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Effect of Breast Feeding vs Oral Sucrose on Pain Relief during Vaccine Intramuscular Injection among Infants

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Abstract Currently, vaccine injections are considered to be the most common source of iatrogenic pain in childhood. They are repeatedly administered to almost all children throughout infancy, childhood and adolescence. Vaccine injections cause pain, anxiety and fear in paediatric patients. Hatfield et al cited that oral sucrose administration is an effective and easy method with short-term effect during the routine immunization process. Osianaike et al also observed that breastfeeding has a soothing effect on infant during the venipuncture prick. The aim of this study is to investigate the effect of breast milk vs. oral sucrose on pain relieve during vaccine Intramuscular Injection among Infants. This study was be conducted in vaccination clinic/ unit in FAMCO & Al-Khobar hospitals at Saudi Arabia on 75 infants who were selected by simple randomization. Assessment Sheet for Infant Pain consisted of two parts: The first part included demographic data such as name, age & body weight of the infant. The second part included the Behavioral and facial expression pain scales (FLACC) that were used to assess in this study to assess the infants' intensity of pain during vaccine intramuscular injection.

Keywords: *breast milk, oral sucrose, vaccine, intramuscular injection, infants*

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1. Introduction

Vaccination is one of the most powerful and cost-effective of all health interventions. It prevents debilitating illness and disability, and saves millions of lives every year. The contribution of immunization is especially critical to achieving the goal to reduce deaths among infants. Vaccines have the power not only to save, but also to transform, lives giving infants a chance to grow up healthy, go to school, and improve their life prospects and play a major role for child survival. [1,2,3]

Vaccination aims to protect children and all community groups from diseases targeted by immunization, keep the community free of polio, as well as getting rid of measles, diphtheria rubella, mumps, in addition to reducing the infection with any of these diseases targeted by immunization. [4,5]

Infants undergo several vaccinations in their first year of life. It is the most common painful medical procedure in healthy infants. The world Health Organization estimates that 12 billion injections are given annually and that 5% are vaccinations for infants. Routine immunization causes a significant burden of pain and distress for healthy infants and their families. It has been reported that young children have a pain memory, causing them to anticipate painful procedures and to react more intensely if they have undergone previous painful procedures with inadequate analgesia. [6,7,8,9]

Pain can cause short- and long-term effects in infants. Generally, vaccination complications include an increase in secretion of hormones and substances, experience of a painful event, pain sensitivity, and lower pain threshold, increased behavioral and physiologic responses to pain, increased neural disorders, psychosocial problems, learning disorders, poor adaptive behaviour, future fear of injection, and long-term complications in brain development. [10,11]

It was believed in the past that neonates and infants did not feel any pain, while numerous studies showed that they feel more pain compared to children and adults. Researchers believe that human beings are able to feel pain physiologically and anatomically even in the fetal period, and infants, contrary to the adults. Remember that the pain of painful events manifests a more acute reaction to next vaccinations. [12,13]

Infants have limited means to cope with pain because they "cannot rub a painful area and stimulate non-nociceptive touch fibers that would block the pain sensation, nor can they distract themselves through visualization." However, there are no current systemic pharmacological treatments that are appropriate to provide pain relief during minor procedures, such as immunizations, in this age group. [14,15]

As vaccination is essential for promotion of children's health, the infants have to experience pain in their very early life and inevitably face painful procedure of vaccination which causes them unpleasant mental and psychological effects. Although pain transmission

pathways have been thoroughly developed during infancy, pain inhibiting systems do not have adequate growth. On the other hand, limited cognitive abilities, lack of verbal and psychological skills, and constant changes occurring in infants are among the major challenges at this period of life. Therefore, evaluation and reduction of vaccination pain among infants are of great importance. [16,17]

Although, it is widely recognized that vaccine injections are distressing for children, their families, and the participating health care professionals, little attention has been given to minimizing the pain associated with these procedures. Due to numerous complications of pain and lack of studies of pain relief among infants during vaccination, this study was conducted to find out the effect of breastfeeding and oral sucrose as pain relief methods during vaccine intramuscular injection among Infants. [18,19]

1.1. Vaccine & Vaccination

Vaccination is the administration of a vaccine to stimulate a protective immune response that will prevent disease in the vaccinated person if contact with the corresponding infectious agent occurs subsequently. Thus vaccination, if successful, results in immunization: the vaccinated person has been immunized. Vaccination is a highly effective method of preventing certain infectious diseases. For the individual, and for society in terms of public health, prevention is better and more cost-effective than cure. Vaccines have one of the greatest impacts on public health. Their impact on reducing human mortality is second only to the provision of safe drinking water. [20,21]

Vaccines are always formulated so as to be both safe and immunogenic when injected into infants. Many inactivated vaccines contain an adjuvant, which is a vaccine component that enhances the immune response to the antigen. Adjuvants can cause an exaggerated local reaction (e.g., pain, swelling, redness). All inactivated vaccines, are administered by the intramuscular route. There are only two routinely recommended IM sites for administration of vaccines, the vastus lateralis muscle (anterolateral thigh) and the deltoid muscle (upper arm). A 1-inch needle is required to ensure intramuscular administration in infants aged 1 month and older. For the majority of infants, a 1-inch, 22-25-gauge needle is sufficient to penetrate muscle in an infant's thigh. Intramuscular injections are administered into muscle tissue below the dermis and subcutaneous tissue. [22,23,24,25]

Vaccine injections cause acute pain through activation of peripheral nociceptors during 2 separate events: (1) when the needle punctures the skin and tissues; and (2) when the vaccine constituents are deposited into the tissue. The pain associated with these injections is a source of great anxiety and distress for many. [26,27]

1.2. Infants' Pain

Pain is defined by the International Association for the Study of Pain (IASP) as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage". Margo McCaffery developed the well-known definition of pain as "whatever the person experiencing the pain says it is, existing whenever the person says it does". Both of these definitions imply that there is a subjective component to pain; however, infant lack the capacity to self-report their pain verbally and therefore challenge both of these definitions. The ISAP and McCaffery have added to their definitions of pain which includes "the inability to communicate in no way negates the possibility that an individual is experiencing pain and is in need of appropriate pain-relieving treatment". Therefore, health care providers must be able to accurately assess pain in those who rely on others to manage their pain in the absence of a self-report. [28,29,30,31]

The importance of pain avoidance in the delivery of health care is recognized in the medical principle to "first do no harm." Pain relief is considered a basic human right and reducing iatrogenic pain in infant is a priority identified by health care agencies, researchers, and parents. [32,33,34,35,36]

Recently, it was believed that young infants and newborns were not able to feel the pain due to lack of evolution in the central nervous system. But, nowadays, it is recognized that physiological, anatomical and nervous-chemical structures which lead the pain, have been well evolved several weeks before the birth. However, immaturity of the pain system, which includes the presence of larger receptive fields and lack of inhibitory controls of pain, may lead infants to have greater responses from the same sensory input compared with adults. [37-41]

Pain is a perception that is often overlooked in the infant population, especially with regard to immunizations. Evidence has shown that infants do perceive and remember pain, demonstrating heightened pain responses to other painful procedures later in life. Pain is associated with physiological, biochemical, behavioural, and psychological alterations that can be recorded and to some extent, quantified. Untreated pain early in life may cause harmful effect in developing central nerve system and also, it might exaggerate affective and behavioural response during immunization. [6,42,43,44]

1.3. Physiological Process of Pain in Infants

Pain is an important protective mechanism that alerts individuals of actual or potential harmful events. The first step in the physiological mechanism of pain is transduction. Transduction occurs when free nerve endings, or nociceptors, are stimulated or damaged in the peripheral nervous system. During the next step, transmission of pain occurs from the site of the stimuli to the spinal cord. The individual then perceives the character, intensity, and meaning of pain as the process continues from the spinal cord to the brain. This step is called perception and occurs in the thalamus and sensory cortex of the brain. The final step is modulation. Modulation allows many factors to influence pain by either heightening or dampening its intensity. When body tissues are damaged, the body releases many chemicals at the site of injury (i.e., prostaglandins, serotonin, norepinephrine, potassium, and iron). These chemicals trigger the nociceptors and the sympathetic (fight or flight)

response is activated. The fight or flight response is a life-sustaining protective mechanism but when prolonged, can lead to many harmful effects on the body. Stress hormones such as epinephrine, norepinephrine, glucagon, cortisol, aldosterone, thyroid stimulating hormone, and growth hormone are all released in response to sympathetic stimulation. These hormones lead to the breakdown of body tissues, water retention, elevated blood glucose with reduction in glucose utilization, increase in metabolic rate, and impairment of immune function. This causes the initial injury to be exacerbated, wound healing to be delayed, an increase in the risk for infection and overall increase in morbidity. [42,45,46]

Infant's response to pain compared to the response of adults is considered to be more exaggerated. Pain stimuli generate short and long term effects on infant. [47,48]

1.3.1. Short-term Effect of Pain

Short term effect of pain are consisting of physiological changes (Heart rate, Blood pressure, Respiratory rate, Oxygen consumption, Mean airway pressure, Muscle tone, Intracranial pressure); behavioural changes (Grimacing, Screwing up of eyes, Nasal flaring, Deep nasolabial groove, Curving of the tongue, Quivering of the chin); biochemical changes (Cortisol, Catecholamines, Glucagon, Growth hormone, Renin, Aldosterone, Antidiuretic hormone); Autonomic changes (Mydriasis, Sweating, Flushing, Pallor). [35,49]

1.3.2. Long-term Effect of Pain

There are many documented adverse effects of untreated procedural pain in childhood. These include: anticipatory fear at future procedures due to negative memories of past procedures, sensitization to future pain due to changes in how the nervous system processes pain, reduced effectiveness of analgesics, difficulty carrying out procedures, and needle phobia. [50,51]

The amount of distress a infant experiences during a procedure is particularly important for how the infant remembers the event. Greater distress is associated with more negative memories, which lead to more reports and displays of pain and distress at future. [52,53,54]

