International Journal of Community Medicine and Public Health
Gurung A et al. Int J Community Med Public Health. 2022 Jan;9(1):59-65
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20214981

Original Research Article

Effectiveness of breastfeeding for pain relief in infants during vaccination at Bharatpur

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Received: 22 October 2021
Accepted: 02 December 2021

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ABSTRACT

Background: Vaccination is an integral part of childhood development since it protects children from a variety of diseases. It is, however, the most common cause of pain in children. Breastfeeding is effective tool for reducing pain in infants during vaccinations. The objective of the study was to determine the effectiveness of breastfeeding for pain relief in infants during vaccination.
Methods: A true experimental pretest and posttest design was conducted at Maternal and Child Health Clinic at Bharatpur, Nepal among 140 infants receiving pentavalent vaccines (Diphtheria, Pertussis, Tetanus, Hepatitis B and Hemophilus influenzae B). A structured interview schedule was used to collect socio-demographic information of mothers and infants. Bio physiologic method was used to determine biological and physical status of the infants. Modified behavioral pain scale was used to measure the level of pain in infants in both the control and experimental groups.
Results: The study revealed that the total modified behavioral pain scale (mean ±SD after vaccination was 8.74±0.53 in control and 8.23±1.07 in experimental respectively. The study showed that breastfeeding had significantly lowered pain level ($p<0.001$) and lessened duration of cry ($p=0.002$) in infants in experimental group than in control group after vaccination. However, related to injectable vaccination, the study showed that breastfeeding did not significantly stabilized heart rate in infants in both the groups ($p=0.122$).
Conclusions: The study concluded that the infants who were breastfed experienced less pain than those who were not breastfed during vaccination.

Keywords: Breastfeeding, Infants, Pain relief, Vaccination

INTRODUCTION

The common reason for pain and discomfort in infants is vaccination which is given to almost all children on a regular basis during their childhood. The pain associated with such injections is a source of distress for infants, their caregivers, and those who administer the injections, and if remains unaddressed, this pain can lead to potential pre-procedural anxiety, needle phobia, and health-care avoidance habits, such as non-compliance with vaccination schedules.[1]

Needles-related painful procedures are needed for various reasons, such as childhood immunization and medical procedures, which cause discomfort among children at the time of such procedures. Following needle-related procedures, many children experience anxiety and fear, as well as altered pain responses later in life.[2]

Children who are frequently exposed to painful stimuli develop changes in thermal pain responsively, which include increased perceptual sensitivity to continuous painful stimulation, hypoalgesia to acute heat pain stimuli, and activity-induced changes in the functioning

of pain pathways that last well beyond childhood.[3] Breastfeeding is thought to lessen pain perception of noxious stimuli by combining different senses and skin to skin contact.[4]

In the case of vaccination, pain is a perception that is frequently neglected in the baby population. Infants may perceive and recall pain, as evidenced by their heightened pain reactions to various painful operations later in life. Breastfeeding is an intervention that combines such traits, and it has lately been researched for its capacity to reduce infants' pain perceptions.[5]

Breastfeeding was found to dramatically reduce physiological parameters such as heart rate, the amount of time spent crying, the duration of the initial cry, and even pain score in the study. According to the findings of the study, breast milk should be utilized to relieve discomfort in neonates during difficult procedures.[6]

Recognizing the significant consequences of untreated pain in infants, national guidelines for evidence-based pain assessment and management approaches have been established. Breastfeeding is a recommended intervention for procedural pain control in such guidelines.[7]

Breastfeeding during unpleasant procedures has been associated with reductions in pain in neonates with variety of reasons which can be summarized as: maternal odor, antinociceptive action, skin-to-skin contact, milk's sweet taste, and sucking.[8]

Breastfeeding nourishes infants and gives comfort as well as an analgesic impact for non-pharmacological pain relief during painful procedures.[9] A recent systematic review exhibited that behavioral responses of cry duration and composite pain scores are consistently decreased with breastfeeding during and following vaccinations compared to no treatment, oral water, oral dextrose, maternal cuddling, massage, vapocoolant spray, and topical anesthetic.[10]

