✣ **RESEARCH PAPER** ✣

Effect of breast-feeding on pain relief during infant immunization injections

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Using a quasi-experimental design, this study was conducted in two maternal & child health centres in Jordan to examine the effects of breast-feeding on pain relief during neonatal immunization injections. Inclusion criteria were first year of age, breast-fed and no concurrent illness. Infants were divided into two groups (of 60 infants for each). One is intervention group: mothers were taken to a private room, seated and reclined on a comfortable chair with their infants awake in their arms, without cloth and with clean diapers. The mothers cradled their infants during breast-feeding to maintain full-body skin-to-skin contact during immunization injections. The other is control group: infants were observed during routine immunization in maternal & child health centres. Pain responses of infants during and after immunization were assessed by using Facial Pain Rating Scale and Neonatal/Infant Pain Scale (NIPS), before, during and after the procedure. Infants' heart rates and duration of crying for both groups were calculated. Findings revealed that the crying time was shorter in intervention (breast-fed) group than in the control group with a statistically significant difference in the duration of crying during and after immunization. We concluded that, breast-feeding and skin-to-skin contact significantly reduced crying in infants receiving immunization.

Key words: breast-feeding, immunization, pain.

INTRODUCTION

Breast-feeding is more than nourishing infants with mother's milk; it provides comfort as well as serves as a pacifier for a non-pharmacological pain relieving during painful procedure.[1] Routine immunization injections are the most common painful procedures in childhood. Most of these injections are administered early in child's life.[2]

Painful experience in infants should be anticipated and prevented as much as possible. Studies have shown that children as young as 2–3 days of age remember painful experience as documented by their reaction to later experience.[3] So when nurses are going to inject the child, they should try to control it as much as possible.[4] Despite the magnitude of the effect of pain in immunization on an infant, it often inadequately assessed and treated.[5] Moreover, pain experienced by infants during and after common hospital procedures that cause tissue damage, for example, heel stick can be palliated by some components of the nursing suckling complex. In addition, various tastes and flavours of milk produce analgesic as well as

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milk protein and fat can reduce crying, grimacing, heart rate, oxygen saturation and other physiologic pain index in premature and full-term infants.[6]

Although a little is known about these pain-relieving mechanisms, the function of mother–infant interaction serves as a means of preventing and/or reducing pain and stress.[7] Holding infants during immunization can reduce crying by 17% compared with control infants who received their immunization while being restrained on the examination table.[8] Also studies represented that holding, rocking and skin-to-skin contact have been shown to effectively modulate the pain responses of newborn during a heel stick procedure. This markedly reduces crying and grimacing as well as breast-feeding before, during and after invasive procedure.[9,10]

Breast-feeding is an effective analgesic easily implemented and safe intervention against pain sensation in the newborn infants.[11] So, the aim of the study is to assess the effects of breast-feeding on pain relief during infant immunization injection.

METHODS

Setting

The study was conducted at two maternal & child health centres (Ain-El Basha and Abo-nsair) in Amman, Jordan.

Design

A quasi-Experimental design was used in this study.

Subjects

Inclusion criteria

The subjects of this study were 120 infants chosen according to the following inclusion criteria: full-term, age between 1 and 12 months old, breast-feed, no concurrent illness. The mothers and infants who met the inclusion criteria were invited to participate in the study.

Exclusion criteria

Infants were excluded from the study if they had a concurrent illness, preterm, not on breast-feeding or had a diagnosis of cerebral palsy, or have intrauterine growth retardation.

Tools

A questionnaire was developed, based on the review of relevant literature, to assess the effects of breast-feeding on pain relief during infant immunization injections. It comprised three parts:

Part one

Addressed information related to sociodemographic data such as age, occupation, level of education, and obtained information about medical and obstetrical histories.

Part two

Infant record included gestational age, birthweight, length, age, sex and method of delivery. Heart rate was measured at two occasions before and after injection. Duration of crying was calculated for all infants by stopwatch from the insertion of the injection up to the cessation of crying. Then, it was calculated and analysed into audible cry, free cry and end cry.

