Effect of Shot Blockers versus Buzzy Bee Distractor on Relieving Pain and Anxiety Level during Insulin Injection among Children with Type I Diabetes

Eman Samy Rady EL-mahdy[1], Sahar Mahmoud El-khedr [2], Shaymaa Mohamed Elrifaey[3], Maha Elsayed Elaraby[4]

[1] Demonstrator of Pediatric Nursing, Faculty of Nursing/ Tanta University, Egypt.

[2] Professor of Pediatric Nursing, Faculty of Nursing/ Tanta University, Egypt.

[3] Assistant prof. of Pediatrics Endocrine Department, Faculty of Medicine/ Tanta University, Egypt

[4] Lecturer of Pediatric Nursing, Faculty of Nursing/ Tanta University, Egypt.

Abstract

Background: Type 1 diabetes is characterized by deficiency in insulin because of the autoimmune destruction of pancreatic β-cells. Children with type 1 diabetes require lifelong insulin therapy. Non pharmacological methods as Buzzy Bee and Shot Blocker used to reduce children's pain and anxiety. **Aim:** the present study was aimed to evaluate the effect of shot blockers versus buzzy bee distractor on relieving pain and anxiety during insulin injection among children with type I diabetes. **Research design:** Randomized controlled experimental study design was used. **Subjects:** Simple random sampling of 90 children with type 1 diabetes from Pediatric Endocrinology Unit of Tanta Main University Hospital was recruited. **Tools:** three tools were used, **Tool (I):** Child's Medical History, **Tool (II):** FLACC Pain Scale and **Tool (III):** Visual Facial Anxiety Scale. **Results:** The mean scores of FLACC Pain Scale and Visual Facial Anxiety Scale was lower among children in Buzzy Bee group compared to other groups during insulin injection. High statistically significant correlations were found between level of pain and anxiety throughout the study period. **Conclusion:** Both Buzzy Bee and Shot Blocker had a positive effect on the reduction pain and anxiety for children with type1 diabetes. Buzzy Bee was more effective than Shot Blocker. **Recommendations:** Implementation of pain and anxiety assessment must be integrated into the routine assessment as vital signs when caring for children. Developing Educational programs for pediatric nurses about non-pharmacological techniques including shot blocker and buzzy bee to minimize procedures associated pain and anxiety.

Keywords: Anxiety, Buzzy Bee, Children, Distractor, Insulin injection, Shot Blocker, Type1diabetes.

Introduction

Diabetes mellitus (DM) is a group of metabolic disorders that is characterized by glycosuria and hyper glycaemia. The absence, destruction, or the loss of beta cells causes type 1 diabetes mellitus (T1DM). (1) In children type 1 diabetes is characterized by deficiency in insulin. It is common among genetically susceptible children because of the autoimmune destruction of pancreatic β-cells. (2)

The International Diabetes Federation (IDF) listed Egypt among the top 10 countries of the world. Regarding to the number of children with diabetes. It is expected that, children with diabetes in the Middle East and North Africa (MENA) region to grow by 96% from year 2013 to 2035 or from 34.6 million to 67.9 million.

This is a significant increase making DM a public health goal. [3,4]

Children with type 1 diabetes require lifelong insulin therapy due to destruction of pancreatic β-cells which is responsible for the production of insulin in the body, and resulting in the body's inability to produce insulin. So, most children with diabetes have a lifetime dependence on insulin therapy to maintain normoglycemia. Prolonged and frequent injections of insulin therapy can cause pain anxiety, fear, and behavioral distress in children with type 1 diabetes. [5,6]

Children who receive repeated injections may not use insulin therapy and may skip doses. To avoid additional consequences including an increase in the quantity of glycosylated haemoglobin (HbA1c), ketonuria, a poor overall state of health, and an elevated risk of mortality, it is crucial to lessen pain and anxiety after insulin injection. Pain management in diabetic children is very important to make them more commitment for insulin therapy, control blood glucose level and reduce the risk for complication and death. [7,8]

Both of pharmacological and non-pharmacological methods are effective in reducing pain and anxiety during painful procedures such as insulin injection. Non-pharmacological methods are a safe, inexpensive, readily available, reusable, easily cleanable, and effective in reducing pain and anxiety. The most effective non-pharmacological methods that can be used to reduce pain and anxiety management during procedure are distraction technique. It takes the child's attention away from the injection and its pain and onto the distraction. Distraction also, makes the areas of the brain which process pain stimuli less active to injection's pain during distraction. This can be applied using many distractors such as buzzy bee and shot blocker. [9-12]

Both of buzzy bee and shot blocker distractors are designed to work on distracting the brain temporary from pain and the child may not even notice the injection through apply light, nerve-stimulating pressure at the injection site. [13]

Buzzy bee is a handheld device with blue ice-pack wings that vibrates the skin with a tiny buzzing vibration. The nerves are confused by a combination of cooling sensation (due to cold "wings") reflect as cryotherapy effect. It also, has a vibration, causing the brain to miss the acute pinch from the needle insertion by replacement needle pain with temperature and movement. [14,15]

Shot Blocker is an innovative, simple, noninvasive, drug- free method that can be effective in reducing needle pain and anxiety among children with type1 diabetes during insulin injection. It is a flexible plastic C-shaped device with a small bump, multiple blunt skin contact points on the back. When pressure is applied to the skin by its bump at the injection site, the sensory nerves are confused by the pressure than the pain signal from the needle stick. [16]

Nurses consider pain, the fifth vital sign. If the pain is evaluated as part of vital sign, it will be completely treated. Nurses assess the child's comfort level as the first step in pain management. If pain is detected, steps must be made to reduce or eliminate it. Pain management in diabetic children is very important to make them more commitment for insulin therapy, control blood glucose level and reduce the risk for complication and death. [17,18]

Significance of the study:

Children with type 1 diabetes are insulin dependent. They require repeated insulin injection per day throughout their life. Repeated injections and its associated pain and anxiety may prevent children from commitment to insulin injections. They may skip doses and these results in increase glucose and glycosylated hemoglobin level. Non-pharmacologic method as shot blocker and buzzy bee distractors can be used to reduce pain and anxiety during insulin injections. They may be excellent options for nurses because they are inexpensive and effective. So, this study aims to assess the effect of Shot Blocker versus Buzzy Bee distractor in relieving pain and anxiety of children during insulin injection. [19-21]

Aim of the study

The current study aims to evaluate the effect of shot blockers versus buzzy bee distractor on relieving pain and anxiety during insulin injection among children with type I diabetes.