National Immunization Program is one of the most important program in Nepal which focuses on reduction of mortality of children under 5 years of age. National immunization schedule includes total 8 vaccines which include BCG (Bacillus Calmette Guerin), Pentavalent Vaccine (Diphtheria, Pertussis, Tetanus, Hepatitis B and Hemophilus influenzae B), OPV (Oral Polio Vaccine), PCV (Pneumococcal Conjugate Vaccine), rotavirus vaccine, FIPV (Fractional Injectable Polio Vaccine), MR (Measles-Rubella), JE (Japanese Encephalitis).[11]

Research hypotheses

H_{01} = There will be no significant difference in the level of pain associated with vaccination among infants in breastfeeding group and non-breastfeeding group.

H_{02} = There will be no significant difference in heart rate associated with vaccination among infants in breastfeeding group and non-breastfeeding group.

H_{03} = There will be no significant difference in the duration of cry associated with vaccination among infants in breastfeeding group and non-breastfeeding group.

Following alternate hypotheses were formulated:

H_1 = There will be significant difference in the level of pain associated with vaccination among infants in breastfeeding group and non-breastfeeding group.

H_2 = There will be significant difference in heart rate associated with vaccination among infants in breastfeeding group and non-breastfeeding group.

H_3 = There will be significant difference in the duration of cry associated with vaccination among infants in breastfeeding group and non-breastfeeding group.

METHODS

The study was carried out in Maternal and Child Health (MCH), Bharatpur Sub-Metopolitan-10, Chitwan, Nepal. Maternal and Child Health Clinic is a government institution which is run under Public Health Unit of Municipality. It provides different services related to maternal and child like immunization for under five children and also provide antenatal, postnatal services, family planning and health education for all the women who were attending at Maternal and Child Health clinic.

The study population was the infants aged less than 6 months who were brought for pentavalent vaccine (Diphtheria, Pertussis, Tetanus, Hepatitis B and Hemophilus influenzae B) at MCH clinic at Bharatpur, Chitwan.

Study design and study population

True experimental pretest and posttest design was used to find out the effectiveness of breastfeeding for pain relief in infants receiving vaccination. Breastfeeding infants age less than 6 months brought at Maternal and Child Health clinic for pentavalent vaccination, without concurrent illness, and mothers who were willing to participate in the study.

Infants excluded from the study if they were brought MCH for other types of vaccination. Infants were randomly assigned into experimental and control groups.

Experimental group was observed for dependent variables (pain, heart rate and cry duration) before and after intervention whereas control group was also observed for dependent variable with no any intervention. Eventually

results were compared between experimental and control groups.

Sample size and sampling technique

A sample size of 140 was calculated using the sample size formula for a finite population and infants were randomized to either experimental or control group who met the inclusion criteria. The randomization list of 140 infants was prepared from the computer by using IBM SPSS version 20 before data collection. In the randomization list, 140 infants were listed as either control or experimental group and randomization list was used to assign infants either to control or experimental groups during data collection. The infants were assigned according to their arrival. The infant who came first for pentavalent vaccine was assigned as random number 1 and the second one as random number 2 and assigned to either control or experimental group on the basis of randomization list. Likewise, other infants were also assigned according to randomization list. Non probability consecutive sampling technique was used for the selection of the infants brought Maternal and Child Health clinic for pentavalent vaccination.

Table 1: True experimental pretest and posttest design on the effectiveness of breastfeeding for pain relief in infants during vaccination.

Groups	First observation	Intervention	Second observation
Experimental group (R)	O_1	X	O_2
Control group (R)	O_3	–	O_4

Data collection

Data collection was done from 11th August, 2019 to 6th September, 2019. Data was collected by using structured schedule, face to face interview, biophysiologic method and observation pain scale (modified behavioral pain scale). Instruction was given to the nurses regarding procedures to be followed during data collection. Firstly, infant who met the inclusion criteria for the study was selected for the study. Permission and informed consent were taken from all the mothers of infant to participate in the study by explaining about the purpose of the study. Infants were randomly assigned in experimental and control groups using randomization list which was prepared on IBM SPSS 20 version. Data was collected from those mothers of infants who were less than 6 months attending MCH for pentavalent vaccination. Mother's and infant's privacy were maintained by interviewing each mother in separate corner of the MCH clinic. Face to face interview took approximately 5-8 minutes to interview the mothers of infants for socio-demographic information, anthropometric data such as weight, length were obtained. Level of pain and physiological parameter such as heart rate were monitored before vaccination in both the groups. The information provided by respondent and the obtained findings were kept confidential by giving code number instead of mother's and infant's name.