A lack of verbal report of pain or overt distress during immunization does not imply a lack of physiologic consequences or distorted negative recall of the pain experienced. Studies have reported that painful events in the infant period can lead to changes in future pain responses. [55,56,57]

Needle phobia is a widely publicized adverse consequence of untreated needle pain. Needle phobia usually develops in childhood, after a negative experience at the immunization clinic. The fear may also become generalized to individuals, objects, and situations related to needles, such as doctors, nurses, syringes, white laboratory coats, and examination rooms. [26]

The consequences of needle fears are considerable. For example, children with needle fears and their parents avoid seeking medical care. As adults, these children decline dental treatments, avoid regular health care visits, and are non-adherent to preventive health care measures (eg, vaccination, blood donation) and medical treatment regimens (eg, insulin injections for diabetes). Thus, individuals with needle fears are assuming higher risks than the general public for morbidity and mortality. [58,59]

Infants' pain has two important deleterious consequences. The first is the mistrust and fear towards the caregiver, generated by failure to prevent or relieve pain. Secondly, inadequate analgesia for initial procedures can decrease the effect of adequate analgesic doses in subsequent procedures. [35]

1.4. Assessment of Pain in Infants

Pain assessment is an important part of pain management. To adequately assess a infant's response to treatment, it is necessary to have ongoing assessment of the infants' pain. Because pain is a subjective experience, individual self-reporting is the preferred method for assessing pain. However, infants cannot communicate this information due to age or developmental status, observational and behavioural assessment tools are acceptable alternatives when valid self-report is not available. [60]

For young infants, there are two pain assessment tools commonly used. One scale is the Premature Infants' Pain Profile (PIPP), which consists of 3 behavioural (facial actions: brow bulge, eye squeeze and nasolabial furrow) and physiological (heart rate and oxygen saturation) indicators, and contextual (gestational age and behavioural state) variables that modify pain. PIPP was developed 13 years ago and continues to be a reliable and valid measure of acute pain in infants. The other scale is the Face, Legs, Activity, Cry and Consolability (FLACC) scale, which incorporates 5 pain behaviours that make up the scale's name: facial expression, leg movement, activity, cry and consolability. Each behaviour is scored from 0 to 2, with the highest possible cumulative score being 10 (most pain). [61,62,63]

1.5. Pain Management

Pain management is usually based on 4 P's (Pharmacological, Physical, Psychological, and Procedural) during Vaccine Injections. [64,65]

1.5.1. Pharmacological

Topical anaesthetics

Lidocaine-prilocaine cream (EMLA) is topical anaesthetics reduce pain associated with needle pro - cedures, including venipuncture and intravenous cannulation. Topical anaesthetics must be applied ahead of time, 20-60 minutes before the injection, depending on the commercial product being applied. [66]

EMLA cream has been found to provide a relief of pain and anesthetic effect for immunization. Several studies have evaluated the use of topical anaesthesia for immunization. Most studies have been conducted with a lidocaine-prilocaine cream. [67,68]

Oral Sucrose

Oral sweet-tasting solutions (with and without non-nutritive sucking) are analgesic for infants. The proposed mechanism of analgesia involves release of endogenous opioids and distraction. Sucrose solutions are inexpensive and simple to prepare. [69]

The optimal dose is unknown, but the most common dose is 2 mL of 24% strength (weight/volume). Up to 10

mL of the 24% strength solution has been studied. One approach to preparing a sucrose solution is to mix one packet or cube of sugar with 10 mL (two teaspoons) of water in a medicine cup. Alternatively, sucrose solutions can be obtained from some pharmacies. Place the dose in the infant's mouth using an oral syringe, medicine cup or pacifier a minute or two before the injection. [65,70]

1.5.2. Physical

Breastfeeding

Breastfeeding is the preferred method of feeding infants in the first year of life and has been shown to have analgesic effects. Breastfeeding is considered a combined analgesic intervention because several aspects of breastfeeding (e.g., holding the infant, skin-to-skin contact, the sweet-tasting milk and the act of sucking) may individually attenuate pain responses. [71,72]

Breastfeeding should be started before and should continue during and after the vaccine injections, for up to several minutes after the last injection is complete. An adequate latch must be established before the injection. This may take about one minute. Some infants may refuse to breastfeed, and some mothers may not wish to breastfeed during the vaccination. Offering breast milk or formula via a bottle should not be considered a substitute for breastfeeding as a method of reducing pain. [72]

Position of the infant

Infant may be vaccinated in various positions (lying supine, sitting upright or being held). However, parents instinctively pick up infant when attempting to comfort them. [73]

The optimal position during vaccination is unknown. Infants and children should be held by a parent in a position that is most comfortable for both of them (e.g., hold a baby in a bear hug, hold a infant on the parent's lap). One or more limbs must remain exposed for the vaccination provider. [74]

Skin cooling technique

Vapocoolants (skin refrigerants) contain chemicals that produce an instantaneous cooling effect upon contact with the skin. The coldness may, in turn, reduce the sensation of pain during the vaccine injections. Ice or cool/cold packs: Applying ice or cool/cold packs to the skin produces a cooling sensation that may reduce the sensation of pain during vaccine injections. For infant undergoing vaccination, there is insufficient evidence for or against the use of skin-cooling techniques (vapocoolants, ice, cool/cold packs) to reduce pain at the time of injection. [75,76]

1.5.3. Procedural

Intramuscular injection technique

Aspiration before intramuscular injection and slow injection of vaccines are long-standing practices that have never been subjected to scientific evaluation. Aspiration was initially proposed for safety reasons, to prevent penetration of blood vessels during the injection. Slow injection was recommended to minimize pain from sudden distension of the tissues. Together, aspiration and slow injection may actually add to the pain of vaccine injections because of longer contact time between the needle and the tissue and through lateral movement of the needle ("wiggle") within the tissue. At present, aspiration is not deemed necessary because the anatomic sites recommended for vaccination are devoid of large blood vessels. [64,77,78]

Order of Injection

At present, infants routinely receive two or more vaccine injections at each immunization visit. Because some vaccines cause more pain than others, and because the pain may increase with each subsequent injection, the order in which vaccines of differing degrees of "painfulness" are administered may influence the overall pain response. [64,79]

Tactile stimulation

Providing tactile stimulation is a cost-neutral intervention that may reduce the sensation of pain. The proposed mechanism of action involves the gate control theory of pain and the notion that the sensation of touch competes with the sensation of pain for transmission to the brain, thereby resulting in less pain. [80,81,82]

1.5.4. Psychological

Distraction

Distraction has been shown to reduce infants' pain and distress from medical procedures. Distraction is defined as the use of strategies to take an individual's attention away from the procedure. Distraction that is directed or facilitated by the clinician is referred to as clinician-led distraction. [83,84,85]

Breathing Technique

Breathing exercises make use of inexpensive and accessibleitems that can easily be made available in vaccination settings. Slow, deep breathing or blowing is facilitated by distracting toys and activities (e.g., bubbles, party blowers, pinwheels). The specific impact of each component (that is, slow deep breathing and distraction). [80]

Breastfeeding

As one of the most universal and natural facets of motherhood, the ability to breastfeed is a great gift. Breastfeeding helps mothers and infants bond, and it is vitally important to mothers' and infants' health. Breastfeeding is a human rights issue for both mother and infant. Infant have the right to the "highest attainable standard of health," which entails the right to be breastfed, and women have the right to breastfeed as related to self-determined reproductive rights. [86,87]

Breastfeeding is the preferred method of feeding infants in the first year of life and has been shown to have analgesic effects. Mothers' breastfeeding is a multisensory experience that employs several concurrent sedation techniques such as mother-infant skin touch infant distraction as a result of sucking, and the feeling security for the infant. Mother's milk contains carbohydrate and precursors of melatonin (B endorphins release stimulators) which can probably affect pain reduction. Several studies showed that sweet tasting liquids can reduce vaccination pain in infants. [88,89]

Mothers can breastfeed their infants before, during, and after the immunization. Research indicates that breastfeeding during immunization may reduce pain and distress through: presence of a comforting person, diversion of attention (sucking and distraction), physical sensation of skin to skin contact with mother and sweet taste of breast milk and other chemicals in the milk (e.g., tryptophan [a precursor of melatonin] which has

been reported to increase the concentration of Beta-endorphins, thereby producing analgesia and relaxation). [72,90]

For nearly all infants, breastfeeding is the best source of infant nutrition and immunologic protection. A wealth of evidence demonstrates that breastfeeding provides numerous short- and long-term benefits for both mother and infant. A healthy diet for infants and children is critical for lifetime cardiovascular health and breastfeeding is a cornerstone of that healthy foundation. Breastfeeding also lowers the incidence of many infant and childhood diseases, including ear and respiratory infections, gastroenteritis, type 2 diabetes, and sudden infant death syndrome. Breastfeeding may also reduce the risk of obesity later in life. In addition, breastfeeding may hold the promise of helping decrease hypertension and high cholesterol as children mature. The potential health benefits of breastfeeding are not limited to infants and children. Breastfeeding can help mothers reduce their risk of cardiovascular disease, breast and ovarian cancer, type 2 diabetes and postpartum depression. [91-101]

Sweet-tasting solution (Oral Sucrose)

Oral sucrose has been studied extensively in infants and shows promise as a developmentally appropriate and effective means of relieving pain in infants during procedures. [102]

The use of oral sucrose has been the most extensively studied pain intervention in infant care to date. More than 150 published studies relating to sweet taste- induced calming and analgesia in human infants have been identified, of which 100 (65%) include sucrose. With only a few exceptions, sucrose, glucose, or other sweet solutions reduced pain responses during commonly performed painful procedures in diverse populations of infants up to 12 months of age. Sucrose has been widely recommended for routine use during painful procedures in infants and young infants, yet these recommendations have not been translated into consistent use in clinical practice. [103,104]