Subjects and Method

A randomized controlled experimental study design research design was used in the present study.

Setting:

The study was conducted at Pediatric Endocrinology Unit of Tanta Main University Hospital affiliated to the Ministry of High Education.

Subjects:

A simple random sampling of children with type 1 diabetes mellitus (T1DM) was assigned in the current study from the previously mentioned setting. Ninety Children were classified into 3 groups, 30 children in each group. The researcher was used buzzy bee for one group and shot blocker for the second group and the third group is a control group. The total number of type 1 diabetes children in the age between 3-6 years was 400 child / year.

Tools:

Three tools were used in the current study as follow:

Tool (I): **Child's Medical History:** It was developed by the researcher to collect data related to socio demographic characteristics and commitment to insulin therapy. It was consisted of two parts.

Part (1): Child's Bio-Socio demographic characteristics: including children' age, sex and birth order, history of diabetes in children, age of onset and duration of diabetes, manifestations, complications, and frequency of blood glucose monitoring per day.

Part (2): Insulin injection commitment: it includes, daily insulin dosage, frequency of missed doses, reasons for refusal of injection and assessment of insulin injection site.

Tool (II): FLACC Pain Scale: It was adopted From Merkel S, et al. (1997). [22] FLACC is a behavioral pain assessment scale used for children who are unable to self-report their level of pain. It is an observational scale comprised five behavioral indicators (Face, Legs, Activity, Cry, Consolability). Each indicator was scored from zero to two. The pain score is the sum of the item scores and ranges from zero to 10.

FLACC Pain Scoring as follow:

- no pain which scored as zero,
- Score from 1to 3 resemble mild pain,
- Moderate pain ranged between 4-6 &
- Severe pain from 7-10.

Tool (III): Visual Facial Anxiety Scale (VFAS): It was adopted From Luyk, Beck, & Weaver, (1988).[23] It was used to assess children's anxiety level. It is formed from eleven different faces; the researcher will

select the suitable face that indicates the child's anxiety level. The face in the far left represent no anxiety, while the face in the far right indicates high level of anxiety. It ranged from zero to ten. Number (0) mean no anxiety while, number (10) means extremely high anxiety.

Scoring system includes:

- No anxiety scored zero,
- Mild anxiety takes the score 1-2,
- Mild-moderate anxiety between 3-5 score,
- Moderate anxiety scored 6-7,
- Moderate-high anxiety take score 8-9&
- 10 for highest level of anxiety.

Method

The study was accomplished through the following steps:

1- **Administrative process:** An official permission for data collection was obtained from the Dean of the Faculty of Nursing, and the directors of Pediatric Endocrinology Unit of Tanta Main University Hospital in order to obtain their approval and cooperation for carrying out this study.

2- **Ethical and legal considerations**: Ethical approval to conduct the study was taken from scientific research ethical committee at the Faculty of Nursing at 20 October 2021 and Faculty of Medicine scientific research ethical committee Code No. (34966/10/21).

Nature of the study didn't cause any harm or pain to the entire sample. Confidentiality and privacy regarding the data collection were taken into consideration.

Consent to participate in the study was taken from the children's mothers after explaining the aim of the study and the participants had the right to withdraw from the study at any time. They are informed that withdrawal from the study will not affect the care demonstrated to their children.

3- Tools Development: Three tools were used for data collection**.**

Tool I: was developed by the researcher. It consisted of two parts. Tool (II) FLACC Pain Scale and Tool (III) Visual Facial Anxiety Scale were used to assess children's pain and anxiety level before, during and after intervention.

4-Content validity: The tools of the study were presented to a jury of five experts in the field of Pediatric Nursing to check content validity and clarity of the tools. Modifications were carried out accordingly.

5- Reliability of tools:

Test of reliability using Cranach's alpha was 0.975 that indicates high reliability of the tools used for data collection in the current study.

6- Pilot study:

A pilot study was carried out on (10%) of the studied children to test the tool for its clarity, applicability and feasibility. Pilot study was excluded from the total sample of the study because some modification was done in tool (I).

Phases of the study:

The study was conducted through four phases:

1- **Assessment Phase:** It was carried out by the researcher to collect baseline data, and to assess children who met the criteria. Then, the researcher began to explain the aim of the study to the children's mother to gain their cooperation**.**

2- **Planning Phase:** as follow:

- Children who included in the current study were coded.
- Preparing the environment, needed equipment and children.

3- Implementation Phase:

Socio-demographic and medical data of the selected children were collected using tool (I). The researcher met every child in the presence of his/her mother in the endocrinology unit. The researcher attended the hospital and applies the procedure for 3 consecutive days where as administrating insulin therapy took place in the early morning before breakfast, before lunch, before dinner and Lantus dose which used before sleep.

The researcher uses simple random technique to classify children into groups. The children's identification code / hospital number was written on a slip of a paper, it was tucked and placed in a container, mixed well then randomly pick a subject of the children. Finally draw one at a time till got the desired sample size. The researcher started to implement the study, with shot blocker group, then, the buzzy bee group and finally, the control group who received routine hospital care. The researcher uses Tool I, II & Tool III to collect data from the three groups.

Group (1) Shot blocker group:

The researcher wiped shot blocker with 70% alcohol before used, selected suitable injection site. Then applied the shot blocker to press firmly with its multiple blunt skin contact points and produced its necessary sensation. After that giving insulin injection through the central opening. The researcher assessed the child's pain intensity and anxiety level before, during and after insulin injection by using FLACC scale and VFAS Scale. This step took about 5minutes.

Group (2) Buzzy bee group:

The researcher freezes the ice wings for 10 minutes before starting the procedure, wiped the buzzy with 70% alcohol before used, connected the ice wings with the buzzy vibration. Then placed buzzy on the site of the injection for 30-60 seconds to provide the cryotherapy effect through cold gel packages. Move the buzzy up 2-5 cm from the injection site and secured there during procedure. The researcher assessed the child's pain intensity and anxiety level before, during and after insulin injection by using FLACC scale and VFAS Scale. This step took about 5minutes.

