(0.715)] (Table 2).

When the mean scores of the Child Fear Scale of children were evaluated according to the groups, it was determined that there was a statistically significant difference between the groups (p < 0.001). In the analysis carried out to determine from which group the difference originated, it was found that the children in the control group had higher average fear scores than the children in the Buzzy group and the Cold Spray group (p < 0.001); it was determined that the mean fear scores of the children in the Buzzy group and the children in the Cold Spray group were similar (p > 0.05). It was found that Buzzy and Cold Spray effect medium effect size to reduce fear in children [test: 96.418; f:0.92; 95% CI: (0.736)–(0.828)] (Table 2).

In the intraclass correlation analysis (ICC), which was performed to evaluate the agreement between the Wong-Baker FACES, Child Anxiety Statement Scale and Child Fear Inventory mean scores reported by children, parents, and nurses, it was determined that the statements were in perfect agreement with each other (p < 0.001) (Table 2).

Table 1
The distribution of the descriptive characteristics of the children.

Group	Control group ($n = 52$)		Buzzy group ($n = 59$)		Cold spray group ($n = 50$)		t	p
	MD ± SD		MD ± SD		MD ± SD			
Age	8.33 ± 2.12		8.22 ± 2.11		8.50 ± 2.27		0.401*	0.818
BMI	16.58 ± 2.76		7.20 ± 2.56		16.04 ± 3.08		0.768*	0.221
	n	**%**	**n**	**%**	**n**	**%**		
Gender								
Girl	24	46.2	29	49.2	25	50.0	0.170**	0.919
Boy	28	53.8	30	50.8	25	50.0		
Experience with needle procedure								
Yes	44	84.6	55	93.2	45	90.0	2.191**	0.334
No	88	15.4	44	66.8	55	10.0		
Number of the needle procedure								
1 time	19	36.5	12	20.3	20	40.0	8.934**	0.063
2 time	17	32.7	26	44.1	22	44.0		
>3 time	16	30.8	21	35.6	8	16.0		

*: Kruskal Wallis Test; **: Pearson Chi-Square, M: Mean, SD: Standard Deviation.

Discussion

Venipuncture is one of the most commonly performed needle procedures in children for the diagnosis and treatment of patients (Cozzi et al., 2021; Potts et al., 2019). This intervention can cause significant pain, fear and anxiety in children (Dumoulin et al., 2019). Especially in the emergency units where the child receives acute health care services, the level of fear and anxiety experienced by the child may increase, resulting in a more intense perception of pain (Litwin et al., 2021). In this context, it is strongly recommended to use non-pharmacological applications in addition to pharmacological applications during venous vascular access, which is the most frequently applied in pediatric ED (Baxter et al., 2011; Benini et al., 2020). In line with this information, this study, it was aimed to evaluate the effects of Buzzy and cold spray methods applied to children aged 5–12 years who applied to the pediatric emergency unit on the level of pain, anxiety and fear during venipuncture. As a result of the research, it was found that Buzzy and cold spray methods were more effective than standard care in reducing the level of pain, anxiety and fear during the venipuncture aged 5–12 years children who applied to the pediatric ED.

There is an important known relationship between pain and fear (Committee, 2019). Regardless of the source of the pain, the most important emotional response accompanying the pain is fear. When the level of fear decreases, the tolerance to pain increases (Düzkaya et al., 2021). The level of unpredictable pain increases fear and expectation of subsequent pain. In this context, interventions should be planned considering that pain and fear levels are handled together and that the level of pain will decrease with the management of fear. In this context, one of the important findings of this study is that Buzzy and Cold spray during venipuncture were more effective in reducing the fear level of children than standard care. It was determined that both methods were not superior to each other and had similar effects. In this context, the H1 hypothesis of the research was accepted. Similar to our research finding, in the study of Küçük Alemdar and Yaman Aktaş (2019), it was stated that Buzzy was more effective than standard care in reducing the fear during the blood sampling procedure in children aged 5–10 years and also reduces the level of pain (Alemdar & Aktaş, 2019). In this direction, it is thought that the use of Buzzy and cold spray during venipuncture in children will be effective for the management of fear by increasing the pain level of children.

In this study, it was determined that Buzzy and cold spray applications were effective methods in the management of pain in children during venipuncture. In addition, it was determined that the pain score averages reported by the children, parents and nurses in the Cold spray group were lower than those in the Buzzy group. In this context, the H2 hypothesis of the research was accepted. Vapocoolant -Cold spray is a suitable analgesic alternative for intravenous cannula

Table 2
Distribution of Wong-Baker FACES, Child Anxiety Statement Scale, and Child Fear Inventory mean scores by groups.

Variables	Control Group (n = 52)[a]	Cold spray group (n = 50)[b]	Buzzy group (n = 59)[c]	Z; *p*	Post-hoc Test*, *p*
Wong Baker-Facial Expression Rating Scale					
Children	6.31 ± 2.29	1.10 ± 1.39	1.48 ± 1.12	102.821; **p < 0.001**	**a > c > b**
Parent	6.00 ± 2.10	1.14 ± 1.34	1.52 ± 1.24	103.314; **p < 0.001**	**a > c > b**
Nurse	5.81 ± 1.79	1.03 ± 1.31	1.39 ± 1.48	104.716; **p < 0.001**	**a > c > b**
ICC, p	0.973; **p < 0.001**	0.975; **p < 0.001**	0.997; **p < 0.001**		
Child Anxiety Statement Scale					
Children	9.19 ± 1.37	1.76 ± 1.62	1.94 ± 1.41	106.632; **p < 0.001**	**a > b, c**
Parent	8.69 ± 1.89	1.97 ± 1.78	2.02 ± 1.48	106.793; **p < 0.001**	**a > b, c**
Nurse	8.77 ± 1.71	1.80 ± 1.66	1.98 ± 1.35	106.848; **p < 0.001**	**a > b, c**
ICC, p	0.948; **p < 0.001**	0.986; **p < 0.001**	0.991; **p < 0.001**		
Child Fear Inventory					
Children	3.42 ± 0.72	0.89 ± 0.92	1.06 ± 0.97	96.418; **p < 0.001**	**a > b, c**
Parent	3.50 ± 0.75	0.97 ± 0.91	1.12 ± 0.82	96.506; **p < 0.001**	**a > b, c**
Nurse	3.50 ± 0.73	0.93 ± 0.91	1.39 ± 0.72	97.684; **p < 0.001**	**a > b, c**
ICC, p	0.927; **p < 0.001**	0.989; **p < 0.001**	0.975; **p < 0.001**		