Description and Forms of

Oral Sucrose is a disaccharide composed of a-glucose and fructose in a 1: 1 ratio. It is obtained commercially from sugarcane, sugar beets (Beta vulgaris), and other plants. Commonly known as table sugar, sucrose is a fine, white, crystallized odorless substance used extensively as a food and sweetener. [105,106]

Sucrose as a Pain Reliever

The administration of sucrose thus became the most frequently studied non-pharmacological intervention for relief of procedural pain. The analgesic effect of sucrose occurs by the activation of central endogenous opioid system, an action similar to that of opioid (e.g. morphine) analgesics. The presence of sucrose in the mouth also stimulates the release of endorphins from the hypothalamus sector of the brain. Studies have attributed the pain relieving quality of sucrose to the presence of a sweet taste in the mouth; researchers have termed this the "sweetness effect". [107-111]

Oral Sucrose Administration

Sucrose solution 24% is administrated orally to the anterior portion of the tongue two minutes before a painful procedure. The peak response time of two minutes is the time needed for taste stimulation to activate the endogenous opioid system for the release of endorphins. The dosage is then recorded on the infant's medication record. [112,113]

Table 1. Recommended dose of oral sucrose

Patient group	Nil orally	<1500 grams	Neonate (0-1)	Infants (1-18)
Recommended maximum for a particular procedure	0.2 ml	0.2 - 0.5 ml	0.2 - 1 ml	1 - 2 ml
Recommended maximum in 24 hrs	1 ml	2.5 ml	5 ml	5 ml

1.6. Aim of the Study

The aim of this study is to investigate the effect of breast feeding vs. oral sucrose on pain relief during vaccine Intramuscular Injection among Infants.

1.7. Hypothesis

Breast feeding enhances less pain sensation than oral sucrose solution during vaccine Intramuscular Injection among Infants.

2. Methodology

2.1. Study Design

Randomized controlled trial design was used in this study.

2.2. Setting

This study was conducted in vaccination paediatric clinics in primary healthcare in Family and Community Medicine Centre at Al-Khobar, Saudi Arabia.

2.3. Subject

Systematic random sampling of 60 infants were selected from the previously mentioned settings. Sample of study was divided into three homogenous groups; group (A) (who was receiving breast feeding), group (B) (who was receiving oral sucrose) and group (C) (control group; who was receiving hospital routine care).

2.4. Inclusion Criteria

1. Age of the infant ranges from 2 to 12 months.
2. Infants who were attending the clinic to take their vaccine intramuscular injection.

2.5. Exclusion Criteria

1. Infants who were either suffering from acute or chronic diseases or pain for any reason.
2. No analgesic medicine taken in the last three hours before the vaccination procedure.

2.6. Ethical Consideration

Permission for conducting this study was obtained from responsible authorities at King Fahd University Hospital.

Research related risks were minimized by using procedures that are consistent with careful data security measures. The data entry and storage was done on a password-protected computer. Information was only known to the investigator and the supervisors. Any print copies of the information were kept in a locked file. Concerns about participants' privacy were addressed by using a de-identified process related to the checklist information. There were no foreseen risks to the participation in this study and no risks were noted during the study.

2.7. Tool

One tool was used in this study (Assessment Sheet for Infants 'Pain) it was consisting of two parts:

The first part included demographic data such as name, age and body weight of the infant. The second part included the behavioral pain assessment scale for facial expression, leg movement, activity, cry, and consolability (FLACC) that was used to assess the infants' intensity of pain during their vaccine intramuscular injection.

The FLACC behavioural pain assessment scale had been validated for assessment of pain in infants between the ages of 2 months and 7 years. It was developed by Merkel S. *et al*. [114] by the Department of Anesthesiology, University of Michigan Medical School and Health Systems. This tool included five categories of pain behaviors, including facial expression, leg movement, activity, cry, and consolability. Infants were observed for one to five minutes, then a pain score was obtained by reviewing the descriptions of behaviour and selecting the number that most closely matches the observed behaviour. Each category was scored on the 0-2 scale, which results in a total score of 0-10.

0 = Relaxed and comfortable; 1-3 = Mild discomfort; 4-6 = Moderate pain;

7-10 = Severe discomfort or pain or both.

2.8. Data Collection Procedure

1. Part one of the study tool was developed by the researcher after reviewing of the literatures.
2. The purpose of the study was explained to infants' parents who were coming to the clinic to vaccinate their infants. Then consent to participate in the study was obtained.
3. A pilot study was carried out on 5 infants to evaluate the clarity and applicability of the tool. These infants were excluded from the study.
4. Data was collected during working hours of Vaccination Clinic over 2 months from 1 March to 4 May 2015.
5. The researcher had collected the needed data as following;
   a. The demographic data was collected by using part one of the tool.
6. The pain intensity was assessed for infants in all three groups (breast feeding group, oral sucrose group and control group) before and during the administration of vaccine intramuscular injection by using the FLACC behavioural pain assessment scale, as per the following scoring system:

2.9. Scoring System

2.9.1. Face

- Score 0 when the infant had a relaxed face, made eye contact, showed interest in surroundings.
- Score 1 when the infant had a worried facial expression, with eyebrows lowered, eyes partially closed, cheeks raised, mouth pursed.
- Score 2 when the infant had deep furrows in the forehead, closed eyes, an open mouth, deep lines around nose and lips.

2.9.2. Legs

- Score 0 when the muscle tone and motion in the limbs were normal.
- Score 1 when the infant had increased tone, rigidity, or tension; when the infant had intermittent flexion or extension of the limbs.
- Score 2 when the infant had hypertonicity, the legs were pulled tight, there was exaggerated flexion or extension of the limbs, tremors.

2.9.3. Activity

- Score 0 when the infant had moved easily and freely, normal activity or restrictions.
- Score 1 when the infant had shifted positions, appeared hesitant to move, demonstrated guarding, a tense torso, pressure on a body part.
- Score 2 when the infant a fixed position, rocking; demonstrated side-to-side head movement or rubbing of a body part.

2.9.4. Cry

- Score 0 when the infant had no cry or moan, awake or asleep.
- Score 1 when the infant had occasional moans, cries, whimpers, sighs.
- Score 2 when the infant had frequent or continuous moans, cries, grunts.

2.9.5. Consolability

- Score 0 when the infant was calm and did not require consoling.
- Score 1 when the infant had responded to comfort by touching or talking in 30 seconds to 1 minute.
- Score 2 when the infant had required constant comforting or was inconsolable.

7. For infants who were awake: the researcher had observed for 1 to 5 minutes, the legs and body uncovered, repositioned the infant, observed activity, assessed body for tenseness, and initiated consoling interventions when needed.
8. For infants who were asleep: the researcher had observed for 5 minutes, body and legs uncovered, repositioned the infant, touched the body and assessed for tenseness and tone.
   a. For group one, vaccination was conducted while providing infant with breastfeeding. Group two received 2 ml of oral sucrose via syringe two minutes prior to the administration of vaccine intramuscular injection.

After data collection, it is coded and entered to computer. The data was checked for correction of any errors during data entry. SPSS program version 16 was used for data presentation (tables, graphs and mathematical presentation) statistical analysis and finally decision taken according to the significance depending on P-values. The 50% level of significance was used. Number & percent were used for presenting qualitative variables. Test of normality was carried out for the quantitative variables. Accordingly, if this test is significant P≤0.05 the quantitative variables are normally distributed, otherwise it is normally distributed. Hence, median and Interquartile range were used for mathematical presentation and non-parametric test were used for analysis. Chi-square test was used for comparison of qualitative variables. The test used for comparison of median Sperman test. Mann-Whitney test and Kruskle Wallis were used for comparison of median according to the number of groups.

3. Result

Table 2 presents the percentage distribution of demographic data in relation to three groups (Breastfeeding, Sucrose & Control). It was found that no statistically significant differences between infants in all groups related to their age, gender and body weight. It was revealed that the highest percentage of the infants were in the age group ranged between 6 to 12 months among all the three groups {Control (75%), Sucrose (60%) and Breastfeeding (55%)}. It was found that the percentages of female gender were equal in both groups {Breastfeeding (50%), Sucrose (50%}. While the percentages of female were higher than male in control group (55%, 45% respectively). It was also noticed that the majority of infants among the three groups were in the average body weight range {Sucrose (100%), Breastfeeding (90%), Control (85%)}.

Table 3 shows percentages distribution of infant's vaccination data in relation to three groups (Breastfeeding, Sucrose & Control). It was observed that no statistically significant differences between infants in all groups related to the provided vaccine type and dose number. It was notcied that half of the infants were given MCV4 vaccine in breastfeeding group {MCV4 (50%), Hexavalent (35%), PCV13 (15%)}. And close to half of the infants were provided with Hexavalent vaccine in the Sucrose group {Hexavalent (45%), MCV(35%), PCV13(20%)}. While infants in the Control group were equally injected by the three types of vaccinations {Hexavalent (35%), MCV (35%), PCV13(30%)}. It is clear from the table that most of the infants were given 6th dose and more in the three groups {Control (75%), Sucrose (60%), Breastfeeding (55%)}

Table 2. Percentages distribution of demographic data in relation to three groups (Breastfeeding, Sucrose & Control)

		Breastfeeding		Sucrose		Control			
		n(20)	%	n(20)	%	n(20)	%	Test of significance	
Age	2 to < 6 M	9	45	8	40	5	25		
	6 to 12 M	11	55	12	60	15	75		
	Min-Max	2-12		2-12		2-12			
	Mean± SD	6.20±3.72		6.90±3.84		7.30±3.29			
	Median (IQR)	7.50 (7)		6.00 (7)		6.00 (7)		x^2# =1.028	P = 0.6
Gender	Male	10	50	10	50	9	45	x^2 =0.133	P = 0.9
	Female	10	50	10	50	11	55		
Body weight	Below average	2	10	0	0	1	5		
	Average	18	90	20	100	17	85		
	Above average	0	0	0	0	2	10		
	Min-Max	4.5-10.6		5.10-11.9		5.3-12.2			
	Mean± SD	7.39±1.87		7.73±1.95		8.83±1.81			
	Median (IQR)	7.70(3.35)		7.47(2.98)		8.40(1.67)		x^2# =2.270	P = 0.3

