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Effect of cryotherapy at venipuncture site on pain intensity among children undergoing blood sampling

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Abstract
Blood drawing is one of the most frightening and distressing nursing procedures for hospitalized children. The present study aimed to evaluate the effect of cryotherapy at venipuncture site on pain intensity among children undergoing blood sampling. One group pre-posttest quasi-experimental research design was utilized in the current study. 60 preschool-age children participated in the study at pediatric medical unit in Minia University Hospital for Obstetrics and Pediatrics. The tools used in the study were Wong-Baker Faces Pain Rating Scale, Children's Hospital of Eastern Ontario Pain Scale and Vital Signs Recording Sheet. The study resulted that total mean scores of Wong-Baker Faces Pain Rating Scale and Children's Hospital of Eastern Ontario Pain Scale were decreased markedly after cryotherapy application on the venipuncture site with highly statistically significant differences. The study concluded that cryotherapy effectively diminishes pain intensity at the venipuncture site among preschool children during blood sampling. The study recommended that, Pediatric health care units should integrate cryotherapy to manage needle puncture pain in the routine care for children undergoing venipuncture procedures.

Keywords: cryotherapy, venipuncture, children, blood sampling, pain intensity

1. Introduction
Pain is much more than the conscious perception of a sensory event. It is aversive and inseparably linked to emotion as reflected in the generally accepted definition of pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" [1, 2].
Emerging evidence from a recent study by Levy and Mills [3] emphasized that pain is considered the fifth vital sign. In the same context, Pancekauskaitė and Jankauskaitė [4] pointed out that pediatric pain and its assessment and management are challenging for health care professionals. Pediatric procedural pain is often underestimated and neglected because of various myths, beliefs, and difficulties in its evaluation and treatment. It is known that neonates and children can feel pain and have long-term effects that last through childhood into adulthood.
Venipuncture is a recurrently performed needle-related procedure, is one of the most alarming experiences and a common source of moderate to severe pain among children. Venipuncture is a devastating medical, emotional, and physical problem for pediatric patients and their families [5].
Management of pain is a basic need and precise of all children; effective pain management requires health professionals, including nurses, eager to try many interventions to achieve optimal results. Pain-reducing methods are grouped into pharmacological and non-pharmacological interventions or both (as integrative medicine) [6].
In a recent Egyptian study carried out by Ebrahem, Ahmed, Hammad, Hamdy and Eid, [7] to examine the effect of cryotherapy and balloon inflation on reducing pain of arteriovenous fistula (AVF) cannulation among 45 children undergoing hemodialysis. The study results concluded that cryotherapy positively affects reducing the pain of arteriovenous fistula cannulation among children undergoing hemodialysis. The authors documented that cryotherapy is one of the non-pharmacological methods done by using cooling to lower the temperature over the painful area or inflamed area and reduce the velocity of nerve conduction in C and A-delta fibers; therefore, the transmission of pain signals slowed. It is being a natural treatment modality, simple, non-invasive, and has absolutely no side effects.
In a recent quasi-experimental study conducted by Roy [8] to determine the effect of local cold application before venipuncture on pain-related responses among 50 children in India.

The study findings confirmed that local cold application before venipuncture could be considered an easy and effective intervention of reducing venipuncture related pain.

2. Significance of the study

Despite the up warding evidence on pain management and the accessibility of evidence-based clinical guidelines, pain is still inadequately treated. This can be attributed to a lack of knowledge among health professionals, misconceptions among patients, or lack of guidelines [9]. Several previous studies have shown cryotherapy as that one of the non-pharmacological pain management methods have proven to be a success to decrease venipuncture pain among children during blood sampling extraction procedure.

Through empirical observations and experiences as a clinical instructor in the pediatric care units, it was noticed that many children who are scheduled for venipuncture for blood sampling are exposed to varying intensity of pain. Based on the literature review, preschool children were selected to participate in the current study because they are among the hospital's most affected age groups. They have worries about the anticipation of the painful procedures, fear of bodily injury from mutilation, bodily intrusion, body image changes, disability, or even death. As well they perceive painful procedure as a punishment for misdeeds. Effective procedural pain management is essential to ensure adherence to the increased number of painful procedures required for health maintenance in pediatric patients and to create a cooperative and trusting relationship between health care providers, children, and their families. Finally, most pain can be either prevented, treated, or at least reduced using inexpensive techniques. Despite this, most children in our hospitals do not receive adequate treatment.

Scares research studies were conducted nationally to use cryotherapy to reduce pain associated with invasive procedures in children. Thus, the current study aimed to evaluate the effect of cryotherapy at the venipuncture site on pain intensity among children undergoing blood sampling, reducing the pain and suffering of children exposed to venipuncture. Ultimately, the results of the current study might generate attention and motivation and evidence-base for further research in pediatric pain and provide guidance and recommendations that should be reflected in pediatric nursing education and practice.

3. Aim of the Study

The current study aimed to evaluate the effect of cryotherapy at venipuncture site on pain intensity among children undergoing blood sampling.

4. Research hypotheses

H1: Children undergoing blood sampling who applied cryotherapy at the venipuncture site had lower Wong-Baker Faces Pain Rating Scale scores compared with pre-application scores.