Group (3) control group:

The researcher collected the data from the control group who didn't receive any intervention except the routine care. The researcher assessed the child's pain intensity and anxiety level before, during and after insulin injection using FLACC scale and VFAS Scale. This step took about 5minutes.

4- Evaluation phase:

Data collection lasted about six months from January 2022 to June 2022. Evaluation of the children's level of pain and anxiety were done before, during and after administration of insulin injection using tool II, III in all shot blocker, buzzy bee and control groups.

Statistical analysis:

The collected data were organized, tabulated and statistically analyzed using SPSS software. For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, Chi-square test (χ^2), F value of ANOVA test, t-test was used. Correlation between variables was evaluated using Pearson's correlation coefficient (r). Significance was adopted at $P < 0.05$ and highly significance was adopted at $P < 0.01$.[24]

Results

Figure (1) shows percentage distribution of the Buzzy bee group according to their age

Show that, it was clear that, nearly equal percent (33.4%, 33.3% & 33.3%) of the children were between 5-6 years, 3-4 years and 4-5 years respectively

As regards **figure (2)** it was clear that 40% of the children in the shot blocker group aged between 3-4 years as compared to 30% of them whose age between 4-5 years and 5-6 years.

Percentage distribution of the control group according to age was illustrated in **figure (3)**. It was evident that 40 % of the children in this group aged between 4-5 year as compared to 36.7% who were 3-4 years and 23.3% who aged between 5-6 years.

In relation to gender, **(Figure 4):** Clears that most of studied groups were males with percentage of 56.7%, 60%, 60% in buzzy bee, shot blocker and control group respectively.

Regarding **Figure (5):** It was evident that, nearly equal percentage of 80%, 83.3% of the buzzy bee and shot blocker respectively was admitted because of hyperglycemia, compared to 90% of the control group. Children admitted because of hypo glycaemia were 20% of the buzzy bee, 16.7% of the shot blocker & 10% of the control group.

Children commitment to daily insulin injection before intervention was illustrated in **Table (1):** It was evident that, 66.7%, 50%, 76.7% of the buzzy bee, shot blocker and control group respectively had received 15-<30 units of insulin daily. Nearly equal percentage 86.7%, 86.7%, 80% of the buzzy bee, shot blocker and control group respectively used insulin syringe as a method of insulin injections. All the studied children 100% received insulin injections four times/ day. Before intervention, most of the children 83.3%, 86.7% and 93.3% of the buzzy bee, shot blocker and control group refused insulin injection because of pain. Fibrosis result from repeated injections was observed in 46.7% of the buzzy bee group, 43.3% of the shot blocker group and 40.0% of the control group. No statistically significant difference was observed between the studied groups before intervention.

Table (2): clarifies mean score of the studied children in all groups according to FLACC Pain Scale for 1st, 2nd and 3rd day. As regard, this table there were highly statistically significant differences regarding FLACC Pain Scale during and after injections in 1st, 2nd and 3rd day (P=0.0001). While high statistical significant difference was found only in the 3rd day before injection (P=0.0001).

Table (3): Shows mean scores of the studied children according to Visual Facial Anxiety Scale in the first, second and third days. It was evident that, highly statistical significant differences were found in the second and third days before, during and after injection (P value= 0.0001**). While, P value was (0.013) before injection in the second day. Highly statistical significant differences were also found within each group before, during and after injection in the three days (p value= 0.0001). It was clear that, the buzzy bee group generally had the least mean score of the three groups during the study days.

Table (4): illustrates correlation between level of pain and level of anxiety for the studied groups in the study days It was clear that, there were statistical positive correlations between level of pain and level of anxiety before, during and after injections in the first, second and third day of the study. This mean that when the level of pain increases the anxiety level also, increase.

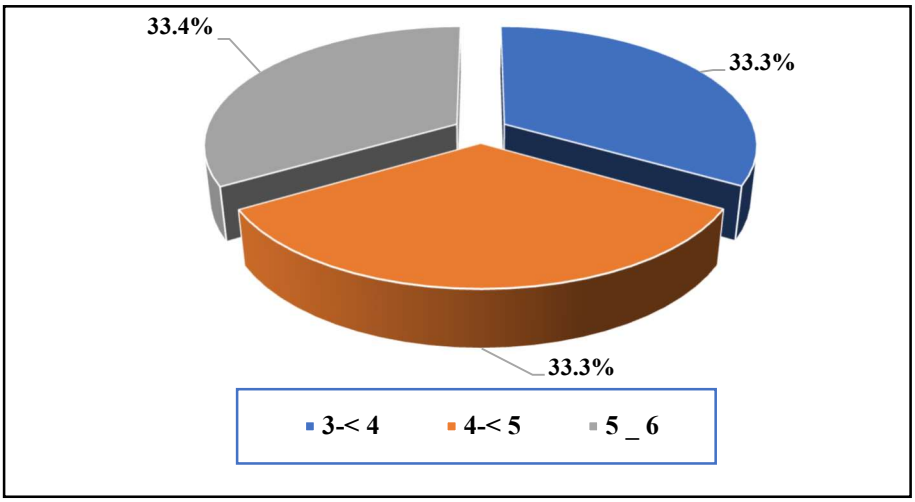

Figure (1): Age of children in the Buzzy bee group (n=30).

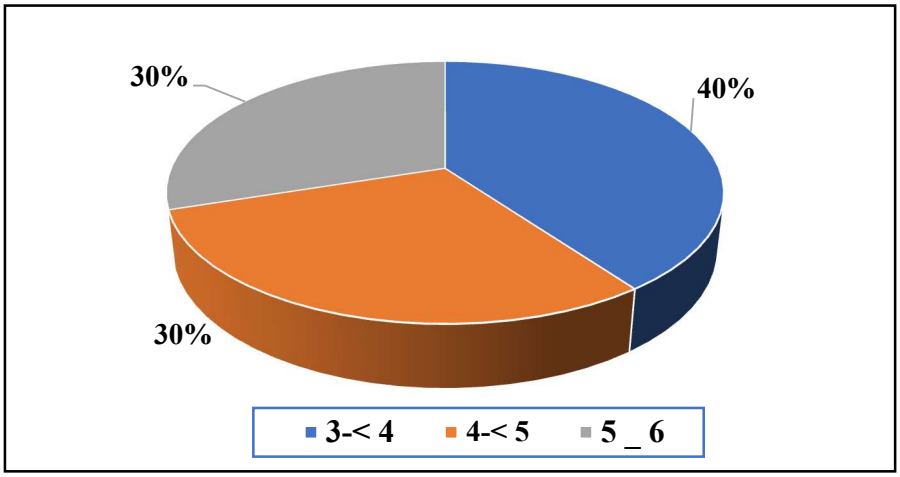

Figure (2): Age of children in the Shot blocker group (n=30).