P: Probability of chance; x^2: Chi-square test; x^2#: **Kruskal – Wallis.**

Table 3. Percentages distribution of infant's vaccination data in relation to three groups (Breastfeeding, Sucrose & Control)

		Breastfeeding		Sucrose		Control			
		n(20)	%	n(20)	%	n(20)	%	Test of significance	
Vaccine Type	Hexavalent	7	35	9	45	7	35	x^2 =2.17	P = 0.70
	PCV13	3	15	4	20	6	30		
	MCV4	10	50	7	35	7	35		
Dose no.	2	7	35	4	20	2	10		
	4	2	10	4	20	3	15		
	6 & more	11	55	12	60	15	75		
	Min-Max	2-9		2-9		2-9			
	Mean± SD	5.50±2.947		5.95±2.724		6.40±2.257			
	Median (IQR)	7 (6)		6 (5)		6 (4)		x^2# =1.028	P = 0.6

Table 4 illustrates the infants' pain intensity in relation to breastfeeding and control groups before and during vaccine injection. It was notcied that most infants were relaxed before vaccination in both groups {Breastfeeding (90%), Control (85%)}. Whereas, most infants had Moderate pain in Breastfeeding group and Severe pain in Control group during vaccination (60%, 80% respectively).

Table 5 demonstrate the infant's pain intensity in relation to Control Sucrose groups before and during vaccine injection. It was observed that most infants were relaxed before vaccination in both groups {Sucrose (95%) (Control (85%)}. However, most infants had Severe pain in both groups during vaccination {Control (80%), Sucrose (55%)}.

Table 6 portrays the relation between breastfeeding and oral sucrose solutions and control groups in relation to infants' pain intensity before and during vaccine injection. The significance difference was shown regarding to the infants pain intensity in all the three groups (Breastfeeding, Sucrose and Control) during vaccination ($x^2\# = 26.761$, P<0.001). The test shows that all the three groups have significance differences before and during vaccination. Where, the majority of infants in Breastfeeding (60%) experienced moderate pain while more than half of them experienced severe pain in Sucrose group (55%) and Control group (80%). The table shows that the median was higher in Control group (8) which means that this groups had the highest level of pain compared to the other groups {i.e. Sucrose (7), Breastfeeding (5)}.

Table 7 illustrates the relation between infant's gender and the degree of pain intensity in Breastfeeding & Sucrose during vaccine injection. It was shown that there was no significant differences between infants' pain sensation and their gender variable in the three groups [Breastfeeding (Z=0.118, p=0.9), Sucrose (Z=1.598, p=0.1), Control (Z=0.040 p=1)].

Table 4. The infant's pain intensity in relation to breastfeeding and control groups before and during vaccine injection

Pain Scale	Before				During			
	Breastfeeding		Control		Breastfeeding		Control	
	n(20)	%	n(20)	%	n(20)	%	n(20)	%
Relaxed	18	90	17	85	0	0	0	0
Mild	2	10	3	15	7	35	1	5
Moderate	0	0	0	0	12	60	3	15
Severe	0	0	0	0	1	5	16	80

Table 5. Percentage distribution of infant's pain intensity in relation to control and oral sucrose groups before and during vaccine injection

Pain Scale	Before				During			
	Control		Oral sucrose		Control		Oral sucrose	
	n(20)	%	n(20)	%	n(20)	%	n(20)	%
Relaxed	17	85	19	95	0	0	0	0
Mild	3	15	1	5	1	5	0	0
Moderate	0	0	0	0	3	15	9	45
Severe	0	0	0	0	16	80	11	55

Table 6. The relation between breastfeeding and oral sucrose solutions and control groups in relation to infants' pain intensity before & during vaccine injection

	Before						Significance Test	During						Significance Test
Pain Scale	Breastfeeding		Sucrose		Control			Breastfeeding		Sucrose		Control		
	n(20)	%	n(20)	%	n(20)	%		n(20)	%	n(20)	%	n(20)	%	
Relaxed	18	90	19	95	17	85		0	0	0	0	0	0	
Mild	2	10	1	5	3	15		7	35	0	0	1	5	
Moderate	0	0	0	0	0	0		12	60	9	45	3	15	
Severe	0	0	0	0	0	0		1	5	11	55	16	80	
Min-Max	0-1		0-2		0-2			1-7		5-9		3-10		
Mean± SD	0.10±0.30		0.10±0.44		0.25±0.63			4.335±1.46		6.60±1.35		7.7±1.86		
Median (IQR)	0 (0)		0 (0)		0 (0)		$x^2\# = 1.098$ P=0.6	5 (2)		7 (3)		8 (2)		$x^2\# = 26.761$* P<0.001
Test before & during for each group	Z##=3.696* P<0.001		Z##=3.942* P<0.001		Z##=3.955* P<0.001			Z##=3.696* P<0.001		Z##=3.942* P<0.001		Z##=3.955* P<0.001		

P: Probability of chance; x^2: Chi-square test; $x^2\#$: **Kruskal – Wallis**; Z##: Wilcoxon test.

Table 7. The relation between infant's gender and the degree of pain intensity in Breastfeeding & Sucrose during vaccine injection

Pain intensity	Gender		Breastfeeding	Sucrose	Control
Relaxed Mild Moderate Severe	Male	Median (IQR)	5 (2)	6 (2)	8 (2)
	Female	Median (IQR)	4.5 (2)	7 (2)	8 (2)
	Test (Z)		0.118	1.598	0.040
	P		0.9	0.1	1

Table 8. The relation between age and the degree of pain intensity in Breastfeeding & Sucrose during vaccine injection

Pain intensity	Age	Breastfeeding	Sucrose	Control
Relaxed Mild Moderate Severe		Median	Median	Median
	2 to < 6 M	4	5	5
	6 to 12 M	5	7	8
	r	0.03	0.78*	0.58*
	P	0.9	<0.001	0.008

P: Probability of chance; r= Correlation coeffecience.

Table 9. The relation between body weight and the degree of pain intensity in Breastfeeding & Sucrose during vaccine injection

	Body weight	Breastfeeding	Sucrose	Control
Pain intensity		Median	Median	Median
Relaxed Mild Moderate Severe	Below average	4.5	-	9
	Average	5	7	8
	Above average	-	-	9
	r	-0.07	0.74*	0.45*
	P	0.8	<0.001	0.046

Table 10. The relation between type of vaccine and the degree of pain intensity in Breastfeeding & Sucrose during vaccine injection

Pain intensity	Vaccine Type		Breastfeeding	Sucrose	Control
Relaxed Mild Moderate Severe	Hexavalent	Median (IQR)	3 (1)	5 (2)	8 (3)
	PCV13	Median (IQR)	6 (1)	6.5 (2)	8 (3)
	MCV4	Median (IQR)	5 (2)	8 (2)	8 (1)
	Test (x^2#)		8.696*	11.570*	2.951
	P		0.01	0.003	0.2

P: Probability of chance; x^2#: **Kruskal – Wallis**.

Table 11. The relation between dose number and the degree of pain intensity in Breastfeeding & Sucrose during vaccine injection

Pain intensity	Dose no.	Breastfeeding	Sucrose	Control
Relaxed Mild Moderate Severe		Median	Median	Median
	2	4	5.5	5
	4	5.5	5	8
	6 & more	5	7	8
	r	0.03	0.78*	0.58*
	P	0.9	<0.001	0.008

P: Probability of chance; r= correlation coeffecince.

Table 8 describes the relation between infant's age and the degree of pain intensity in Breastfeeding, Sucrose and control groups during vaccine injection. It was illustrated that infants between two to six months of age were experiencing more pain intensity during vaccine injection in sucrose and control groups than in breastfeeding group {Breastfeeding [Median=4], Sucrose [Median=5], Control [Median=5]}. However, there were significant positive correlation in Sucrose group [r=0.78 and p<0.001] and in Control group [r=0.58, p<0.008]. While in breastfeeding there is no clear change in infants' pain sensation for the young and older infants, where, there was insignificant weak positive correlation [r=0.03, p=0.09]. Concerning each group, it was found that the older infants (from 6 to 12 months) experienced more pain than young ones (less than 6 months) for each of Sucrose and Control groups during the vaccine immunization injection.

It was shown that infants who were in the average of their body weight experienced more pain in Sucrose and Control groups than infants in breastfeeding during

vaccine immunization injection [Breastfeeding; median=5, Sucrose; median=7 and Control; median=8]. Regarding, each group, it was shown that there is no definite change in infants' sensation of their pain in Sucrose group, where all of them were on average category of their body weight [average=7]. Almost, there was no clear change in infants' pain sensation within the Control group [Below average=9, average=8 and above average=9]. However, there were a significant positive correlation in Sucrose [r=0.74, p<0.001] and Control groups [r=0.45, p<0.046]. In breastfeeding also there was no clear change in infants' pain sensation for those below and on average of their body weight. Where there was insignificant weak negative correlation [r=-0.07] as clarified in Table 9.

Table 10 demonstrates the relation between type of vaccine and the degree of pain intensity in Breastfeeding, Sucrose and Control groups during vaccine injection. It was indicated that infants who were provided with Hexavalent vaccine had the lowest pain intensity in Breastfeeding & Sucrose groups {Breastfeeding [Median(IQR)=3(1)], Sucrose [Median(IQR)=5(2)]}.