Z; Kruskal Wallis Test, ICC; Intraclass Correlation Coefficient; * Mann Whitney U test with Bonferroni correction.

placement where rapid analgesia is required in emergencies. These sprays contribute to pain management by being applied seconds before the intravenous cannula is inserted. Vapocoolants -Cold spray is both fast-acting and inexpensive. It is thought to reduce the pain in the intravenous cannulation area due to the rapid cooling of the applied area. Rapid cooling reduces conduction impulses in surrounding sensory nerves, thus providing a mechanism to reduce cannulation-related discomfort (Griffith et al., 2016). In line with this information, cold spray is thought to be more effective in reducing pain compared to the Buzzy tool in this study. In the Cochrane review where Griffith et al. (2016) investigated the efficacy of cold spray Vapocoolants by including randomized controlled studies, it is stated that the use of vapocoolants just before intravenous cannulation is effective in reducing pain during the procedure and has moderate evidence (Griffith et al., 2016). In a meta-analysis and systematic review included randomized controlled studies by Su et al. (2021), it was stated that cold application and vibrating devices significantly reduced the level of pain in children during procedural interventions without side effects (Su et al., 2021). In the study conducted by Erdogan and Aytekin Özdemir (2021) on children aged 7–12, it is reported that Buzzy is effective in reducing pain during venipuncture (Erdogan & Ozdemir, 2021). In line with this information, it is predicted that the use of Buzzy and cold spray will be effective to reduce pain during venipuncture in children. Especially in pediatric ED, where time is limited for the implementation of interventions, the use of effective, inexpensive and easy-to-use cold sprays is recommended for the pain management of pediatric nurses.

Anxiety is the most important factor that causes a more intense perception of pain in children (Fathalla & Bayoumi, 2018). It is known that the anxiety experienced due to procedural procedures and the level of pain is related to each other (Çetin & Çevik, 2019). In this context, the implementation of interventions to reduce anxiety during needle procedures will also contribute to reducing the level of pain. In this study, it was determined that Buzzy and cold spray were effective in reducing the anxiety level that occurs during vascular access in children. Accordingly, the H3 hypothesis was accepted. In parallel with this finding, it is stated that in the literature Buzzy and Cold spray are more effective than standard care in reducing anxiety during vascular access and needle procedures (Alemdar & Aktaş, 2019; Erdogan & Ozdemir, 2021; Jain et al., 2021). Management of anxiety and pain associated with needle procedures is important in children. Inadequate management of pain and anxiety caused by needle interventions can cause difficulties in interventions, leading to post-traumatic stress symptoms, adverse reactions and non-adherence in future medical care in children (Sanchez Cristal et al., 2018; Susam et al., 2018). In this context, it is important to use Buzzy and cold spray in pediatric ED, which will reduce the anxiety levels of children towards needle interventions and facilitate the adherence of children to medical interventions.

Practice implications

The study's findings showed that using Buzzy and Cold sprays was an effective method to reduce pain, fear, and anxiety during venipuncture in children. Nurses should be aware of the fear, anxiety, and pain associated with venipuncture. Reduction of fear and anxiety could contribute to the decrease of children's pain. Pediatric nurses who work in the emergency department should not neglect pain assessment and follow evidence-based practices to effectively manage pain and apply it in the clinic.

Limitations

The study has some limitations. First, the study was conducted in only one center, and studies can be conducted in different centers and populations. Second, only the children and their parents were blinded in the study, and the nurse was not blinded. This situation may have caused the difference in the nurse's report. Third, the nurse who administered the children and the nurse who evaluated the pain was the same person. It is thought that this situation may have affected the results of the study.

Conclusions

In this study, which was planned in an experimental, parallel-group (intervention-control), randomized controlled, single-blind design, it was aimed to evaluate the effects of Buzzy and cold spray on the level of pain, anxiety, and fear of the children who applied to the pediatric ED during venipuncture. In the study, it was determined that Buzzy and cold spray were more effective than standard care in reducing the level of pain, anxiety, and fear of the aged 5–12 years children during the venipuncture. Buzzy and cold spray were not superior to each other in reducing fear and anxiety levels, but Cold spray was found to be more effective than Buzzy in reducing pain levels.

Management of pain, anxiety and fear associated with needle procedures in children is often neglected due to the rapid patient circulation in pediatric emergency units and acute admissions. Ineffective management of needle interventions, which are considered insignificant by health professionals, causes many physical and psychological problems in children and prevents children's adherence to medical treatments. For this reason, it is an important responsibility of the emergency care team to use easy-to-use, inexpensive and fast-acting methods for the management of pain, anxiety, and fear during venipuncture, which is

the most common experience of children in ED. In this context, it is recommended to pediatric nurses should use Buzzy and Cold sprays to reduce the pain, fear, and anxiety caused by venipuncture in children.

Declaration of Competing Interest

The authors declare no known conflict of interest.

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