Part three

Neonatal/Infant Pain Scale[12] and Facial Pain Rating Scale by Wong and Baker[13] were used to assess and observe pain during vaccination and matched infant responses with the two scales. Those two scales were chosen according to their consistency with the infant age as well as their validity and reliability. Neonatal Infant Pain Scale (NIPS) inter-rater reliability = 0.92–0.97, internal consistency alpha: $r = 95$, 79 and 88 for before, during and after the procedure respectively. Construct validity $P \leq 0.001$ and the concurrent validity $r = 0.53$–0.84. The second scale used is the Facial Pain Rating Scale developed by Wong and Baker[13] that is the easiest scale used universally. There is a universal facial expression for pain in infants. The forehead becomes wrinkled with furrow; the eyes are kept tightly closed; the nose bulges; the nasal labial fold becomes deep; the mouth is open and squarish; and when the baby cries the tongue quivers. The score ranged from 0 to 5. Score 0 represented no hurt, 1 little hurt, 2 hurt little more, 3 hurts even more, 4 hurts whole lot and 5 hurts worst. Score more than 3 indicates pain.

Informed consent

- Permission was taken from authorized personnel to conduct this study.
- All eligible mothers were informed about the aim of the study and the methodology in the vaccination room before the infant immunized, and their questions were answered, then the informed consent was taken orally before the study begins.
- All staff nurses were carefully instructed at the beginning of the study on the methodology.
- All infants included in the study were divided into two equivalent groups (of 60 infants):

Intervention group: mothers were taken to a private examination room, seated and reclined on a comfortable chair with their infants in their arms after the infants clothes were taken off and soiled diapers were changed. The mothers cradled their infants during breast-feeding to maintain full-body skin-to-skin contact during immunization injections. All infants were awake at the time of the procedure. The study was initiated when the infants were observed to have a large amount of areola in their mouth. The infants were breast-fed before, during and after the injection. The mothers were encouraged to continue breast-feeding their infants even if they started to cry during and after the injections. If the infants stopped sucking, the mothers were encouraged to stimulate the infants to continue breast-feeding.

Control group: not received breast-feeding and restrained by their mothers during vaccination injection.

- Data were collected from March 2007 to October 2007. All groups received prenatal care according to the approved model.

Statistical analysis

Data were analysed by using SPSS, statistical software (SPSS Inc, Chicago, IL, USA). Chi-squared, descriptive statistics (Mean ± SD, frequency and percentage for category data) and confidence interval (95 %) were used to analyse the data.

RESULTS

Table 1 represents the distribution of demographic characteristics for mothers between intervention and control groups. Mothers' ages were ranged from 18 up to more than 35 years; more than 30% (33.3%) of mothers' age were distributed around 20 years for intervention group and around 25 years for control group (31.7%). Approximately, one-third of mothers (30%) were distributed equally for educational level between intervention and control groups for preparatory and secondary school respectively. Majority of mothers were house wives for both groups (73% and 63%) and prim Para.

Table 2 shows biosocial infant characteristics and their measurements. The mean and SD for infant age were nearly equally distributed for intervention and control groups (8.13 ± 1.52 and 9.33 + 2.048 respectively). Distribution of male infants were greater among control group (70%) than intervention group (58.3%), and female infants were vice versa as well as their gestational age (39.12 ± 1.05 and 37.45 ± 6.66 for control and intervention group respectively). Also the anthropometric measurements were nearly equally distributed for both groups.

Table 1 Demographic characteristics of mothers between intervention and control groups

Demographic characteristics	Intervention group $n = 60$		Control group $n = 60$	
Mothers' age (years)	N	%	N	%
> 18	4	6.7	8	13.3
20	20	33.3	18	30.0
25	13	21.7	19	31.7
30	12	20.0	9	15.0
< 35	11	18.3	6	10.0
Education				
Read and write	16	26.7	17	28.3
Preparatory	18	30.0	12	20.0
Secondary	15	25.0	18	30.0
High university	11	18.3	10	16.7
Occupation				
House wife	44	73.3	38	63.3
Working	16	26.7	22	36.7
Parity				
Prime	38	63.3	29	48.3
Multi-par	22	36.7	31	51.7
Total	60	100.0	60	100.0

Table 3 shows infants' duration of crying between intervention and control groups.

The mean and SD for breast (intervention) group were different significantly than the control group ($P < 0.005$).