H2: Children undergoing blood sampling who applied cryotherapy at the venipuncture site had a lower pain score based on Children's Hospital of Eastern Ontario Pain Scale compared with pre-application scores.

5. Subjects and Methods

5.1 Research design

One group pre-posttest quasi-experimental research design was utilized to achieve the aim of the current study.

5.2 Setting of the study

The current study was conducted in the pediatric medical unit on the fourth floor at Minia University Hospital for Obstetric and Pediatric (MUHOP).

5.3 Study subjects

The study sample consisted of all available preschool-age children undergoing blood sampling procedures -over six months (the total number was 60 children) who were admitted to the pediatric medical unit at Minia University Hospital for Obstetrics and Pediatrics (MUHOP).

Inclusion criteria

- Children aged 3-6 years
- Children exposing to peripheral venipuncture without interventions to decrease pain during puncture (local anesthetics)

Exclusion criteria

- Children who positive to cold sensitivity test that was done by the researcher.
- Children who have any contraindications for cold application e.g. vascular diseases.
- Children on analgesic medications.
- Children who were having peripheral vascular diseases, connective tissue disorders, diabetic neuropathy, and alternated level of consciousness.

5.4 Data collection Tools

The following four tools were used to collect data

Tool I: A structured interview questionnaire sheet in the Arabic language was designed by the researcher after reviewing the related literature and consists of 19 questions. It divided into two parts

Part 1: - Personal and social characteristics of children as age, gender, rank, place of residence, mothers' age, and occupation.

Part 2: - It involved 13 questions, five questions related to the child's medical history, such as diagnosis, history of previous hospitalization, causes, and the number of prior hospitalization admissions. Also, it comprised five questions about past painful experiences that the child exposed to it. The mothers of children have answered these questions as previous painful events, factors that increase the child's pain, factors that decrease the child's pain, and the sites of the past pain. This part included three questions related to the venipuncture site, such as the site of venipuncture, numbers of vein penetration, and the place where the venipuncture took place.

Tool II: Wong-Baker Faces Pain Rating Scale, developed by Wong and Baker [10]. It was a self-report pain scale to assess pain intensity in children aged 2 to 7 years. Each child was asked to choose the face that best described the intensity of the pain being experienced. Each face was rated by number to determine the intensity of pain, which (0-10) coding as the following: (Face 0 = No hurt, Face 2 = Hurts a little bit, Face 4 = Hurts a little more, Face 6 = Hurts, even more, Face 8 = Hurt whole lot and Face 10 = Hurts worst). These faces were assigned scores from 0 to 10, with a higher score indicating a higher severity of pain. According to a study in the Kingdom of Saudi Arabia, conducted by Alalo, Ahmad, and El Sayed [11] to identify pain intensity after an ice pack application prior to venipuncture among 50

school-age children that modify the scoring system of Wong-Baker Faces Pain Rating Scale to become score 0 referred to no pain, score two referred to mild pain, score 4&6 referred to moderate pain and score 8&10 referred to sever pain. Apart from being acceptable and straightforward, this scale had a high test-retest reliability and content validity. The scale had high reliability with a Cronbach's alpha coefficient of 0.70, as tested by Drendel, Kelly, and Ali [12]. The scale is available online without copyright restrictions.

Tool III: The Children's Hospital of Eastern Ontario Pain Scale (CHEOPS): Developed by McGrath *et al*. [13]. The scale can be used to monitor the effectiveness of interventions for reducing pain and discomfort. A behavioral observation scale will be used to rate a child's intensity of pain on six verbal and motor behaviors. Each behavior was assigned a value according to the following criteria, 0 (behavior that is the antithesis of pain), 1 (behavior that not indicative of pain, but not the antithesis of pain), two behavior indicating mild to moderate pain), and 3 (behavior indicative of severe pain). The total score for the tool ranges from 4-13; a score higher than 4 indicates pain. Concerning the reliability of the scale, Suraseranivongse *et al*. [14] tested the scale using inter-rater and intra-rater reliabilities, and it was 0.80, which was considered acceptable. CHEOPS is available online without copyright restrictions.

Tool IV: Vital Signs Recording Sheet: It was developed by the researcher to record children's vital signs (respiratory rate, heart rate, as well as systolic and diastolic blood pressure) before and after the application of cryotherapy.

5.5 Validity and Reliability

Three experts examined the content validity of the data collection tool in Pediatric Nursing.

Cronbach's alpha for reliability testing internal consistency was performed for each tool of the structured interview questionnaire. The results were 0.790, and 0.719 for Wong-Baker Faces Pain Rating Scale and The Children's Hospital of Eastern Ontario Pain Scale, respectively.

5.6 Pilot study

The pilot study was conducted on six children who met the inclusion criteria to investigate and ensure the feasibility, objectivity, applicability, clarity, adequacy, content validity, and to determine possible problems in the methodological approach or tools. The results of the pilot study were used to test the proposed statistical and data analysis methods. The tools were completed without difficulty, adding support to the validity of the tools. Children who participated in the pilot study were included in the total sample of the current study.