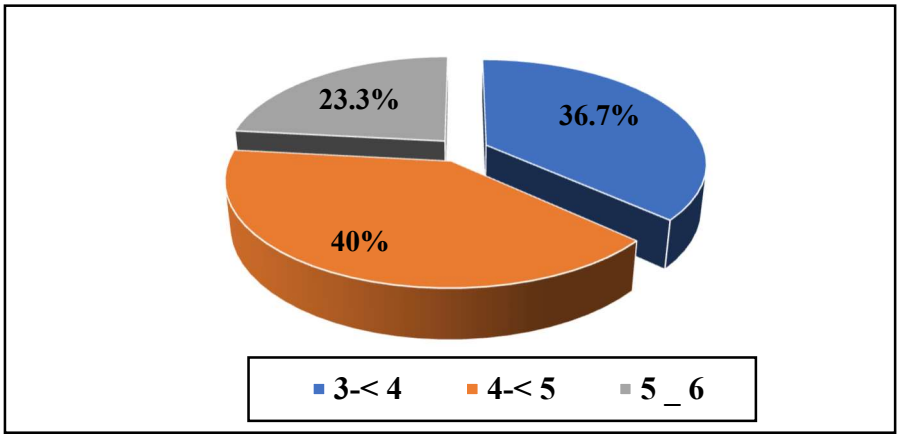

Figure (3): Age of children in the control group (n=30).

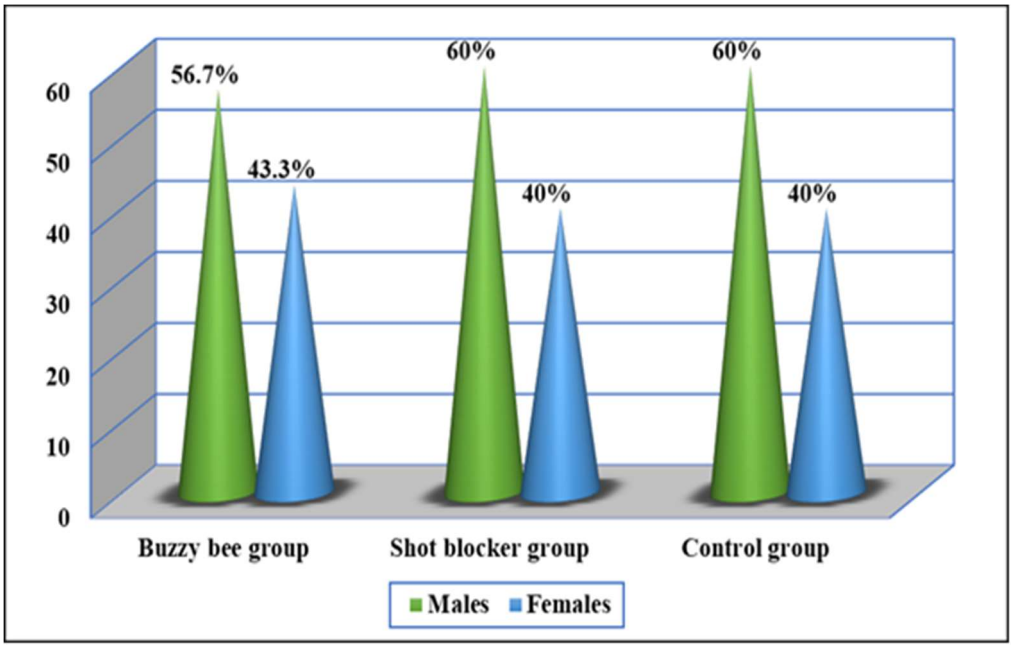

Figure (4): Distribution of the studied children according to their gender (n=90).

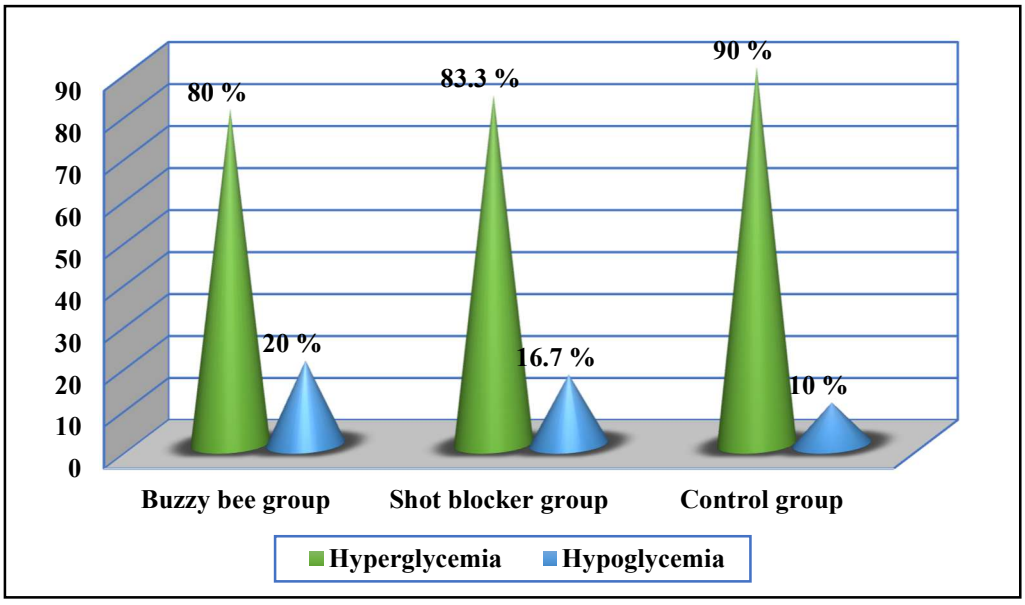

Figure (5): Distribution of the studied children according to reason of hospitalization.