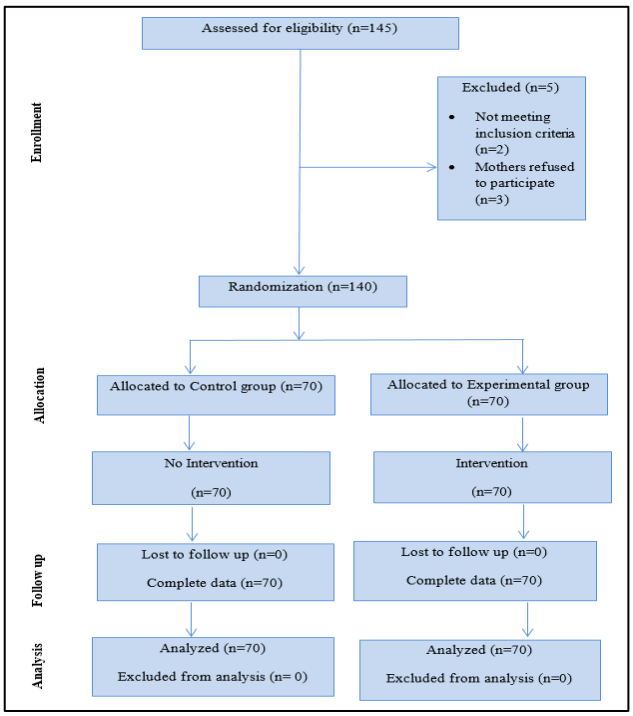

Figure 1: Schematic representation of study design on the effectiveness of breastfeeding for pain relief in infants during vaccination.

Experimental group

In experimental group, the breastfeeding position recommended by the World Health Organization for mothers was adopted to the infants (baby's head and body are in a straight line; the baby face the breast; the baby's nose opposite her nipple; hold the baby's body close to her body; the baby's whole body, not just the neck.[12]

The nurse, who administered the vaccine, placed herself in the appropriate position when administering vaccine.

Both legs of the baby were held by the other nurse without applying pressure during vaccination to administer vaccine properly to the right location.

Allow mother to breastfeed infants for 2 minutes. After 2 minutes of breastfeeding, researcher notified the nurse to perform vaccination. The nurse who performed vaccination notified the researcher by saying in and out of needle at the time of vaccination. The level of pain was observed immediately after insertion of injection. Heart rate of infant was monitored within 2 minutes after insertion of injection. The total duration of cry was recorded with electronic stopwatch by the researcher. The infant was ensured to breastfed for 2 minutes after

administering the vaccine. The mother was allowed to hold, talk, or rock the baby after the procedure in both groups.

Control group

In control group, injection was administered with no pain control intervention. All the procedures were same as in experimental group.

Data collection

The official approval was obtained from Chitwan Medical College (CMC), School of Nursing. Data was collected after getting ethical clearance from Institutional Review Board and approval letter from Chitwan Medical College, School of Nursing, Bharatpur-5. The researcher submitted the written request letter from CMC, School of Nursing to Bharatpur Metropolitan City, Office of Municipal Executive. Data collection was done from 11th August, 2019 to 6th September, 2019. Data was collected by using structured schedule, face to face interview, biophysiologic method and observation pain scale (modified behavioral pain scale). Instruction was given to the nurses regarding procedures to be followed during data collection.