5.7 Ethical Considerations

Written approval was obtained from the Research Ethics Committee at the Faculty of Nursing, Minia University. Written permission was granted from the director of MUHOP and the chairpersons of the pediatric medical units after explaining the aim and nature of the study. The written informed consent was obtained from the mothers of children after a complete description of the study's aim and nature to gain their acceptance and cooperation. Children and their mothers were informed that contribution to the study was voluntary. The researcher also informed the mothers and preschool children about their rights to withdraw from the study at any time without giving any cause and without any effect on the care of their children. Confidentiality was secured for each mother and her child, where they assured that the study was harmless, and all the gathered data used for the research purpose only.

5.8 Field Work

Before the vein puncture procedure

The researcher gave the mothers and their children a clear and simple explanation of the aim and the sheet's content, reassuring them that the procedure is safe, invited them to participate, and written informed consent from mothers. The researcher interviewed the children and their mothers individually to collect data related to the characteristics of children who met the inclusion criteria using (tool 1); the interview took place in the medical unit beside the medical unit where venipuncture for blood samples was taken. After explaining the purpose and during the interview, the researcher explained the first pain assessment scale (Wong-Baker Faces Pain Rating Scale), and the second pain scale (The Children's Hospital of Eastern Ontario Pain Scale) taught each child about how to use the scale. The time for the interview took about 30-35 minutes. The procedure was discussed with the responsible nurse to gain her cooperation and to save time and effort

At the first time (venipuncture without cryotherapy)

Children were served as a control group where no intervention (no cryotherapy), only a usual venipuncture done by the assigned nurse based on physician written order. During the venipuncture procedure, the researcher assessed and documented the child's pain intensity using the behavioral observation scale (CHEOPS). Immediately after the venipuncture, each child was asked to choose the face that describes his intensity of pain based on the Wong-Baker Faces Pain Rating Scale. Concurrently, the researcher measured the child's respiratory rate, heart rate, and systolic and diastolic blood pressure and documented the vital signs recording sheet findings.

At the second time (venipuncture with cryotherapy)

The same children were served as a study group where cryotherapy intervention was applied for them. The duration between first and second venipuncture ranged from 1 day to 2 days according to physician orders. The researcher did an ice sensitivity test for each child. The ice pack was applied over the chosen insertion site for children for 3 minutes. Children presented with allergic reactions as redness and irritation of the skin should be excluded from the study. No children complained of ice sensitivity in the current study.

The ice (2-3 cm pieces of frozen distilled water) placed inside a plastic bag. Packs were frozen for 24 hours in the freezer, and they were carried in the Cooler Box to keep it consistently cold. The ice pack applied over the chosen insertion site for children for 5 minutes (3 minutes over chosen insertion site plus 2 minutes by slow circular motion massage with interrupted periods to prevent skin injury by the researcher and stopwatch was used) and continued throughout the puncturing procedure (approximately two minutes) or until skin numbness was felt. Replacing the ice bag occurred when necessary if ice melting starts.

Sterilization for puncture sites was done based on the unit's policy immediately after removing the ice bag.
During the venipuncture procedure with cryotherapy, the researcher assessed and documented the child's pain intensity using the behavioral observation scale (CHEOPS). Immediately after the venipuncture, each child asked to choose the face that was described his intensity of pain based on the Wong-Baker Faces Pain Rating Scale. Alongside this, the researcher measured the child's respiratory rate, heart rate, and systolic and diastolic blood pressure and document the findings in the vital signs recording sheet. Data collection was conducted over six months extending from March 2019 till August 2019.

Statistical Analysis
The collected data were coded, categorized, tabulated, and analyzed using the Statistical Package for Social Science (SPSS 20.0). Descriptive data were expressed as mean and standard deviation. Qualitative data were expressed as frequency and percentage. Chi-square was used to test the association between two qualitative variables. Quantitative continuous data were compared by using a t-test in case of comparisons between the mean scores of the pre- post-application. Spearman's rank correlation was used to assess the interrelationships among the quantitative variables. Graphs were done for data visualization using Microsoft Excel. The P - value of ≤ 0.05 indicates a significant result while, P value of > 0.05 indicates a non-significant result.

6. Results

Table 1: Percentage Distribution of Studied Children According to their Characteristics and Social Data (n=60)

Personal and social data	No.	%
Age / years		
3 - < 4	10	16.7
4 -< 5	18	30.0
5 - < 6	22	36.6
6	10	16.7
Mean ± SD	4.6 ±.9 years	
Gender		
Male	36	60.0
Female	24	40.0
Child ranking		
First	22	36.7
Second	26	43.3
Third	8	13.3
Fourth or more	4	6.7
Mother educational level		
Illiterate	42	70.0
Basic school	15	25.0
University	3	5.0
Mother job		
Housewife	51	85.0
Working outside the house	9	15.0
Place of Residence		
Rural	40	66.7
Urban	20	33.3

Table (1) presented the personal data pertinent to children and their mothers who participated in the current study. More than one-third (36.6%) of children's age ranged from 5-6 years, and their mean age was 4.6 ±.9 years. Besides, 43.3% of them ranked as the second child, 60% were male, and 40% were female. The highest percentage (70%) of the mothers was not read and writes, and 85.0% were housewives. It showed that 67% of the studied children came from rural areas, while 33% came from urban areas.