In breastfeeding, it was shown that pain intensity was lower for infants who were provided Hexavalent vaccine {Hexavalent [Median(IQR)=3(1)], PCV13 [Median(IQR)=6(1)], MCV4[Median(IQR)=5(2)]}. In oral sucrose solution, it was revealed that pain intensity was lower for infants who were provided Hexavalent vaccine {Hexavalent [Median(IQR)=5(2)], PCV13 [Median(IQR)=6.5(2)], MCV4[Median(IQR)=8(2)]}. However, it was discovered that pain intensity was equal in Control group for the three types of vaccine {Hexavalent [Median(IQR)=8(3)], PCV13 [Median(IQR)=8(3)], MCV4[Median(IQR)=8(1)]}. It was shown on the table that there is a statistical significance in Breastfeeding and Sucrose groups. However, there was a no statistical significance in Control group.

It is noticed that infants who had six or more doses of vaccine injections experienced more pain in Sucrose and Control groups than infants in Breastfeeding group [Control (median=8), Sucrose (median=7) and Breastfeeding (median=5)]. Concerning to each group, it was shown that infants who had two doses of vaccine injection experienced less pain than those infants who had two number of doses for each one of the three groups. However, significant positive correlation were illustrated for the Sucrose [r=0.78, p<0.001] and Control group [r=0.58, p<0.008] as presented in Table 11.

4. Discussion

Prevention and treatment of pain whenever possible are nursing priorities to reduce morbidity and improve the outcomes. Nurses are instrumental in the development and implementation of effective pain-reducing strategies. However, many articles reviewed that infants feel more pain than older children and adults do because they lack of their physiological abilities to block the transmission of pain. So, their painful experience should be anticipated and prevented as much as possible. There are different forms of non-pharmacological strategies that may be used to reduce pain in infants such as holding, swaddling them, sucking on a pacifier, or giving sweet solutions (such as sucrose or glucose). [115,116,117]

The results of the present study showed that mother's breast feeding during vaccination injection reduced infants' pain more than oral sucrose administration, Where, the majority of infants in Breastfeeding (60%) experienced moderate pain while more than half of them experienced severe pain in other groups, Sucrose group (55%) and Control group (80%). This is congruent with Codipietro et al. [40] who reported that the effect of mothers' breast feeding on relieving pain experienced for taking blood sample from infants' heel was more than the effect of oral sucrose in term infant.

In addition, other studies have been done and compared the analgesic effects of sucrose and breast-feeding, Carbajal *et al*. [118] suggested that sucrose administration and pacifier use together showed a trend toward lower pain scores compared with pacifier use alone. Gradin *et al*. [119] reported an association between combined oral glucose administration and breast-feeding with the lowest pain scores and significantly shorter duration of crying.

On the other hand, Ors *et al*. [120] found that 25% sucrose solution had superior pain-reducing effects to breast milk. Similarly, Skogsdal *et al.* [121] reported that strong sweet solutions, such as sucrose and 30% glucose, alleviated pain successfully, whereas breast milk did not. Bilgen *et al.* [10] also compared the analgesic effects of sucrose, expressed breast milk and breast feeding during heel pricks. Breast feeding was allowed for 2 minutes and then stopped before a heel prick. This type of intervention had no analgesic effect.

The result of the current study revealed that the breastfeeding is the most effective method in relieving infants' pain during vaccine immunization injection. Where, the significance difference was shown between the three studied groups [Breastfeeding, Sucrose and Control, $x^2\# = 26.761$, p<0.001].

The showed superiority of breastfeeding in relieving infants pain could be related to certain factors, first, suckling at the breast, focuses attention on the mouth and reducing outside influences. Second, the sweet flavour of milk stimulates the release of opioids in midbrain of infant which act on receptor that decrease the perception of pain. Thirdly, breastfeeding involves maternal skin to skin contact which stabilizes blood glucose level, body temperature and respiratory rate and reduces release of stress hormone. Finally, breastfeeding involves intimate social interaction between mother and child and may release anti stress hormone, oxytocin. [122,123]

This results were parallel with many studies, Razak et al. [115] in their study on the effect of breastfeeding on vaccination pain reported that breastfeeding reduced pain in 30% of the infants in the intervention group while 95% of the infants in the control group experienced painful vaccination. Modares et al. [124] in their study on the effect of breastfeeding during vaccination on vaccination pain in infants reported mean scores of pain (based on facial reaction, limb movements, and noise) to be 6.78 and 3.52, respectively, in the control and study groups, with a significant difference. The effect of breastfeeding as decreasing length of infants crying during painful procedures has been reported by some authors during blood sampling Carbajal et al. [15] and Shah *et al*. [65].

Moreover, Osinaike et al. [90] showed that infants' feeding from their mothers' breasts leads to a reduction in pain caused due to blood sampling from their heel. Gray et al. [122] reported that infants' sucking milk from mothers' breasts and infant-mother skin touch acted as a strong pain killer during blood sampling from their heels and notably decreased the time of infants' cry and grimace.

Oral sucrose has analgesic and calming properties in infant. Oral sucrose water, generally at a 24% to 25% concentration, seems to provide significant adjunctive pain relief to infants undergoing immunization, the mechanism of action is thought to involve activation of the endogenous opioid system through taste that act as opioid analgesic. The results of this study supported such issue, where about half of studied infants (45%) experienced moderate pain and significance difference was shown (Z##=3.942, p<0.0001). [103,104]

The use of sucrose analgesia for immunization-related pain has been studied previously. Recently, Hatfield *et al*. [79] reported that administration of 2 mL of 24% oral sucrose solution 2 minutes before routine vaccination reduced pain in infants age 2 and 4 months. Barr *et al*. [125] suggested that sucrose loses its efficacy by age 4 to 6 months; however, in the present study, we used sucrose for pain reduction in children age 2 to 12 months and found that sucrose was effective beyond age 6 months.

In contrary, other studies cited that the effect of sucrose solution on infant pain sensation decreased after the 6 months of infants' age and this is related to the sucrose concentration. However, more concentration will inhibit the pain sensation. [65,126]

The result of current study illustrated that infant's age is considered a factor in their pain sensation during vaccine injection. However, it was found that the older infants experienced more pain than younger ones in sucrose and control groups. While in breastfeeding there was no clear change in infants' pain sensation between younger and older ones. These findings could be related to the supporting fact, pain is more severe in higher age due to lack of development of nervous system and pain blocking neurotransmitters, compared to those of lower ages. [13,127]

This was congruent with Shah *et al*. [65] who reported that breastfeeding in infants. Shah reported that breastfeeding in infants of less than 2 months of age is an effective method to reduce vaccination pain, compared to other pain relief methods such as taking oral sucrose. Efe and Ozer [128] in their study on the effect of breastfeeding on vaccination pain of the infants aged up to 4 months reported that breastfeeding significantly reduced pain in these infants, which concords with the findings of the present study. The Meta-analysis revealed that pain severity of painful procedures increases with age [65].

The present study revealed that the infants' body weight was not an effective variable to infants for the degree of their pain sensation. However, there is no clear change in infants' pain sensation and their body weight. This could be related to the majority of all studied infants were plotted in the average of their body weight as clarified in Table 1.

Studies that have been regarding the gender variable have not implicated sex as significant determinant of pain response for infants and young children undergoing immunizaiton. [47,73] The findings of current study were parallel with this citation, where there was no significant differences between infants' pain sensation and their gender in the three groups. This could be related to the fact that the number of studied male and female infants are equal as clarified in Table 1.

5. Conclusion

It is concluded from the present study that breastfeeding is the most effective method alleviating infants' pain sensation followed by Sucrose solution during vaccine injection.

6. Limitation

1. Small sample size.
2. There was some difficulty balancing the behavior of parents during the procedure, especially as the parents of infants in the test group had to be more comfortable, which could contribute to the infant's anxiety and pain

7. Recommendations

1. Promoting breastfeeding for infants during vaccine injection for relieving their pain sensation.
2. Health care professionals should use appropriate environmental, non-pharmacological to prevent, reduce, or eliminate the stress and pain of infants such as breastfeeding and oral sucrose solution.
3. Health care institutions should develop and implement patient care policies to assess, prevent, and manage pain in infants, including those receiving vaccine immunization injections.
4. There is a need for development and validation of infant pain assessment tools that are easily applicable in the clinical setting.

8. Summary

Currently, vaccine injections are considered to be the most common source of iatrogenic pain in childhood. They are repeatedly administered to almost all children throughout infancy, childhood and adolescence. Vaccine injections cause pain, anxiety and fear in paediatric patients. The pain associated with such injections is a source of distress not only for children, but also for their parents and the individuals administering the injections. This pain can lead to pre-procedural anxiety in the future, needle phobias and healthcare avoidance behaviours. It is estimated that up to 25% of adults have a fear of needles, with most fears developing in childhood. Conversely, more positive experiences during vaccine injections would promote and maintain trust in healthcare providers.

Vaccination is a prevalent painful procedure in infants which requires repeated intramuscular injection during the first year of life. It is cited that pain has a short-term and long-term effects on infants. Short-term effects included decline in oxygenation, hemodynamic instability and

increase in intracranial pressure. Long-term effects of pain result in uncontrolled pain and stress experienced by infants caused some changes in the central nervous system. These changes included a permanent impairment in the cognitive development of learning, memory, IQ and behaviour. They also caused an increase in physical impairment, anxiety, emotional complications, hyperactivity and disturbed attention in the childhood period.

Considering the short and long term negative effects of uncontrolled pain and undeniable necessity of vaccination, an effective and secure pain controlling method seems necessary. Non pharmacological methods included sweet solutions such as oral sucrose and glucose, pacifiers, skin contact and breastfeeding.

Hatfield *et al*. [79] cited that oral sucrose administration is an effective and easy method with short-term effect during the routine immunization process. Irani *et al*. [130] also reported the effectiveness of oral sucrose on pain reduction.

Studies support the theory that sucrose and pain relief are interrelated through the body's endogenous opioid system that provides natural analgesia. The analgesic action of sucrose will involve descending pain-modulating mechanisms; the presence of sucrose in the mouth also may stimulate the release of endorphins from the hypothalamus that will inhibit pain transmission at the spinal level.