Data analysis

All the collected data was reviewed and checked daily for its completeness, consistency and accuracy. Coding and organizing were done before data entry. The data was entered into IBM statistical package for the social sciences (SPSS) version 20 for analysis. Data was analyzed using descriptive statistics and inferential statistics. Data was summarized using descriptive statistics such as frequency, percentage, mean, median and standard deviation. The Mann-Whitney U test was used to compare differences between two independent groups (experimental and control groups) regarding level of pain, heart rate and duration of cry. Analyzed data were presented in tables and interpreted accordingly.

Ethical consideration

The official approval was obtained from Chitwan Medical College (CMC), School of Nursing. Data was collected after getting ethical clearance from Institutional Review Board and approval letter from Chitwan Medical College, School of Nursing, Bharatpur-5. The researcher submitted the written request letter from CMC, School of Nursing to Bharatpur metropolitan city, office of municipal executive. Permission and informed consent were taken from all the mothers of infant.

RESULTS

Table 2 depicts socio demographic characteristics of mother. The distribution shows that highest proportion (84.29 %) of the mothers were in the age group 20-30, whereas equal 7.9 percent of them were age less than or equal to 20 and greater than 30. The median age of mothers was 26 with range of 16 to 40. Majority (97.86%) of the mothers were literate. Among literate mother (137), highest proportion (64.23%) had secondary education. Regarding ethnicity, 43.57 percent belonged to Brahmin whereas 32.86 percent of them were Janajati, only 15 percent were Chhetri, least proportion (8.57%) of them were Dalit. Majority of the mothers were Hindu religion (88.57%) and homemaker (81.43%). Distributions of respondents across the units of the hospital and details of socio-demographic characteristics are as shown in Table 2.

Table 2: Socio demographic characteristics of mothers (n=140).

Variables	Number	Percentage
Age (in years)		
≤20	11	7.86
21-30	118	84.29
>30	11	7.85
Median age=26, IQR=Q3-Q1=28-24 , min=16, max=40		
Education status		
Illiterate	3	2.14
Literate	137	97.86
Level of education (n=137)		
Basic education	8	5.84
Secondary education	88	64.23
Bachelor and above	41	29.93
Ethnicity		
Brahmin	61	43.57
Chhetri	21	15.00
Janajati	46	32.86
Dalit	12	8.57
Religion		
Hindu	124	88.57
Non Hindu	16	11.43
Occupation		
Home maker	114	81.43
Working mothers	26	18.57

Table 3 shows information related to infants in which age of the infants ranged from 6 weeks to less than 23 weeks in the experimental and control groups. Half of the infants i.e. (50%) in control group were in 6-11 weeks age group, whereas in experimental group only 31.43 percent. The median age was 12 weeks with range of 6 to 23.

Female were found to be highest in both group which comprised of 54.29 percent in experimental group and 51.43 percent in control group whereas males were 48.57 percent and 45.71 percent in control.

Table 4 reflects distribution of infants according to pain scores on MBPS. The post vaccination score was 6-9 in both groups. After vaccination, (98.57%) infants

experienced severe pain in control group and (95.71%) in experimental group.

Table 3: Information related to infants (n=140).

Variables	Groups	
	Control No. (%)	Experimental No. (%)
Age (in weeks)		
6-11	35 (50.00)	22 (31.43)
12-17	27 (38.57)	32 (45.71)
18-23	8 (11.43)	16 (22.86)
Median=12, IQR=Q3-Q1=17-8, min=6, max=23		
Sex		
Male	34 (48.57)	32 (45.71)
Female	36 (51.43)	38 (54.29)
Types of vaccine		
Pentavalent I	33 (47.14)	19 (27.14)
Pentavalent II	17 (24.29)	28 (40.00)
Pentavalent III	20 (28.57)	23 (32.86)
Nutritional status		
Well nourished	64 (91.43)	66 (94.29)
Malnourished	6 (8.57)	4 (5.71)
Types of feeding		
Breastfeeding	44 (62.86)	45 (64.29)
Formula feeding	2 (2.86)	0 (0.00)
Mixed feeding	24 (34.28)	25 (35.71)

Table 4: Pain score of infants after vaccination (n=140).