Table 2: Percentage Distribution of Studied Children According to Their Medical History (N=60)

Child illness history	No.	%
Child's diagnosis		
Pneumonia	10	16.7
Diarrhea & vomiting, and dehydration	22	36.7
Favism	3	5.0
Post streptococcal glomernepheritis	7	11.7
Nephrotic syndrome	6	10.0
Diabetes mellitus	12	20.0
Type of disease		
Acute	48	80.0
Chronic	12	20.0
Previous hospital admission		
Yes	33	55.0
No	27	45.0
If yes, how many times of admission to hospital (n = 33)		
1	17	51.5
2	14	42.4
3	2	6.1
Mean ± SD	**1.5 ±.6**	
Reason for admission (n = 33)		
Emergency	27	81.8
Follow up	1	3.0
Medical condition	5	15.2

Table (2) pointed out that 36.7% of children diagnosed with diarrhea, vomiting, and dehydration, followed by diabetes (20%). The majority (80%) of the studies children had acute health problems. More than half (55%) of children had previous hospital admissions, and 51.5% were admitted to the hospital for the first time before. The mean of prior hospital admission was 1.5 ±.6 times, and 81.8% from children admitted at the hospital for an emergency health problem.

Table 3: Percentage Distribution of Studied Children According to their Previous Painful Experience (n=60)

Previous history of pain	No.	%
Previous painful experience		
Yes	60	100.0
No	0	.0
If yes, most site of pain in the previous time		
Abdominal pain	48	80.0
Chest pain	4	6.7
Bone pain	8	13.3
Teeth pain	42	70.0
ENT pain	42	70.0
Headache	25	41.7
If yes, in the home, the most measures to decrease pain sensation was		
Go to Sleep and Rest	55	91.7
Taking Shower	5	8.3
Playing with friends	25	41.7
Using Analgesics	36	60.0
The best position feels comfortable		
Abdomen	14	23.3
Back	21	35.0
On side	1	1.7
Semi-sitting	25	41.7
Sitting	2	3.3
Things relief pain at the hospital		

Presence of mother	60	100.0
Toys	32	53.3
Transitional objects	20	33.3
Play with children	33	55.0

Table (3) revealed that all (100%) of the studied children had previous painful experiences, and 80% suffered from abdominal pain. The majority (91.7%) went to sleep and rest as home measures to relieve their pain, and 41.7% of children felt comfort in a semi-sitting position. The mother's presence and playing with other children were the mean things that reduced pain in the hospital, as replied by 100% and 55% respectively of the studied children.

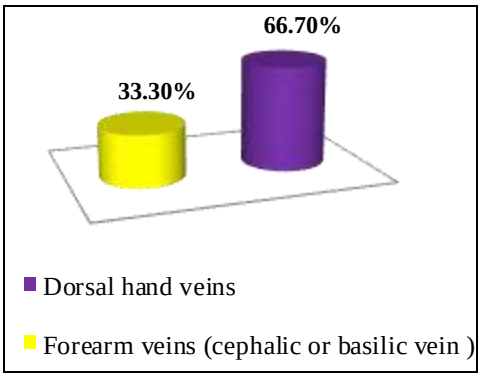

Fig 1: Percentage Distribution Venipuncture Site among Studied Children (n=60)

Figure (1) demonstrated that 66.7% of children had venipuncture from dorsal hand veins whereas 33.3% had venipuncture from forearm veins.

Table 4: Comparison between Studied Children According to Their Vital Signs before and After Cryotherapy (n=60)

Vital signs	Before cryotherapy		After cryotherapy		Test of significance	
	No.	%	No.	%	X^2	*P*-value
Respiratory rate (breath/cycle)						
Bradypnea	0	0	3	5.0	10.619	.005*
Normal respiratory rate	48	80.0	55	91.7		
Tachypnea	12	20.0	2	3.3		
Heart rate (beat/minute)						
Bradycardia	0	0	1	1.7	2.000	.368
Normal pulse rate	59	98.3	59	98.3		
Tachycardia	1	1.7	0	0		
Systolic blood pressure (mm Hg)						
Normal	42	70.0	55	91.7	9.090	.003*
Elevated blood pressure	18	30.0	5	8.3		
Diastolic blood pressure (mm Hg)						
Normal	22	36.7	48	80.0	23.177	0001**
Elevated blood pressure	38	63.3	12	20.0		

*Statistically significant at p=<0.05
** Highly statistically significant at p=<0.001

Table (4) revealed that there was a highly statistically significant difference between diastolic blood pressure readings before and after cryotherapy among studied children (X^2= 23.177, p=<0.001). There were remarkable statistically significant differences between studied children; respiratory rate and systolic blood pressure before and after cryotherapy (X^2= 10.619, & 9.090 p=<0.05). In contrast, no statistically significant difference was noticed between heart rate among studies children before and after cryotherapy (*p*=>0.05).