The studies about the impact of breastfeeding on pain sensation in infants indicated that breastfeeding is a physiological, accessible, practical and safe method which could easily be accepted by the parents and health care providers. It involves holding the infants closely and promotes skin to skin contact which helps in moderating the painful experience. In addition, breastfeeding contains agents that have analgesic properties or can be endogenously converted into analgesic substances. Osianaike *et al*. [90] also cited that breastfeeding has a soothing effect on infant during the venipuncture prick.

8.1. Research Objective

Aim of the study

The aim of this study was to investigate the effect of breast feeding vs. oral sucrose on pain relief during vaccine Intramuscular Injection among Infants.

Hypothesis: Breast feeding enhances less pain sensation than oral sucrose solution during vaccine Intramuscular Injection among Infants.

8.2. Methods and Procedures

Study Design: Randomized controlled trial design was used in this study.

Setting: This study was conducted in vaccination paediatric clinics in primary healthcare in Family and Community Medicine Centre at Al-Khobar, Saudi Arabia.

Subject: Systematic random sampling of 60 infants was selected from the previously mentioned settings. Sample of study was divided into three homogenous groups; group (A) (who was receiving breast feeding), group (B) (who was receiving oral sucrose) and group (C) (control group; who was receiving hospital routine care).

Inclusion criteria:

1. Age of the infant ranges from 2 to 12 months.
2. Infants who were attending the clinic to take their vaccine intramuscular injection.

Exclusion criteria

1. Infants who were either suffering from acute or chronic diseases or pain for any reason.
2. No analgesic medicine taken in the last three hours before the vaccination procedure.

Ethical Consideration

Prior to the study, the research proposal including the observation checklist and demographic data was reviewed and approved by the Institutional Review Board (IRB) in the University of Dammam. Permission for conducting this study was obtained from responsible authorities at King Fahd University Hospital.

Tool: One tool was used in this study (Assessment Sheet for Infants 'Pain) it was consisting of two parts:

- The first part included demographic data.
- The second part included the behavioral pain assessment scale for facial expression, leg movement, activity, cry, and consolability (FLACC).
- Each category was scored on the 0-2 scale, which results in a total score of 0-10. 0 = Relaxed and comfortable; 1-3 = Mild discomfort; 4-6 = Moderate pain; 7-10 = Severe discomfort or pain or both.

8.3. Data Collection Procedure

1. Part one of the study tool was developed by the researcher after reviewing of the literatures.
2. The purpose of the study was explained to infants' parents who were coming to the clinic to vaccinate their infants. Then consent to participate in the study was obtained.
3. A pilot study was carried out on 5 infants to evaluate the clarity and applicability of the tool. These infants were excluded from the study. The researcher had collected the demographic using part one of the tool.

The pain intensity was assessed for infants in all three groups (breast feeding group, oral sucrose group and control group) before and during the administration of vaccine intramuscular injection by using the FLACC behavioural pain assessment scale.

8.4. Data Analysis

- SPSS program version 16 was used for statistical analysis.
- Median and inter quartile range were used for mathematical presentation and non-parametric test were used for analysis.
- Chi-square test was used for comparison of qualitative variables.
- Spearman's correlation test was used for comparison of the median for the same group.
- Mann Whitney test and Kruskal-Wallis were used for comparison of the median according to the number of the groups.
- P-value of < 0.05 was considered statistically significant.

8.5. Results

- It was found that no statistically significant differences between infants in all groups related to demographic data.
- It was revealed that the highest percentage of the infants were in the age group ranged between 6 to 12 months among all the three groups {Control (75%), Sucrose (60%) and Breastfeeding (55%)}.
- The percentages of female gender were equal in both groups Breastfeeding and Sucrose groups. While the percentages of female were higher than male in Control group.
- The majority of infants among the three groups were in the average body weight range {Sucrose (100%), Breastfeeding (90%), Control (85%)}.

The significance difference was shown regarding to the infants pain intensity in all the three groups (Breastfeeding, Sucrose and Control) during vaccination ($x^2\# = 26.761$, P<0.001).

- There was a positive statistical significance correlation in Sucrose group as r = 0.78 & p<0.001, and control group as r=0.58 & p=0.008 regarding to the infants' age.
- There was a positive statistical significance correlation in Sucrose group as r = 0.74 & p<0.001, and control group as r=0.45 & p=0.046 related to the infants' body weight.
- There was a positive statistical significance correlation in Sucrose group as r = 0.78 & p<0.001, and control group as r=0.58 & p=0.008 regarding to the dose number.

8.6. Conclusion

It is concluded from the present study that breastfeeding is the most effective method alleviating infants' pain sensation followed by Sucrose solution during vaccine injection.

Limitation

1. Small sample size.
2. There was some difficulty balancing the behavior of parents during the procedure, especially as the parents of infants in the test group had to be more comfortable, which could contribute to the infant's anxiety and pain

8.7. Recommendations

- Promoting breastfeeding for infants during vaccine injection for relieving their pain sensation.
- Health care professionals should use appropriate environmental, non-pharmacological to prevent, reduce, or eliminate the stress and pain of infants such as breastfeeding and oral sucrose solution.
- Health care institutions should develop and implement patient care policies to assess, prevent, and manage pain in infants, including those receiving vaccine immunization injections.
- There is a need for development and validation of infant pain assessment tools that are easily applicable in the clinical setting.

References

[1] World Health Organization. WHO Library Cataloguing-in-Publication DataState. State of the world's vaccines and immunization (2009).

[2] World Health Organization. World health statistics report (2008).

[3] ChildInfo statistics by area: child survival and health. UNICEF (2009) http://www.childinfo.org/mortality.html.

[4] Ministry of health. Saudi Arabia, Basic Vaccination Schedule (2012).

[5] World Health Organization. Global Burden of disease (2010).

[6] Reis EC, Roth EK, Syphan JL, Tarbell SE, Holubkov R. Effective pain reduction for multiple immunization injections in young infants. Arch Pediatr Adolesc Med. Nov 2003; 157(11): 1115-1120.

[7] Publically funded immunization schedules for Ontario - January 2009. http://www.health.gov.on.ca/english/providers/program/immun/pdf/schedule.pdf. Accessed January 14, 2009.

[8] Jacobson RM, Swan A, et al. Making vaccines more acceptable--methods to prevent and minimize pain and other common adverse events associated with vaccines. Vaccine. Mar 21 2001; 19(17-19) : 2418-27.

[9] Cohen LL, Blount RL et al. Children's expectations and memories of acute distress: the short- and long-term efficacy of pain management interventions. J Pediatr Psychol. 2001; 26: 367-374.

[10] Bilgen H, Ozek E et al. Comparison of sucrose, expressed breast milk and breastfeeding on the neonatal response to heal prick. J Pain. 2001; 2: 301-5.

[11] Larsson BA. Pain and pain relief during the neonatal period. Early pain experiences can result in negative late-effects. Lakartidningen. 2001; 98: 1656-62.

[12] Ramponi DR. Reducing pain in pediatric minor emergency procedures. J Emerg Nurs. 2009; 35: 379-82.

[13] Henry PR, Houbold K et al. Pain in the healthy full- term neonate: Efficacy and safety of interventions. Newborn Infant Nurs Rev. 2004; 4: 106-13.

[14] Puchalski M, Hummel P. The reality of neonatal pain. Adv Neonatal Care. 2002; 2: 233-47.

[15] Carbajal R, Veerapen S, et al. Analgesic effect of breastfeeding in term neonates: randomized controlled trial. Br Med J. 2003; 326: 13-15.

[16] Zahra Abdeyazdan, Mitra Savabi Esfahani et. al. Iran J Nurs Midwifery Res. A comparative study on vaccination pain in the methods of massage therapy and mothers' breast feeding during injection of infants referring to Navabsafavi Health Care Center in Isfahan. 2013; 18(6): 494-8.

[17] Puchalski M, Hummel P. The reality of neonatal pain. Adv Neonatal Care. 2002; 2: 233-47.

[18] Taddio A, Manleyj, Potash L, et al. Routine Immunization practices: Use of topical anaesthetics and oral analgesics. Pedlatncs. 2007; 120: e637-e643.

[19] Taddio A. Proceedings of the Workshop Conquenng Pain: The Hidden Cost of Immunization. University ofToronto, Toronto, Ontano, Canada. March 20, 2008.

[20] World Health Organization. International Travel and Health - Chapter 6: Vaccine-preventable diseases & vaccines (2010). P87-130.

[21] Plotkin SL and Plotkin SA. A Short History of Vaccination. 5th Edition, S Plotkin, W Orenstein And P Offit, Eds, Saunders Elsevier, China, 2008.

[22] Vaccine Factbook, 2013, Pharmaceutical Research & Manufacturing of America, NW, Washington DC, USA. P18-24.

[23] American Academy of Paediatrics. Active and passive immunization. In: Pickering LK, Baker CJ, Long SS, McMillan JA, eds. Red Book: Report of the Committee on Infectious Diseases. 27th ed. Elk Grove Village, IL: American Academy of Paediatrics; 2006: 1-98

[24] Royal College of Paediatrics and Child Health. Position statement on injection technique, 2007.

[25] Centers for Disease Control and Prevention. National Immunization Project. Available at: www.cdc.gov/nip. 2007.

[26] Anna Taddio, Christine T. Chambers, et al. Inadequate Pain Management During Routine Childhood Immunizations. Clinical Therapeutics/ Volume 31, Supplement B, 2009. P152-167.

[27] Schechter NL, Zempsky WT, et al. Pain reduction during paediatric immunizations: Evidence-based review and recommendations. Paediatrics. 2007; 119: e1184-98.

[28] McCaffery, M., & Pasero, C. et al. Pain clinical manual. St. Louis: Mosby. 1999; e2 : 17.