Table (1): Percentage distribution of the studied children according to daily insulin commitment before intervention (n=90)

Variables	Group 1 (Buzzy bee group) (n=30)		Group 2 (Shot blocker group) (n=30)		Group 3 (Control group) (n=30)		χ^2 P
	No	%	No	%	No	%	
Daily insulin dose							
15 - < 30 units	20	66.7	15	50.0	23	76.7	4.752
30 – 45 units	10	33.3	15	50.0	7	23.3	0.093
Mean ± SD	28.66 ± 4.53		29.20 ± 5.74		27.40 ± 5.19		0.398
Method of insulin injection							
Insulin syringe.	26	86.7	26	86.7	24	80.0	0.677
Insulin pen.	4	13.3	4	13.3	6	20.0	0.713
Frequency of insulin injections							
Four times.	30	100.0	30	100.0	30	100.0	--
Missed insulin doses for a child							
No missed	3	10.0	5	16.7	3	10.0	
One time	11	36.7	9	30.0	10	33.3	6.835
Two times.	9	30.0	9	30.0	13	43.3	0.555
Three times.	7	23.3	5	16.7	4	13.3	
Four times.	0	0.0	2	6.6	0	0.0	
Reasons for refusing to take insulin injections #							
No reason	0	0.0	0	0.0	1	3.3	
Repeated injections / day.	10	33.3	14	53.3	12	40.0	2.271
Pain .	25	83.3	26	86.7	28	93.3	0.893
Anxiety.	12	40.0	13	43.3	14	46.7	
Assessment of the insulin injection site #							
No thing	7	23.3	11	36.7	12	40.0	
Presence of infection.	9	30.0	4	13.3	5	16.7	4.673
Fibrosis result from repeated injection.	14	46.7	13	43.3	12	40.0	0.580
Poor blood circulation at the injection site.	4	13.3	6	20.0	7	23.3	

 # More than one answer

Table (2): Mean score of the studied children in all groups according to FLACC Pain Scale in the first, second and third day (n=90)

FLACC Pain Scale	The studied children (n=90)			
	Group 1 (Buzzy bee group)	Group 2 (Shot blocker group)	Group 3 (Control group)	F value P
	Mean ± SD	Mean ± SD	Mean ± SD	
First day				
Before injection	2.60 ± 0.621	2.60 ± 0.770	2.66 ± 0.711	0.090 0.914
During injection	3.60 ± 1.037	6.53 ± 2.43	6.63 ± 2.44	**20.631 0.0001****
After injection	1.56 ± 0.727	2.36 ± 0.764	2.63 ± 1.722	**10.142 0.0001****
Second day				
Before injection	2.20 ± 0.805	2.56 ± 0.773	2.66 ± 0.711	3.100 0.050
During injection	2.53 ± 0.860	6.40 ± 2.49	6.63 ± 2.44	**36.844 0.0001****
After injection	1.40 ± 0.621	2.10 ± 0.758	2.56 ± 1.104	**14.225 0.0001****
Third day				
Before injection	1.63 ± 0.614	2.40 ± 0.813	2.66 ± 0.711	**16.753 0.0001****
During injection	1.63 ± 0.889	5.46 ± 2.58	6.56 ± 2.48	**44.228 0.0001****
After injection	1.13 ± 0.345	1.76 ± 0.678	2.53 ± 1.00	**27.706 0.0001****

***Statistically significant difference at (P<0.05).**
**** Highly Statistically significant difference at (P<0.01).**

Table (3): Mean scores of the studied children according to Visual Facial Anxiety Scale in the first, second and third days (n=90)

Visual Facial Anxiety Scale	The studied children (n=90)			
	Group 1 (Buzzy bee group) (n=30)	Group 2 (Shot blocker group) (n=30)	Group 3 (Control group) (n=30)	F- value (Between groups) P
	Mean ± SD	Mean ± SD	Mean ± SD	
First day				
Before injection	4.100 ± 1.32	4.200 ± 1.44	4.93 ± 1.87	2.533 0.085
During injection	5.50 ± 1.92	7.16 ± 2.46	7.83 ± 2.35	**8.494** **0.0001****
After injection	2.23 ± 1.27	2.86 ± 1.22	4.76 ± 1.59	**9.437** **0.0001****
F- value (each group) **P**	**34.102** **0.0001****	**45.091** **0.0001****	**34.122** **0.0001****	
Second day				
Before injection	3.63 ± 1.44	4.200 ± 1.44	4.90 ± 1.91	**4.599** **0.013***
During injection	4.53 ± 1.67	7.16 ± 2.46	7.63 ± 2.44	**16.934** **0.0001****
After injection	2.00 ± 1.05	2.83 ± 1.20	3.53 ± 1.45	**11.339** **0.0001****
F- value (each group) **P**	**24.677** **0.0001****	**45.890** **0.0001****	**33.344** **0.0001****	
Third day				
Before injection	2.90 ± 1.25	4.200 ± 1.44	4.66 ± 1.91	**10.120** **0.0001****
During injection	3.96 ± 1.51	7.16 ± 2.46	7.10 ± 2.44	**20.987** **0.0001****
During injection	1.73 ± 0.87	2.83 ± 1.20	3.16 ± 1.44	**11.823** **0.0001****
F- value (each group) **P**	**23.679** **0.0001****	**45.890** **0.0001****	**30.290** **0.0001****	

*** Statistically significant difference at (P<0.05)**

**** Highly Statistically significant difference at (P<0.01)**

Table (4): Correlation between level of pain and level of anxiety for the studied groups in the study days (n=90)

Variables	Pain level					
	Group 1 (Buzzy bee group) (n=30)		Group 2 (Shot blocker group) (n=30)		Group 3 (Control group) (n=30)	
	r	P	r	P	r	P
Anxiety level						
First day						
Before injection	0.596	0.001**	0.769	0.0001**	0.737	0.0001**
During injection	0.587	0.001**	0.957	0.0001**	0.967	0.0001**
After injection	0.891	0.0001**	0.781	0.0001**	0.786	0.0001**
Second day						
Before injection	0.803	0.0001**	0.806	0.0001**	0.737	0.0001**
During injection	0.800	0.0001**	0.957	0.0001**	0.967	0.0001**
After injection	0.845	0.0001**	0.543	0.002**	0.773	0.0001**
Third day						
Before injection	0.731	0.0001**	0.751	0.0001**	0.737	0.0001**
During injection	0.603	0.0001**	0.922	0.0001**	0.957	0.0001**
After injection	0.812	0.0001**	0.570	0.001**	0.813	0.0001**