Table 5: Level of Pain Intensity before and After Cryotherapy at Venipuncture Site among Studied Children According to Wong-Baker Faces Pain Rating Scale (n=60)

Items	Before Cryotherapy		After Cryotherapy		X^2	*P*-value
	No.	%	No.	%		
Wong-Baker Faces Pain Rating scale						
No pain	0	0	17	28.3	120.000	.0001**
Mild pain	0	0	26	43.4		
Moderate pain	24	40.0	17	28.3		
Severe pain	36	60.0	0	0		

Table (5) showed that the highest percentage (60%) of the children suffering from severe pain during venipuncture site before applying cryotherapy in comparison, 43.4% of them suffering from mild pain after the utilization of cryotherapy. According to the Wong-Baker Faces Pain Rating scale, there was a highly statistically significant difference between pain intensity levels among children before and after cryotherapy (p=<0.001).

Table 6: Total Mean Score of Faces Pain Rating Scale and CHEOPS Before and After Cryotherapy at Venipuncture Site among Studied Children (n=60)

Pain scales	Before cryotherapy	After Cryotherapy	t-test	*P*-value
Faces Pain Rating Scale	7.2 ± 2.2	2.2 ± 1.8	31.015	.0001**
CHEOPS	12.2 ±.75	5.9 ± 1.2	32.003	.0001**

Table (6) evident that the total mean score of the faces pain rating scale among children before applying cryotherapy on the venipuncture site was 7.2 ± 2.2 decreased to 2.2 ± 1.8 after the application of cryotherapy. The total mean score of CHEOPS among children before the utilization of cryotherapy was 12.2 ±.75, reduced to 5.9 ± 1.2 after the application of cryotherapy. Highly statistically significant differences were detected among children regarding the total mean scores of faces pain rating scale and CHEOPS before and after the application of cryotherapy.

Table 7: Correlational Matrix between Children's Age and the Total Mean Scores of CHEOPS, Wong-Baker Faces Pain Rating Scale Before and After Cryotherapy at Venipuncture Site (n=60)

Items		Child age	Total CHEOPS before	Total CHEOPS after	Face scale before	Face scale after
Child's age	R					
	P- Value					
Total CHEOPS before cryotherapy	R	-.490-**				
	P- Value	.000				
Total CHEOPS after cryotherapy	R	.023	-.113-			
	P- Value	.864	.390			
Face scale before cryotherapy	R	-.305-*	.758**	-.006-		
	P- Value	.018	.000	.964		
Face scale after cryotherapy	R	-.137-	.247	.585**	.292*	
	P- Value	.298	.057	.000	.024	
*. Correlation is significant at the 0.05 level **. Correlation is significant at the 0.01 level						

Table (7) illustrated that there were statistically significant negative correlations between children's age and the total mean score of the CHEOPS and Face Pain Rating Scale before the application of cryotherapy (r=-.490, P=<.0001 & r=-.30, P=<0.05 respectively). There were no statistically significant correlations between children's age and the total mean score of the CHEOPS and Face Pain Rating Scale after the application of cryotherapy (*P*=>0.05).

7. Discussion

Regarding the studied children's characteristics, the current study results proved that more than one-third of their ages ranged from 5-6 years, and their mean age was 4.6 ±.9 years. These results were supported by an Indian study carried out by Abishak [15] to evaluate the effectiveness of cryotherapy for 15 seconds versus 30 seconds on pain intensity during venipuncture among 60 children. The study results assured that 40% of children's age ranged from 5-6 years, and their mean age was 4.3 ± 1.09 years.

The current study results revealed that 43.3% of the studied children ranked as the second child, similarly, in an Egyptian study held by El Said, Ouda, Mahmoud, and El-Sadek [16] to examine the effect of cryotherapy on pain intensity at puncture sites of AVF among 40 children undergoing hemodialysis. The study results confirmed that 42.5% of children ranked as the second child within their families.

Regarding the gender of the studied children, the current study results showed that the highest percentage was males. These results were supported by a similar Egyptian study held by El Said, Ouda, Mahmoud, and El-Sadek [16] who found that 60% of the studied children were males. On the contrary, a study conducted by Alalo, Ahmad, and El Sayed [11] carried out a study to identify pain intensity after an ice pack application prior to venipuncture among 50 school-age children. The study summarized that 52% of children were females, while 48% were males.

The current study results proved that more than half of the studied children came from rural areas. This result could be related to almost hospital referral of acute cases to MUHOP for better facilities and equipment and care for children with various types of diseases in the Minia governorate and surrounding rural and semi-urban areas. In the same context, the United Nations Educational, Scientific, and Cultural Organization [UNESCO] [17] documented that the rural population was 57% of the total population worldwide. In the same context, the results of an Egyptian study carried out by Elhalafawy, Bahgat, Abd-Elhafez, A., and Farag [18] found that 80% of children came from rural areas.

Concerning the personal data related to the mothers of the studied children, the current study results proved that the mothers' highest percentage (70%) were not read and write. This result reflected the lower literacy rates among mothers who participated in the current study. In the same line, Egypt Demographics Profile [19] assured that females' literacy rate was 65.5% compared to 63.5% in 2016. Accordingly, governmental and non-governmental organizations' efforts should continue to focus on female education, particularly in Upper Egypt. Because low levels of literacy can hinder economic development in the current rapidly changing, technology-driven world, this will positively reflect the health care system as a whole and care provided for the sick child.