Level of pain	Post-vaccination score		
	Obtained range (scores)	Control No. (%)	Experimental No. (%)
Mild (0-3)	6-9	0 (0.00)	0 (0.00)
Moderate (4-6)		1 (1.43)	3 (4.29)
Severe (7-10)		69 (98.57)	67(95.71)

Table 5 shows the pain score of infants after vaccination. After vaccination, the total mean score and standard deviation in control group and experimental group were 8.74 (0.53) and 8.25 (0.72) respectively. The mean percentage in control group was 87.4 and in experimental group, the mean percentage was 82.50 (Table 5).

Table 6 shows comparison of post vaccination pain score, heart rate and cry duration among infants. The post vaccination pain score in control and experimental group ranged from 6-9. The median post vaccination pain score was 9 in control group and 8 in experimental group. The test revealed that null hypothesis was rejected ($p<0.001$) which implies that breastfeeding is effective in reducing pain in infants during vaccination.

Table 5: Pain score of infants after vaccination (n=140).

Domains	Maximum possible score	Obtained range	Mean±SD		Mean percentage	
			Control	Experimental	Control	Experimental
After vaccination						
Facial expression	3	2-3	3.00±0.00	2.90±0.30	100.00	96.67
Cry	4	2-3	3.00±0.00	2.96±0.24	75.00	74.00
Movements	3	0-3	2.74±0.53	2.39±0.57	91.33	79.67
Total	10		8.74±0.53	8.25±0.72	87.40	82.50

Table 6: Distribution of infants according to the pain scores on modified behavioral pain scale (MBPS) (n=140).

Groups	Pain score		Heart rate (beats per minute)		Duration of cry (seconds)	
	Range	Median	Range	Median	Range	Median
Control group	6-9	9	108-168	146	14.56-84.00	47.77
Experimental group	6-9	8	102-166	146	10.69-79.20	38.10
P value	<0.001		0.122		0.002	

The heart rate in control group after vaccination ranged from 108 to 168 beats per minute (bpm) and in experimental group, it ranged from 102-166 bpm. After vaccination, both control group and experimental group had a median of 146. The test revealed that null hypothesis was retained ($p=0.122$) which signifies that breastfeeding has no role in stabilizing heart rate in infants after vaccination.

The median cry duration was 47.77 seconds in control group and experimental group had median cry duration of 38.10 seconds after vaccination. The result showed that infants in experimental group had significantly lesser duration of cry as compared to control group. The minimum duration of cry was 10.69 seconds in experimental group. The test revealed that null hypothesis was rejected ($p=0.002$) which implicit that breastfeeding

is effective in reducing the duration of cry in infants after vaccination (Table 6).

DISCUSSION

Concerning to this study, pain score of infants varied before and after vaccination. The total modified behavioral pain scale (mean ±SD) in control group and experimental group were 8.74±0.53 and 8.23±1.07.

The study reported total DAN (Douleur Aigue de Nouvea-ne) pain score (mean ±SD) was 6.78±1.69 and 3.52±1.37 in control and experimental groups.[8] Moreover, study showed that infant's feeding from their mother's breasts leads to a reduction in pain caused due to blood sampling from their heel. The median pain score of the neonates when breastfed was 1.50 and 4.00 when not breastfed (p=0.0001).[14]

The study conducted among 100 term neonates and were randomly assigned into two groups using lottery method without replacement. During BCG vaccination, experimental group neonates were exposed to own mother milk odor and non-experimental group was deprived from it. The findings showed that the mean rank of pain was 32.89 in mother breast milk exposed neonates whereas in non-exposed group it was 62.11 with p value of <0.001. The NIPS (neoantal and infant pain scale) score was found to be significantly lower in neonates exposed to the mother breast milk odor than in non-exposed group which is consistent with the study.[15]

The study reported that median pain scores (interquartile range) for breast feeding, held in mother's arms, placebo, and 30% glucose plus pacifier groups were 1 (0-3), 10 (8.5-10), 10 (7.5-10), and 3 (0-5) with the Douleur Aiguë Nouveau-né scale and 4.5 (2.25-8), 13 (10.5-15), 12 (9-13), and 4 (1-6) with the premature infant pain profile scale. Analysis of variance showed significantly different median pain scores (p<0.0001) among the groups. There were significant reductions in both scores for the breast feeding and glucose plus pacifier groups compared with the other two groups (p<0.0001), two tailed Mann-Whitney U tests between groups) which support the study.[16]

Comparison of post vaccination pain score, heart rate and cry duration among infants using Mann-Whitney U test

The median of post vaccination pain score was 9 in control group and 8 in experimental group. The pain score ranged from 6 to 9 in both control group and experimental (p<0.001), rejecting null hypothesis which indicates that there was statistically significant difference in intensity of pain among experimental and control groups.