**** Highly Statistically significant difference at (P<0.01)**

Discussion

Insulin therapy is an inevitable element for diabetic children receiving for maintenance their blood glucose within normal level. They experienced pain during insulin injection. Inadequate relief of pain during such distressing procedures may permanently decrease pain tolerance and increase pain responses. The use of non-pharmacological measures has increased to reduce pain. [25,26]

The non-pharmacological measures such as shot blocker and buzzy bee are safer than pharmacological measures and have fewer or no side effects. Shot blocker includes a number of short, blunt skin contact points on its underside and a centrally located opening through which injections are administered. [26,27] Buzzy bee includes a small vibrating bee with blue ice-pack wings. Which confuse the nerves by a combination of the cooling sensation and vibrations. It also provides distraction to children during insulin injection. [28] Regarding the onset of diabetes of the studied group, it observed that, the majority of the studied children their age was between 4-6 years, may be

due to the residual amount of insulin in the pancreas among the first year of the child's life so that no symptoms appear on the child during the first year. These results supported with **Elsamahy et al (2017)** [29] who studied long-term prognosis of type 1 diabetes in relation to the clinical characteristics at the onset of diabetes and his study revealed that, the majority of the studied children their age ranged between 2-8 years when have the diabetes. This finding also, agreed with the study conducted by **Thomas et al (2018)** [30] who conducted a cross-sectional, genetically stratified survival analysis from UK Biobank about frequency and phenotype of type 1 diabetes in the first six decades of life. and stated that, the majority of the studied children their age less than 10 years old when have the diabetes.

The present study illustrated that; more than three quarters of the studied children were admitted because of hyper glycaemia this may be due to missed doses of insulin injection as a result of recurrent pain from insulin injection. **Angus et al (2007)** [31] who conducted a systematic review about hospital admission patterns subsequent to diagnosis of type 1 diabetes in children, was in harmony with the finding of the current study and revealed that, the majority of children admitted to hospital due to hyperglycemia.

Mejia-Otero et al (2020) [32] was also, in the same line with the present study as they studied, risk factors for hospitalization in youth with type 1 diabetes and found that, the majority of children admitted to hospital due to hyperglycemia and diabetic ketoacidosis. The finding of the study wasn't in line with **Jane et al (2018)** [33] who studied type 1 diabetes in children and adolescents and found that, the majority of children admitted to hospital due to hypoglycemia.

As regard, symptoms of hyperglycemia on admission. The current study showed that, the majority of studied children have poly urea. This finding may be explained the high level of glucose in the blood exceed the body kidney threshold and make effort for kidney to remove it via urination, so that, kidney filtering out more water which lead to increase urination or poly urea. This finding was in the same line with **Mokashi et al (2018)** [34] who studied, when you suspect diabetes in a child and found that, the majority of studied children have poly urea and other symptoms of diabetic ketoacidosis as coma with acetone smell. While **Pasi et al (2018)**[35] who studied type 1 diabetes mellitus in pediatric age group: A rising endemic and his study revealed that,nearly half of studied children have poly urea.

Regarding, symptoms of hypoglycemia on admission, all the studied children have loss of consciousness, this finding may be explained as missed meals and hyper activity of children while, taking the insulin dose may lead to hypoglycemia and loss of consciousness, it causes the glucose burn and symptoms of hypoglycemia appear as loss of consciousness. **Alkhatatbeh etal (2019)** [36] who studied about impaired awareness of hypoglycemia in children and adolescents with type 1 diabetes mellitus in north of Jordan. wasn't in harmony with this finding of the current study as he revealed only frequent symptom of hunger was significantly more prevalent in children than in adolescents.

The present study illustrated that, the majority of the studied children monitor their blood glucose level before meals, these results may be due to the necessity to

adjust the amount of insulin dose to control their blood glucose level. **Marks et al (2020)** [37] who studied monitoring of pediatric type 1 diabetes was in harmony with the finding of the present study, as he founded that, the most common time for monitoring blood glucose level is before meals.

As regard method of insulin injection, the present study illustrated that, the majority of the studied children used insulin syringes this may be due to the insulin pump or pen aren't available for all diabetic children or may cause financial load for parents. This finding wasn't in harmony with **Zuberi et al (2020)** [38] who studied insulin-delivery methods for children and adolescents with type 1 diabetes and his study revealed that, the diabetic alternate delivery method for children and adolescents is insulin pens.

Concerning to frequency of insulin injections, the current study revealed that, all the studied children taken insulin injection four times per day. This may be the treatment plan that is directed toward control the blood glucose level and prevent hyperglycemia and complication. **Buckingham et al (2017)** [39] supported the finding of the current study as he studied continuous glucose monitoring in children with type1 diabetes and revealed that, the majority of diabetic children taken insulin injection four times per day.

As regard reasons for rejection of insulin injections, the current study revealed that, one third of the buzzy bee group, about half of the shot blocker group and two fifth of the control group refuses insulin injection due to repeated insulin injections/day. This finding can be explained as frequent insulin injection four times/day cause pain and anxiety and resulted in missed insulin doses. **Hanson et al (2014)** [40] who studied painful fat necrosis resulting from insulin injections, was in consistent with the findings of the current study as his study revealed that, the main cause of refusing the insulin injection is pain of frequent insulin injections.

In addition, the present study revealed that, the frequent injection cause fibrosis. This finding may due to repeated insulin injections and the injection site doesn't change continuously. **Malik et al (2014)** [41] who studied insulin therapy in children and adolescents with type 1 diabetes and was in the same line with the current results as he founded that, fibrosis is most common complication from frequent insulin injection without changed the site frequently.