The current study results documented that more than one-third of children diagnosed as having diarrhea, vomiting, dehydration, and one-fifth of them have diabetes. The current study findings were in accordance with the World Health Organization (WHO) [20] which documented that diarrheal disease is a chief reason for child mortality and morbidity worldwide. It typically results from contaminated food and water sources and is responsible for killing around 525000 children every year. Severe dehydration and fluid

loss were the leading causes of diarrhea deaths.

A recent systematic review held by Patterson *et al*. [21] documented that the incidence rates in diabetes in children were available for 45% of countries (ranging from 6% in the sub-Saharan Africa region to 77% in the European region). Worldwide annual incidence estimates were 98,200 (128,900) new cases under 15-year (under 20 years) age-groups. Corresponding prevalence estimates were 600,900 (1,110,100) existing cases. The prevalence estimates have decreased in sub-Saharan Africa because allowance has been made for increased mortality in those with diabetes.

Concerning the previous hospital admissions of the studied children, the current study results showed that more than half of the children had prior hospital admissions. This result was similar to a quasi-experimental study conducted in India by [8] to determine the local cold application's effect before venipuncture on pain-related responses among 50 children. The results of the study indicated that 76% of studied children had previous hospital admissions.

In relation to the previous pain experience of studied children, the current study results revealed that all studied children had previous painful experiences. This result was similar to a study done by Roy [8], who summarized that 74% of studied children had previous painful experiences. The results of the current study documented that 80% of them suffered from abdominal pain. This result could be rationalized as acute abdominal pain is one of the most common complaints in children. The same explanation was mentioned by Brusaferro, Farinelli, Zenzeri, Cozzali, and Esposito [22] who documented that abdominal pain is one of the utmost common symptoms in children. The pain is often acute onset and may be due to several gastrointestinal (GI) or extraintestinal causes.

According to Santillanes and Claudius [23] as in adults, the usual site for venipuncture in infants and children is the antecubital fossa. However, any reasonably accessible or easily visible peripheral vein may be used, such as those on the hands, feet, or scalp for a tiny infant. The current study results were in accordance with the above-mentioned empirical evidence and demonstrated that about two-thirds of children had venipuncture from dorsal hand veins, whereas the rest had venipuncture from forearm veins. These results are similar to the findings of the study conducted by Abishak [15] who found that 60% of children metacarpal vein in dorsal hand was punctured while 40% of them basilic vein was punctured.

Regarding children's vital signs before and after cryotherapy at the venipuncture site, the current results revealed a highly statistically significant difference between diastolic blood pressure readings before and after cryotherapy among studied children (X^2= 23.177, p=<0.001). There were remarkable statistically significant differences between studied children; respiratory rate and systolic blood pressure before and after cryotherapy (X^2= 10.619, & 9.090 p=<0.05). In contrast, no statistically significant difference was noticed between heart rate among studies children before and after cryotherapy (*p*=>0.05).

These results are parallel to the results of an Egyptian study conducted by Ebrahem *et al*. [9]; the results showed that there is a highly statistically significant difference between mean scores of vital signs among children across (pre-intervention, cryotherapy, and balloon inflation) before and immediately after AVF punctures. An Egyptian study done by Attia and Hassan [24] found that all physiological parameters showed improvements after cryotherapy either before or after the needle puncture. In other Egyptian study done by Fathalla and Bayoumi [25], children in the buzzy and cryotherapy groups had lower mean heart and respiratory rates during and after blood specimen collection.

Before and after cryotherapy at venipuncture site among studied children related to Wong-Baker Faces Pain Rating Scale, the pain intensity level was assessed. The current study results showed that the highest percentage of the children suffering from severe pain during venipuncture site before applying cryotherapy in comparison, the highest percentage of them suffering from mild pain after the utilization of cryotherapy. According to the Wong-Baker Faces Pain Rating scale, there was a highly statistically significant difference between pain intensity levels among children before and after cryotherapy (p=<0.001). These results may indicate the maximum effectiveness of cryotherapy in reducing pain intensity in the studied children.

Consistent with the current study results, El Said *et al*. [11] found that more than two thirds (72.5%) of children had severe pain during AVF puncture at pre cryotherapy. In contrast, post cryotherapy, more than half of children (55%) had mild pain during AVF puncture. There was a highly statistically significant difference between the level of pain pre and post-intervention at p-value <0.001. A study was done by Gaikwad, Naregal, Mohite, and Karal [26] was congruent with this result. They found that in the control group, the vast majority of them (93%) experienced severe pain while most children (97%) experienced mild pain after using ice therapy.

In the same context, Alalo *et al*. [11] found that 36% of the children had moderate pain during venipuncture of blood sampling pre-ice pack application. While post ice pack application 40% of children had mild pain. There was a statistically significant difference between pain pre- and post-intervention at p-value <0.001. The current study results are similar to the study's findings held by Aswathi [27] to measure the effectiveness of local cold application on pain response during intravenous cannula insertion among children. The study findings concluded that the majority (83.33%) of children in the control group experienced severe pain. Even though after cold application, 67.67% of children experienced moderate pain.

This study results evident that the total mean score of the Wong-Baker Faces Pain Rating scale among children before applying cryotherapy on the venipuncture site was 7.2 ± 2.2 decreased to 2.2 ± 1.8 after applying cryotherapy. Highly statistically significant differences were detected among children regarding the total mean scores of faces pain rating scale before and after the application of cryotherapy. These results support the first hypothesis of the current study.