The study showed that the neonatal infant pain scale (NIPS) was significantly lower in experimental group compared to the control (Mann-Whitney tests).[10] The finding of the study revealed that there were significant differences in behavioral pain scores of two groups in all parts include: facial expression (4 items), cry (5 items), and movements (p<0.0001).[17]

Regarding heart rate, it ranged from 108 to 168 bpm in control group and 102-166 bpm in experimental group after vaccination. The median heart rate in both groups (p=0.122) was 146, retaining null hypothesis which indicates that there was no significant difference in heart rate among experimental and control groups.

The study showed that breastfeeding method prevented the increase of heart rate (p≤0.05) which is contrasted to this study.[10] The finding of the study is different than the study conducted which represent that infant's heart rate before and after immunization for intervention and control groups was a statistically significant difference between the mean distribution for heart rate before and after immunization between intervention and control groups (p<0.005).[9]

Regarding cry duration, control group had median cry duration of 47.77 seconds and experimental group had 38.10 seconds. The minimum duration of cry in experimental group was 10.69 seconds. The duration of cry ranged from 14.56 to 84 seconds in control group whereas in experimental group it ranged from 10.69 to 79.20 seconds (p=0.002), rejecting null hypothesis which indicate that there was statistically significant difference in duration of cry among experimental and control groups.

These finding is supported by other studies. The study demonstrated that babies who were breastfed had significantly shorter duration of crying in experimental group as compared to the control groups. The total of crying time, mean (SD) was 20.5 (16.2) in experimental group and 45.1 (14.5) in control group with p value <0.01.[10] The study showed that there was statistically significant difference in duration of crying among experimental and control group which supports this study (p<0.05).[4] The study revealed that the infants in experimental group had significant lesser duration of cry as compared to infants in control group (p<0.01).[3]

The effect of breastfeeding as decreasing length of infants crying during painful procedures has been reported by the study during blood sampling.[6] The study represents different types of crying among infants for intervention and control groups, which shows a significant difference between the length of audible cry, free cry and end of crying among infants for intervention and control groups which supports the finding of the study. The study revealed that the duration of crying was reduced more among infants in the intervention group than in the control group (125.33±12.18 and 148.66±13.96 respectively) which is consistent with the study.[9]

Limitations of the study was that this study was conducted in only one Maternal and Child Health Clinic, Bharatpur.

CONCLUSION

Conclusion of the study has been drawn on the basis of the study findings. The study shows that breastfeeding has significantly reduced level of pain and lessened duration of cry in infants after vaccination whereas; breastfeeding has no role in stabilizing heart rate in infants in both the groups. It is concluded from the present study that breastfeeding is the effective method for alleviating infant's pain sensation. Breastfeeding is effective and has a soothing effect to reduce pain during immunization. This pain reduction approach can be easily adopted as a part of standard injectable immunization programmes.

The study can be conducted among infants going through other painful procedures, receiving vaccines other than pentavalent vaccines and painful invasive procedures. Breastfeeding for infants shall be promoted during vaccine injection for relieving their pain sensation. Similar types of study can be conducted among infants receiving vaccination in a large scale.

ACKNOWLEDGEMENTS

Authors like to thank all the mothers and their infants for their participation in the research.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee Chitwan Medical College, School of Nursing, Bharatpur-5

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Cite this article as: Gurung A, Bajracharya S. Effectiveness of breastfeeding for pain relief in infants during vaccination at Bharatpur. Int J Community Med Public Health 2022;9:59-65.