[29] Merskey, H., & Bogduk, N. et al. Classification of chronic pain and definitions of terms . Seattle: IASP Press. 1994; e2: 213.

[30] Lemons, J., Blackmon, L., et al. Speer, M. Prevention and management of pain and stress in the neonate. Pediatrics, 2000; 105(2), 454-461.

[31] Pain terms: A list with definitions and notes on usage. Recommended by the IASP Subcommittee on Taxonomy. Pain. 1999; 6: 249.

[32] Brennan F, Carr DB, et al. M.Pain management: A fundamental human *nght. Anesth Analg.* 2007; 105: 205-221.

[33] Anand KJ, Aranda JV, Berde CB, et al. Summary proceedings from theneonatal pain-control group. *Pedlatncs. 2006; 117: 59-522.*

[34] Southall DP, Burr 5, Smith RD, et al. The Child-Fnendly Healthcare Initiative (CFHI): Healthcare provision In accordance with the UN Convention on the Rights of theChild Advocacy International. Department of Child and AdolescentHealth and Development ofthe World Health Organization(WHO). Royal College of Nursing(UK). Royal College of Paedlatncs and Child Health (UK). United NationsChildren's Fund (UNICEF).*Pedtatncs.* 2000; 106: 1054-1 064.

[35] Taylor EM, Boyer K, Campbell FA. Pain In hospitalizedchildren: A prospective cross-sectional survey of painprevalence, intensity, assessment and management In a Canadian paediatric teaching hospital. Pain Res Manag. 2008; 13: 25-32.

[36] Guideline statement: Management of procedure-related pain In children and adolescents. J Paedlatr Chtld Health. 2006; 42(Suppl 1): 51-529.

[37] Khodam H, Zeaee T, Hosseini SA. Effect of skin contact between mother and newborn infant pain relief. Journal of Gorgan University of Medical Sciences. 2002; 4(9): 11-8.

[38] Bembich S, Brovedani P et al. Functional Neuroimaging of Breastfeeding Analgesia by Multichannel Near-Infrared Spectroscopy. Institute for Maternal and Child Health. University of Padova, Italy. 2013: 1-5.

[39] Efe E, Savaser S. The effect of two different methods used during peripheral venous blood collection on pain reduction in neonates. Agri. 2007; 19(2): 49-56.

[40] Sabety F, Yaghoobi M et al. Which is Better for Pain Reduction before Venipuncture: Glucose, Lidocaine or Expressed Breast Milk. HK J Paediatr (new series) 2013; 18: 19-23.

[41] Fitzgerald M, Walker SM. Infant pain management: A developmental neurobiological approach. Nat Cltn Pract Neural. 2009: 5: 35-50.

[42] Tansky C, Lindberg CE. Breastfeeding as a Pain Intervention When Immunizing Infants. Journal for Nurse Practitioners. 2010; 6.

[43] Modarres M, Jazayeri A et al. Breastfeeding and pain relief in full-term neonates during immunization injections: a clinical randomized trial. BMC Anesthesiology 2013: 1-5.

[44] Mathew P J, Mathew J L et al. Assessment and management of pain in infants. Med J 2003; 79: 438-43.

[45] Arnstein, P. Clinical coach for effective pain management. Philadelphia, PA: F.A. Davis Company. 2010.

[46] Ponder, B. L. Effects of pain in the human neonate. American Journal of Electroneurodiagnostic Technology, 2002; 42(4), 210-23.

[47] Young KD. Pedlatnc procedural pain.Ann Emerg Med. 2005; 45: 160-171.

[48] Goodenough B, Perrott DA, vanDongen K, et al. Children's responseto vaccine fluid injection versus needlepuncture pain dunng routineImmunization. Amb Chtld Health. 2008; 6: 91-100.

[49] Codipietro L, Ceccarelli M, Ponzone A. Breastfeeding or oral sucrose solution in term neonates receiving heel lance: A Randomized, Controlled Trial. Paediatrics Official Journal Of the AAP. 2008; (122): 3

[50] Taddio A, KatzJ. The effects of early pain experience In neonates on pain responses In Infancy and childhood. Paediatric Drugs. 2005; 7: 245-257.

[51] O'Brien L, Kemp 5, et al. Pharmacologic managementof painful oncology procedures Inpediatric patients. Am J Cancer. 2003; 2: 403-426.

[52] Chen E, Zeltzer LK, et al. Children's memories forpainful cancer treatment procedures: Implications for distress.Chtld Dev. 2000; 71: 933-947.

[53] Jacobson RM, Swan A, Adegbenro A, et al, for the Vaccine ResearchGroup. Making vaccines moreacceptable-methods to preventand minimize pain and other commonadverse events associated withvaccines. Vaccine. 2001; 19: 2418-2427.

[54] Rocha EM, Prkachln KM, Beaumont SL, et al. Pain reactivity and somatization In kindergarten-age children.} Pedtatr Psychol. 2003; 28: 47-57.

[55] Megel ME, Heser R, et al. assistance to children having Immunizations. Issues Compr PedtatrNurs. 2002; 25: 151-165.

[56] Cohen LL, Blount RL, et al. Children's expectations and memories of acute distress: Short and long-term efficacy of pain management interventions. J Pedtatr Psychol. 2001; 26: 367-374.

[57] Taddio A, Shah V, Gilbert-MacLeodC, Katz j. Conditioning and hyperalgesiaIn newborns exposed to repeatedheel lances. JAMA. 2002; 288: 857-861.

[58] Nlr Y, Paz A, Sabo E, Potasman I.Fear of injections In young adults: Prevalence and associations. Am JTrop Med Hyg. 2003; 68: 341-344.

[59] Grunau R. Long-term consequences of pain in human neonates. Elsevier Science USA. 2007; 45-55.

[60] American Academy of Paediatrics. Committee on Psychosocial Aspects of Child and Family Health; Task Force on Pain in Infants, Children, and Adolescents. The assessment and management of acute pain in infants, children, and adolescents. *Paediatrics* 2001; 108: 793-7.

[61] Campbell F, Palozzi L, Jeavons M, et al. Pain management. In: Brown S, Daneman D, Dodds A, et al., editors. *Policies & procedure database*. *Clinical practice guideline*. Toronto (ON): The Hospital for Sick Children; 2008.

[62] Stevens B, Johnston C, Taddio A, et al. The premature infant pain profile: evaluation 13 years after development. *Clin J Pain* 2010; 26: 813-30.

[63] Manworren RC, Hynan LS. Clinical validation of FLACC: preverbal patient pain scale. *Pediatr Nurs* 2003; 29: 140-6.

[64] Taddio A, Ilersich AL, Ipp M, et al.; HELPinKIDS Team. Physical interventions and injection techniques for reducing injection pain during routine childhood immunizations: systematic review of randomized controlled trials and quasi-randomized controlled trials. Clin Ther 2009; 31(Suppl 2): S48-76.

[65] Shah V, Taddio A, Rieder MJ; HELPinKIDS Team. Effectiveness and tolerability of pharmacologic and combined interventions for reducing injection pain during routine childhood immunizations: systematic review and meta-analyses. 2009; 31(Suppl 2): S104-47.

[66] Lander JA, Weltman BJ, So SS. EMLA and amethocaine for reduction of children's pain associated with needle insertion. Cochrane Database Syst Rev2006; (3): CD004236.

[67] Halperin BA, Halperin SA, McGrath P, Smith B, Houston T. Use of lidocaine-prilocaine patch to decrease intramuscular injection pain does not adversely affect the antibody response to diphtheria-tetanus-acellular pertussis-inactivated poliovirus- Haemophilus influenzae type b conjugate and hepatitis B vaccines in infants from birth to six months of age. Pediatr Infect Dis J. 2002; 21: 399-405.

[68] Halperin SA, McGrath P, Smith B, Houston T. Lidocaine prilocaine patch decreases the pain associated with the subcutaneous administration of measles-mumps-rubella vaccine but does not adversely affect the antibody response. J Pediatr. 2000; 136: 789-794.

[69] Stevens B, Yamada J, Ohlsson A. Sucrose for analgesia in newborn infants undergoing painful procedures. Cochrane Database Syst Rev 2001; (4): CD001069. Update in: Cochrane Database Syst Rev 2004; (3): CD001069.

[70] Pasek T A, Huber J M. Hospitalized Infants Who Hurt: A Sweet solution with oral sucrose. American Association of Critical-Care Nurses. 2012; (32): 1.

[71] Gartner LM, Morton J, Lawrence RA, et al. Breastfeeding and the use of human milk. Paediatrics 2005; 115: 496-506.

[72] Shah PS, Aliwalis L, Shah V. Breastfeeding or breastmilk to alleviate procedural pain in neonates: a systematic review. Breastfeed Med 2007; 2: 74-82.

[73] Ipp M, Taddio A, Goldbach M, et al. Effects of age, gender and holding on pain response during infant immunization. Can J Clin Pharmacol 2004; 11: e2-7.

[74] Sparks LA, Setlik J, Luhman J. Parental holding and positioning to decrease IV distressin young children: a randomized controlled trial. J Pediatr Nurs 2007; 22: 440-7.

[75] Cohen LL, MacLaren JE, DeMore M, et al. A randomized controlled trial of vapocoolant for paediatric immunization distress relief. Clin J Pain 2009; 25: 490-4.

[76] Mawhorter S, Daugherty L, Ford A, et al. Topical vapocoolant quickly and effectively reduces vaccine-associated pain: results of a randomized, single-blinded,placebo-controlled study. J Travel Med 2004; 11: 267-72.

[77] Taddio A. Proceedings of the workshop conquering pain: the hidden cost of immunization; 2008 Jan. 28; Toronto. Toronto (ON): University of Toronto; 2008. Available: http://resources.cpha.ca/CCIAP/data/700e.pdf. (accessed 2009 Jan. 25).