As regard mean score of the studied children in all groups according to FLACC Pain Scale throughout the study days. The current study revealed that, there were highly statistical significant differences regarding FLACC Pain Scale during and after injections. **Sahiner et al (2018)** [42] was in the same line with these findings, his study compared the effect of Shot Blocker and the combination of vibration and cold application (Buzzy) in reducing pain during insulin administration in children, and founded that, the buzzy bee method is more effective than shot blocker in in reducing pain for children under going to insulin injection.

As regard mean score of the studied children in all groups according to Visual Facial Anxiety Scale. The current study revealed that, highly statistical significant differences were found within each group before, during and after injection in the three days. It was clear that, the buzzy bee group generally had the least mean anxiety

score of the three group during the study days. **Redfern et al (2018)** [43] & **Susam et al (2018)** [44] were in support with this finding, who studies conducted on children revealed that buzzy bee reduced the pain & anxiety during blood sampling, intravenous, and immunization injections.

The current study revealed that, there was positive correlation between level of pain and level of anxiety before, during and after injections in the 1st, 2nd and 3rd days of the study. This mean that when the level of pain increases the anxiety level also, increase. These results may due to frequent and prolonged exposure the children for insulin injection can cause pain which can change their mood and cause anxiety.

The current study finding was in agreement with **Michaelides etal (2019)** [45] who studied the association between acute pain, depression and anxiety, and proved that, extended acute pain duration increases depression and anxiety and linked to higher perception of pain severity. Also, **Hanberger et al (2021)** [46] who studied the needle related to pain, fear and anxiety in children and adolescent with type 1 diabetes, was in agreement with this findings. He stated that, children and adolescents who experience more pain during treatments using needles as insulin injection are less able to cope and need for additional support which necessary for pediatric diabetes teams to create pain management techniques.

Conclusion and Recommendations

Children with type 1 diabetes are exposed to frequent insulin injections for a lifelong and have to experience the same pain numerous times per day. This may prevent them from commitment to insulin therapy and skip dosing. So that, it is very important to reduce pain and anxiety during insulin injection to prevent further complications. Buzzy Bee and Shot Blocker are two non- pharmacological methods which may use during insulin injection to reduce its pain and anxiety, through distracting the brain temporary from pain, take the brain's focus away from the pain and the child may not even notice the injection.

Based on the findings of the current study, it can be concluded that:

- Both buzzy bee and shot blocker were effective on relieving pain and anxiety for children undergoing insulin therapy.
- Buzzy bee was more effective in relieving pain and decreasing the level of anxiety than shot blocker.

Recommendations:

The following recommendations are suggested:

1- Educational programs should be conducted for pediatric nurses about application of non-pharmacological techniques as shot blocker and buzzy bee to minimize procedures associated pain &anxiety.

2- Assessment of ain and anxiety level must be integrated into the routine assessment as vital signs when caring for children.

3- Replication of the study using a larger probability sample from different geographical areas, on various age groups.

References

1. The Facts, Stats, and Impacts of Diabetes. 2022. Available at https://www.cdc.gov/diabetes/library/spotlights/diabetes-facts-stats.
2. Roep O, Thomaidou S, Van Tienhoven R Zaldumbide A. Type 1 diabetes mellitus as a disease of β-cell Nature Reviews Endocrinology. 2021;17(3):150-61.
3. Williams R, Colagiuri S, Chan J, Edward W. IDF Atlas 9th ed. International Diabetes Federation. 2019; 87(4): 98-150.
4. El-Ziny M, Salem N, El-Hawary A, Chalaby N. Epidemiology of childhood type 1 diabetes mellitus in nile delta, northern egypt. Journal of Clinical Research in Pediatric Endocrinology. 2017; 6(1):9-15.
5. People Living with Diabetes .2019. Available at https://www.idf.org/e-library/welcome/copyright-permission.
6. Abd Elhameed Z, Ezz Eldene A, Abd El Hafeez H, Mohammed H, Abd El Salam A, Mokhtar A. Prevalence of zinc tansporter 8 auto antibodies among newly diagnosed type 1 diabetic cases admitted to assiut university children hospital. Egyptian Journal of Immunology. 2020;27(1): 29-36.
7. Mcmurtry M, Riddell R, Taddio A, Racine N. Far From "Just a Poke": Common painful needle procedures and the development of needle fear. Clinical journal of pain. 2015;31(1):377-80.
8. Chiang L, Maahs M, Garvey C, Hood K, Schatz D. Type 1 Diabetes in Children and adolescents: A position statement by the American Diabetes Association. Diabetes Care. 2018 ;41(9):26-44.
9. Bergomi P, Scudeller L, Pintaldi S, Dal Molin A. Efficacy of non-pharmacological methods of pain management of children undergoing venipuncture at Pediatric outpatient clinic. Journal Pediatric Nursing. 2018 ;42(1):66-72.
10. Margarete A and Barber N. Pediatric Primary Care. 5th ed., Philadelphia: Elsevier Co., 2013:190-98.
11. Stéphanie B, Nedjoua K, Maria V, Alexandra U, Emmanuelle R, Bruno P, Brigitte F, Etienne M. Cold Vibration (Buzzy) Versus Anesthetic Patch (EMLA) for pain prevention during cannulation in children. Pediatric Emergency Care. 2021; 37 (2): 86-91.
12. Semerci R, Kocaaslan N, Akgün Kostak M, Akın N. [Reduction of pain during intravenous cannulation in children: Buzzy application]. National Library of Medicine. 2020; 32(4):177-85.
13. Caglar S, Büyükyilmaz F, Cosansu G, Çaglayan S. Effectiveness of Shot Blocker for immunization pain in full-term neonates: a randomized controlled trial. The Journal of perinatal & neonatal nursing. 2017;31(2):166-71.
14. About Buzzy. 2019. Available at: https://buzzyhelps.com/pages/buzzy.
15. Crevatin G, Bertossa V, Rizzitelli G, Matassi P, Minute D, Egidio D. Distraction using Buzzy or handheld computers during venipuncture. Pediatric Emergency Care.2021;37(9):512-6.
16. Katia P, Joreta L, Delbosa P, Briend-Godeta V , Blanchib S. The effectiveness of the Buzzy device to reduce or prevent pain in children undergoing needle-related procedures. International Journal of Nursing Studies. 2021; 113(1): 103-803.