Similarly, Elhalafawy *et al*. [18] found that the mean score of Wong-Baker Faces Pain score during fistula puncture was 7.266 and 5.667, respectively, on days 1 and 2, which decreased to 2.666 and 1.733 respectively on day 3 and 4. These results are consistent with the results of the study conducted by Kurian [28], who found that the total mean score of the faces pain rating scale among children before the application of cryotherapy on the venipuncture site was 8.26 ± 1.36 decreased to 2.8 ± 1.44 after the application of cryotherapy. There were statistically significant differences in the experimental (Group I) pain score and the control group. The same findings were reported by Gaikwad *et al*.

[26]; they found that the total mean of Wong-Baker Faces Pain Rating Scale scores level was lower from 8.93 ±1.461 in the control group to 0.66 ±1.093 among children in the experimental group after cryotherapy.

Concerning the total mean score of CHEOPS among children before and after cryotherapy at venipuncture site among studied children, the results of the current study clarified that the total mean score of CHEOPS among children before the utilization of cryotherapy was 12.2 ±.75, reduced to 5.9 ± 1.2 after the application of cryotherapy. Highly statistically significant differences were detected among children regarding the total mean scores of faces pain rating scale and CHEOPS before and after the application of cryotherapy. These results may confirm the effectiveness of the utilization of cryotherapy in reducing pain in children. These results also support the second hypothesis of the current study.

A quasi-experimental Indian study conducted by Roy [8] reported significantly lower mean pain scores among children in the intervention group (8.28± 1.94) than in the control group (9.92± 2.23). This finding was supported by the results of an earlier study held by Movahedi, Salsali, Keikhaee, Moradi, and Rostami [29] to determine the local refrigeration effect prior to venipuncture on the pain-related responses in 80 children. It was found that the total mean score of CHEOPS among children was 9.950 ± 1.796, which decreased to 8.475 ± 1.50 after the application of local cold applications. There was a significant difference (p=0.0011) between the study and the control groups.

The study of current results illustrated statistically significant negative correlations between children's age and the Face Pain Rating Scale's total mean score before applying cryotherapy (r=-.30, P=<0.05, respectively). There were no statistically significant correlations between children's age and the total mean score of the Face Pain Rating Scale after the application of cryotherapy (*P*=>0.05). These findings are in agreement with a study conducted by Alalo *et al.* [11] found that no significant association was found between the pain intensity reported by children and their age in the study group during venipuncture procedure with ice back application (*P*-value >0.05). Still, a significant positive correlation was observed among them in the control group (r =0.549 P= <0.05).

Conclusions

The current study results concluded that the total mean scores of Wong-Baker Faces Pain Scale and CHEOPS among children were decreased significantly after the application of cryotherapy on the venipuncture site. There were highly statistically significant differences between the total mean of respiratory rate, heart rate, systolic blood pressure, and diastolic blood pressure among studied children before and after cryotherapy. It was also concluded that cryotherapy effectively diminishes pain intensity at the venipuncture site among preschool children undergoing blood sampling.

Recommendations

In light of the findings of the current study, the following recommendations were suggested: -

- Pediatric health care units should integrate cryotherapy to manage needle puncture pain in routine care for children undergoing venipuncture procedures.
- An educational training program is mandatory for pediatric nurses about the effect of cryotherapy as a non-pharmacological pain management strategy during blood sampling withdrawal and other painful procedures.
- Further research must utilize a randomized controlled trial with a placebo to further support this procedure's benefits.
- Further studies are needed to compare cryotherapy's impact with other non-pharmacological pain management methods such as relaxation, distraction, and play in managing pain among children undergoing venipuncture procedure.

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References

1. Becker S, Navratilova E, Nees F, Van Damme S. Emotional and motivational pain processing: current state of knowledge and perspectives in translational research. Pain Research and Management 2018;1;2018.
2. International Association for the Study of Pain (IASP) Available at 2020. www.iasp.pain.org. Accesssed on 1-9-2020.
3. Levy N, Sturgess J, Mills P. Pain as the fifth vital sign and dependence on the “numerical pain scale” is being abandoned in the US: why?. British journal of anaesthesia. 2018;1;120(3):435-8.
4. Pancekauskaitė G, Jankauskaitė L. Paediatric pain medicine: pain differences, recognition and coping acute procedural pain in paediatric emergency room. Medicina 2018;54(6):94.
5. Walther-Larsen S, Pedersen MT, Friis SM, Aagaard GB, Rømsing J, Jeppesen EM *et al*. Pain prevalence in hospitalized children: a prospective cross-sectional survey in four Danish university hospitals. Acta Anaesthesiologica Scandinavica 2017;61(3):328-37.
6. Bukola IM, Paula D. The effectiveness of distraction as procedural pain management technique in pediatric oncology patients: a meta-analysis and systematic review. Journal of Pain and Symptom Management. 2017;1;54(4):589-600.
7. Ebrahem GGS, Ahmed GEN, Hammad A, Eid R. Applying cryotherapy and balloon inflation technique to reduce pain of arteriovenous fistula cannulation among children undergoing hemodialysis. International Journal of Nursing Didactics 2019;9(05):29-35.
8. Roy M. Effect of local cold application prior to venipuncture on pain related response among children in selected hospital Burdwan, West Bengal. Journal of Medical Surgical Nursing Practice and Research 2019;1(2):6-16. http://doi.org/10.5281/zenodo.3240746.
9. Thrane SE, Wanless S, Cohen SM, Danford CA. The assessment and non-pharmacologic treatment of procedural pain from infancy to school age through a developmental lens: a synthesis of evidence with recommendations. Journal of pediatric nursing 20161;31(1):e23-32.