[78] Ipp M, Taddio A, et al. Vaccine-related pain: randomized controlled trial of two injection techniques. Arch Dis Child 2007; 92: 1105-8.

[79] Hatfield LA, Gusic ME, Dyer AM, et al. Analgesic properties of oral sucrose during routine immunizations at 2 and 4 months of age. Paediatrics 2008; 121: e327-34.

[80] Sparks L. Taking the "ouch" out of injections for children. Using distraction to decrease pain. MCN Am J Matern Child Nurs 2001; 26: 72-8.

[81] Chung JW, Ng WM, Wong TK. An experimental study on the use of manual pressure to reduce pain in intramuscular injections. J Clin Nurs 2002; 11: 457-61.

[82] Taddio A, Lord A, Hogan ME, et al. A randomized controlled trial of analgesia during vaccination in adults. Vaccine 2010; 28: 5365-9.

[83] Cohen LL, Bernard RS, McClellan CB, et al. anaesthesia versus distraction for infants' immunization distress: evaluation with 6-month follow-up. Child Health Care 2006; 35: 103-21.

[84] Uman LS, Chambers CT, McGrath PJ, et al. 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. J Pediatr Psychol 2008; 33: 842-54.

[85] Cohen LL. Reducing infant immunization distress through distraction. Health Psychol 2002; 21: 207-11.

[86] The Academy of Breastfeeding Medicine Protocol Committee. 2010. ABM Clinical Protocol #7: Model Breastfeeding Policy (Revision 2010)ABM Clinical Protocol #7: Model Breastfeeding Policy (Revision 2010). Breastfeeding Medicine 5: 4, 173-177.

[87] Amanda L. Watkins, Joan E. Dodgson. 2010. Breastfeeding Educational Interventions for Health Professionals: A Synthesis of Intervention Studies. Journal for Specialists in Paediatric Nursing 15: 3, 223-232.

[88] Uga E, Candriella M, Perino A, Alloni V, Angilella G, Trada M, et al. Heel lance in newborn during breastfeeding: An evaluation of *analgesic effect of this procedure. Ital J Pediatr. 2008; 34: 3. [PMC free article]

[89] Golestan M, Sadrebafghi M, Akhavan Karbasi S, Eslami Z, Hashemi A, Mirnaseri F, et al. Comparison Pain relieving effects of glucose and water in neonates. Iran J Pediatr. 2006; 16: 441-6.

[90] Osinaike BB, Oyedeji AO, Adeoye OT et al. Effect of breastfeeding during venipuncture in neonates. Ann Trop Paediatric. 2007; 27(3): 201-5.

[91] Schack-Nielsen L, Michaelsen KF. Breast feeding and future health. Curr Opin Clin Nutr Metab Care 2006; 9(3): 289-96.

[92] Goldman AS, Hopkinson JM, Rassin DK. Benefits and risks of breastfeeding. Adv Pediatr 2007; 54: 275-304.

[93] Benefits of breastfeeding. Nutr Clin Care 2003; 6(3): 125-31.

[94] Ip S, Chung M, Raman G, Chew P, Magula N, DeVine D, et al. Breastfeeding and maternal and infant health outcomes in developed countries. Evid Rep Technol Assess (Full Rep) 2007(153): 1-186.

[95] Wolf JH. Low breastfeeding rates and public health in the United States. Am J Public Health 2003; 93(12): 2000-10. 7

[96] Singhal, A. The early origins of atherosclerosis. Adv. Exp. Med Bio. 2009; 646: 51-58.

[97] CDC. Breastfeeding Trends and Updated National Health Objectives for Exclusive Breastfeeding --- United States, Birth Years 2000--2004. MMWR. August 3, 2007; 56(30); 760-763.

[98] Grummer-Strawn LM, Mei Z. Does breastfeeding protect against paediatric overweight? Analysis of longitudinal data from the Centers for Disease Control and Prevention Paediatric Nutrition Surveillance System. Paediatrics 2004; 113(2): e81-6.

[99] Gillman MW, Rifas-Shiman SL, Camargo CA, Jr., Berkey CS, Frazier AL, Rockett HR, et al. Risk of overweight among adolescents who were breastfed as infants. JAMA 2001; 285(19): 2461-7.

[100] Leon DA. Ronalds G. Breast-feeding influences on later life-- cardiovascular disease. Adv Exp Med Biol. 2009; 639: 153-66.

[101] Schwarz EB, Ray RM, Stuebe AM, Allison MA, Ness RB, Freiberg MS, Cauley JA. Duration of lactation and risk factors for maternal cardiovascular disease. Obstet Gynecol. 2009; 113(5): 972- 973.

[102] Curtis S, Jou H, Ali S. A randomized controlled trial of sucrose and/or pacifier as analgesia for infants receiving venipuncture in a paediatric emergency department. BMC Pediatr. 2007;7: 27. [PMC free article] [PubMed]

[103] Taddio A, Shah V, Hancock R, Smith R, et al. Effectiveness of sucrose analgesia in newborns undergoing painful medical procedures. Canadian Medical Association. 2008; 179 (1): 37-43.

[104] Kumar P. Prevention of pain in neonates. JAMA. 2008; 300(19): 2248-49.

[105] Sucrose. 3Dchem.com Web site. http://www.3dchem.com/molecules.asp?ID=59 Published December 1996. Updated November 26, 2011.

[106] Drug Information Portal. Search for Sucrose. National Library of Medicine Web site. http://druginfo.nlm.nih.gov/drugportal. updated November 26, 2011.

[107] Gibbins, Sharon McDonald et al. The efficacy and safety of sucrose for procedural pain relief in preterm and term neonates. A thesis submitted in conformity with the requirements For the degree of doctor of philosophy Graduate department of nursing science University of Toronto. 2001. 24-43.

[108] Harrison D, Johnston L, Loughnan P. Oral sucrose for procedural pain in sick hospitalized infants: A randomized controlled trial. J Paediatric Child Health 2003; 39: 5917.

[109] Stevens B, Yamada J, Ohlsson A. Sucrose for analgesia in newborn infants undergoing painful procedures. In: The Cochrane Library, Oxford: Update Software 2004.

[110] Harrison, D.M. Oral Sucrose for pain management in infants: Myths and misconceptions. Journal of Neonatal Nursing 2008, 14, 3946.

[111] Stevens B, Yamada J, Beyene J, Gibbins S, Petryshen P, Stinson J, et al. Consistent management of repeated procedural pain with sucrose in preterm neonates: Is it effective and safe for repeated use over time? Clin J Pain 2005;21: 5438.

[112] Harrison D, Loughnan P, Manias E, Johnston L. The effectiveness of repeated doses of oral sucrose in reducing procedural pain during the course of an infant's prolonged hospitalisation. J Paediatric Child Health 2007;43: A20.

[113] Stevens B, Yamada J, Ohlsson A. Sucrose for analgesia in newborn infants undergoing painful procedures. Cochrane database of systematic reviews, 2010, Issue 1.

[114] Merkel S et al. The FLACC: A behavioral scale for scoring postoperative pain in young children. Journal of Paediatric Nursing (Pediatr Nurs); 1997, 23(3): 293-97.

[115] Razak AA, El N. Effect of breastfeeding on pain relief during infant immunization injections. Int J Nurs Pract. 2009; 15: 99-104.

[116] Anand K. The International Evidence Based Group for Neonatal Pain. Consensus statement for the prevention and management of pain in the newborn. Archive of Paediatrics and Adolescent Medicine 2001; 155: 173-180.

[117] Ramponi DR. Reducing pain in pediatric minor emergency procedures. J Emerg Nurs. 2009; 35: 379-82. [PubMed]

[118] Carbajal R, Chauvet X, Couderc S, Olivier-Martin M. Randomised trial of analgesic effects of sucrose, glucose, and pacifiers in term neonates. BMJ 1999; 27: 1393-7.

[119] Gradin M, Finnstro¨m O, Schollin J. Feeding and oral glucose—additive effects on pain reduction in newborns. Early Hum Dev 2004; 77: 57-65.

[120] Ors R, Ozek E, Baysoy G, Cebeci D, Bilgen H, Türküner M, et al. Comparison of sucrose and human milk on pain response in newborns. Eur J Pediatr 1999; 158: 63-6.

[121] Skogsdal Y, Eriksson M, Schollin J. Analgesia in newborns given oral glucose. Acta Paediatric 1997; 86: 217-20.

[122] Gray et al. Breast feeding is analgesic in healthy newborns. Paediatrics April 2002; 109; 4: 590-593.

[123] Phillips RM, Chantry CJ, Gallagher MP. Analgesic effects of breast-feeding or pacifier use with maternal holding in term infants. Ambul Pediatr. 2005; 5: 359-64.

[124] Modares M, Rahimpour V, Mehran A. The effect of breast feeding during injection on injection pain in infants. J Hayat. 2006; 12: 31-7.

[125] Barr RG, Young SN, Wright JH, Cassidy KL, Hendricks L, Bedard Y, et al. Sucrose analgesia and diphtheria-tetanus-pertussis immunizations at 2 and 4 months. J Dev Behav Pediatr 1995; 16: 220-5.

[126] Harrison D, Stevens B, Bueno M, et al. Efficacy of sweet solutions for analgesia in infants between 1 and 12 months of age: A systematic review. Arch Dis Child 2010; 95: 406-413.

[127] Cohen LL. A multifaceted distraction intervention may reduce pain and discomfort in children 4-6 years of age receiving immunization. Evid Based Nurs. 2010; 13: 15-6. [PubMed]`

[128] Efe E, Ozer ZC. The use of breastfeeding for pain relief during neonatal immunization injections. Appl Nurs Res. 2007; 20: 10-6.

[129] Young KD. Paediatric procedural pain. Ann Emerg Med. 2005; 45: 160-171.

[130] Irani H, Esna Ashar M, Maarizi P, Naseri F. Oral glucose effect on newborn pain. Journal of Medical Sciences - Gonabad. 2005; 11(1): 5-9.