17. Clara S. Moving beyond pain as the fifth vital sign and patient satisfaction scores to improve pain care in the 21st century. Pain Management Nursing. 2018;19(2):125-9.
18. Frid A, Deeb A, Strauss W. Pediatric Insulin Injection Technique: A Multi-country survey andclinical practice implications. Diabetes Therapy. 2018;44(6):291-302.
19. Schreiber S, Cozzi G, Rutigliano R, Ballard A. Analgesia by cooling vibration during venipuncture in children with cognitive Impairment. Acta Paediatr 2020; 105: 12-6.
20. Yildirim D, Dinçer B. Shotblocker Use in Emergency Care: A randomized clinical trial. Advanced Emergency Nursing Journal . 2021 ;43(1):39-47.
21. Uman L, Chambers C, McGrath P, Christine T. A systematic review of randomized controlled trials examining psychological interventions for needle-related procedural pain and distress in children and adolescents: An abbreviated Cochrane review. Journal of Pediatric Psychology, 2019;33(8): 842– 54.
22. Merkel S, Voepel-Lewis T, Shayevitz R, Malviya S.The FLACC: A behavioural scale for scoring postoperative pain in young children. Pediatric nursing. 1997;23:293-797.
23. Luyk N, Beck F, Weaver J. A visual analogue scale in the assessment of dental anxiety. Anesth Prog. 1988;35(3):121-3.
24. White S E. Reading the medical literature: Basic & Clinical Biostatistics. 5th ed., Ch. New York.: Lange Medical Book/ McGraw Hill. Medical Publication Division Co., 3-10, 20 - 233, 2019.
25. Boom V, Karel K. Patterns of insulin therapy and insulin daily doses in children and adolescents with type 1 diabetes in Germany. Diabetes, Obesity and Metabolism. 2022; 24(2): 296-301.
26. Theign I, Shunn M. Virtual reality as a non-pharmacological adjunct to reduce the use of analgesics in hospitals. Journal of Cognitive Enhancement. 2022; 6(1): 108-13.
27. Gurda P, Züleyh A, Zeliha C. Comparison of cold spray and shotblocker to reduce intramuscular injection pain: A randomized controlled trial. Journal of Clinical Pharmacy and Therapeutics. 2022;4(1):233-40.
28. Cho A, Yen-Hua C. The Effectiveness of the Buzzy Device for Pain Relief in Children During Intravenous Injection: Quasirandomized Study. JMIR Pediatrics and Parenting. 2022; 5(2): 157-58.
29. Elsamahy M, Elhenawy Y, Altayeb N. Long-term prognosis of type 1 diabetes in relation to the clinical characteristics at the onset of diabetes. Egyptian Pediatric Association Gazette.2017;65(3):90-4.
30. Thomas N, Jones S, Weedon M, Shields B, Oram R, Hattersley A. Frequency and phenotype of type 1 diabetes in the first six decades of life. a cross-sectional, genetically stratified survival analysis from UK Biobank. Lancet Diabetes Endocrinology. 2018;6(2):122-9.
31. Angus C, Waugh N. Hospital admission patterns subsequent to diagnosis of type 1 diabetes in children: a systematic review. BMC Health Serv Res. 2007 ;7(5):199-205.

32. Mejia-Otero D, Adhikari S, White C. Risk factors for hospitalization in youth with type 1 diabetes: Development and validation of a multivariable prediction model. Pediatric Diabetes. 2020;21(7):1268-76.
33. Jane L, David M, Katharine C, Korey K. Type 1 Diabetes in Children and Adolescents: A Position Statement by the American Diabetes Association. Diabetes Care. 2018; 41(9): 2026–44.
34. Mokashi A, Young M. When you suspect diabetes in a child. Can Fam Physician. 2018 ;64(1):32-5.
35. Pasi R, Ravi S. Type 1 diabetes mellitus in pediatric age group: A rising endemic. J Family Med Prim Care. 2022;11(1):27-31.
36. Alkhatatbeh M, Abdalqader N , Alqudah M. Impaired awareness of hypoglycemia in children and adolescents with type 1 diabetes mellitus in north of Jordan. BMC Endocrine Disorders. 2019;107(19):244-8.
37. Marks E, Wolfsdorf I. Monitoring of Pediatric Type 1 Diabetes. Front Endocrinology. 2020; 17(11):121-8.
38. Zuberi Z, Sauli E, Cun L, Deng J. Insulin-delivery methods for children and adolescents with type 1 diabetes. Ther Adv Endocrinol Metab.2020;11(1):203-9.
39. Buckingham B, Beck W, Tamborlane V, Xing, D, Mauras N. Continuous glucose monitoring in children with type 1 diabetes. The Journal of pediatrics. 2017;151(4):388–93.
40. Hanson P, Pandit M, Menon V, Roberts S, Barber M. Painful fat necrosis resulting from insulin injections. Endocrinology Diabetes Metab Case Rep. 2014;14(1): 73-8.
41. Malik F, Taplin C. Insulin therapy in children and adolescents with type 1 diabetes. Pediatric Drugs. 2014;11(1):220-8.
42. Sahiner N, Turkmen A, Acikgoz A, Simsek E, Kirel B. Effectiveness of Two Different Methods for Pain Reduction During Insulin Injection in Children With Type 1 Diabetes: Buzzy and ShotBlocker Worldviews on Evidence-Based Nursing. Sigma Theta Tau International. 2018; 15(6):464–70.
43. Redfern E, Chen T, Sibrel S. Effects of thermomechanical stimulation during vaccination on anxiety, pain, and satis-faction in pediatric patients: A Rndomized Controlled Trial. 2018;38(1):1-7.
44. Susam V, Friedel M, Basile P, Ferri P, Bonetti L. Efficacy of the Buzzy System for pain & anxiety relief during venipuncture in children: A randomized controlled trial. Acta Biomed for Health Professions. 2018;89(6):6-16.
45. Michaelides A ,Zis P. Depression, anxiety and acute pain: links and management challenges. Postgard Med. 2019;131(7):438-44.
46. Hanberger P , Tallqvist E , Richert A, Olinder A, Forsner M. Needle-related pain, affective reactions, fear, and emotional coping in children and adolescents with type 1 diabetes: A cross-sectional study. Pain Management Nursing.2021;22(4):516-21.