10. Wong D, Baker C. Wong-Baker FACESR Pain Rating Scale [Internet]. Oklahoma City, Wong-Baker FACES Foundation; Available from 2018. http://wongbakerfaces.org/
11. Alalo FM, Ahmad AE, El Sayed HM. Pain Intensity after an Ice Pack Application Prior to Venipuncture among School-Age Children: An Experimental Study. Journal of Education and Practice 2016;7(36):16-25.
12. Drendel AL, Kelly BT, Ali S. Pain assessment for children: overcoming challenges and optimizing care. Pediatric emergency care. 2011;1;27(8):773-81.
13. McGrath PJ, Johnson G, Goodman JT, Schillinger J, Dunn J, Chapman J. Children's Hospital of Eastern Ontario Pain Scale. Assessing children's well-being: a handbook of measures 2003;12;28(3):38.
14. Suraseranivongse S, Santawat U, Kraiprasit K, Petcharatana S, Prakkamodom S, Muntraporn N. Cross-validation of a composite pain scale for preschool children within 24 hours of surgery. British Journal of Anaesthesia 2001;1;87(3):400-5.
15. Abishak R. Effectiveness of cryotherapy for 15 seconds versus 30 seconds on pain during venipuncture among children in the pediatric ward, Government Rajaji Hospital, Madurai 2017 (Doctoral dissertation, College of Nursing, Madurai Medical College, Madurai).
16. El Said R, Ouda W, Mahmoud F, El-Sadek B. Effect of cryotherapy on pain intensity at puncture sites of arteriovenous fistula for children undergoing hemodialysis therapy. Unpublished Doctorate Thesis, Faculty of Nursing, Benha University 2017.
17. United Nations Educational, Scientific, and Cultural Organization (UNESCO). Education in rural community, 2017. Available at www.un.org.Accessed on 1/9/2020.
18. Elhalafawy SEH, Bahgat RS, Abd-Elhafez MA, Farag NH. Effect of cryotherapy versus aromatherapy on pain of arteriovenous fistula puncture for children undergoing hemodialysis. IOSR Journal of Nursing and Health Science 2020;9(1):9-19.
19. Egypt Demographics Profile. Available at 2017. www.indexmundi.com/egypt/ demographics _profile. Accessed in 26/9/2020.
20. World Health Organization. Diarrhea. Fact sheet Available at 2020, 331. https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease Accessed at 2\10\2020.
21. Patterson CC, Karuranga S, Salpea P, Saeedi P, Dahlquist G, Soltesz G *et al*. Worldwide estimates of incidence, prevalence and mortality of type 1 diabetes in children and adolescents: Results from the International Diabetes Federation Diabetes Atlas. Diabetes research and clinical practice 2019;1;157:107842.
22. Brusaferro A, Farinelli E, Zenzeri L, Cozzali R, Esposito S. The management of paediatric functional abdominal pain disorders: latest evidence. Pediatric drugs 2018;1;20(3):235-47.
23. Santillanes G, Claudius I. Pediatric vascular access and blood sampling techniques Available at 2015. www.clinicalgate.com. Accessed on 5/10/2020.
24. Attia AA, Hassan AM. Effect of cryotherapy on pain management at the puncture site of arteriovenous fistula among children undergoing hemodialysis. International journal of nursing sciences 2017;10;4(1):46-51.
25. Fathalla AA, Bayoumi MH. Effect of thermomechanical stimulation (buzzy®) and cryotherapy on children pain, anxiety and satisfaction during blood specimen collection. Journal of Health, Medicine and Nursing 2018;57:12-25.
26. Gaikwad NS, Naregal PM, Mohite VR, Karale RB. A Study to Assess the Effectiveness of Ice Application on Pain Response Prior to Intravenous Procedures among Children at Tertiary Care Hospital. Asian journal of pharmaceutical research and health care 2017;1;9(4):167-73.
27. Aswathi V. A study to assess the effectiveness of local cold application on pain response during intravenous cannula insertion among children (6-12years) admitted in government district head quarters hospital, Namakkal, Tamilnadu (Doctoral dissertation, Vivekanandha College of Nursing, Tiruchengode).
28. Kurian JA. Effect of Local Cold Application on Venipuncture Site in Reducing Pain among School Age Childre. International Journal of Research and Review 2019;6(8):545-9.
29. Movahedi AF, Salsali M, Keikhaee B, Moradi A, Rostami S. Effect of local refrigeration prior to venipuncture on pain related responses in school age children. Australian Journal of Advanced Nursing 2007;19:51-5.