Table 4 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

Table 5 represents infants' heart rate before and after immunization for intervention and control groups. There was a statistically significant difference between the mean distribution for heart rate before and after immunization between intervention and control groups ($P < 0.005$).

In Table 6, majority of pain distribution among intervention group represents a little more pain (38%) than

Table 2 Infant distribution according their demographic characteristics between intervention and control groups

Demographic characteristics	Intervention group $n = 60$		Control group $n = 60$	
Age (months)	N	%	N	%
< 4	16	26.7	18	30.0
6	14	23.3	12	20.0
8	10	16.7	15	25.0
10	18	30.0	7	11.7
> 12	2	3.3	8	13.3
	8.13 (M)	1.52 (±SD)	9.33 (M)	2.048 (±SD)
Gestational age (weeks)	37.45 (M)	6.66 (±SD)	39.12 (M)	1.05 (±SD)
Weight (g)	9.133 (M)	4.26 (±SD)	11.64 (M)	4.13 (±SD)
Length (cm)	62.35 (M)	2.54 (±SD)	66.35 (M)	3.41 (±SD)
Sex				
Male	35	58.3	42	70.0
Female	25	41.7	18	30.0

Table 3 Distribution of infants according to their duration of crying between intervention and control groups

Duration of crying	Intervention group $n = 60$		Control group $n = 60$			
Duration of crying (s)	N	%	N	%	*T*	*P*
60	12	20.0	10	16.7	4.1	0.382
80	4	6.7	11	18.3		
100	17	28.3	13	21.7		
120	10	16.7	4	6.7		
140	2	3.3	2	3.3		
160	5	8.3	5	8.3		
180	5	8.3	7	11.7		
200	5	8.3	8	13.3		
	125.33 (M)		148.66 (M)			
	12.18 (±SD)		13.96 (±SD)			

Table 4 Distribution of type of crying among infants of intervention and control groups

Types of crying	Intervention group		Control group		*P*-value
Audible cry	N	%	N	%	$\chi^2 = 17.69$
	10	16.7	39	65.0	$P < 0.5$
Free cry	35	58.3	15	25.0	
End Cry	15	25.0	6	10.0	
Total	60	100.0	60	100.0	

Table 5 Heart rate distribution for infants between intervention and control groups

Heart beats (per minute)	Intervention group $n = 60$		Control group $n = 60$			
	M	±SD	M	±SD	*T*	*P*
Before	128.590	15.450	125.220	29.150	2.016	1.330
After	149.210	20.510	162.250	40.220	4.061	—

control group, which represents hurts even more Score 3 that indicate pain.

Table 7 represents facial responses of infants regarding pain during immunization.

Table 6 Facial pain rating scale

Neonatal/infant facial pain rating scale	Intervention group $n = 60$		Control group $n = 60$		*P*-value
	N	%	N	%	
No hurt	8	13.3	0	0.0	$\chi^2 = 35.5$
Hurts little	10	16.7	3	5.0	$P < 0.05$
Hurts little more	23	38.3	12	20.0	
Hurts even more	5	8.3	23	38.3	
Hurts whole lot	8	13.3	10	16.7	
Hurts worst	6	10.0	12	20.0	

Table 7 Neonatal/infant pain rating scale for intervention and control groups

Neonatal facial pain	Intervention group $n = 60$		Control group $n = 60$	
0	8	13.3	0	0.0
1	10	16.7	3	5.0
2	23	38.3	12	20.0
3	5	8.3	23	38.3
4	8	13.3	10	16.7
Hurts worst	6	10.0	12	20.0

More than one-third of control group (38.3%) represented hurts even more pain during vaccination

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 [3] our study not representing a statistically significant difference regarding sociodemographic data, among intervention and control groups. However, researchers suggested that age, gender, temperament. Previous painful experience and cultural background contribute to the child's pain experience. Obviously, these factors can not be altered between intervention and control groups but they can be recognized as a moderator for pain experience. Sample under investigation are infant; 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.

Duration of crying (s) was reduced more among infants in the intervention group than in the control group (125.33 ± 12.18 and 148.66 ± 13.96 respectively). This reflects the penfecilarity of breast-feeding over other types of pain reduction as destruction of attention. In addition, breast-feeding is an effective, easily implemented and safe intervention against pain sensation in newborn infants. Studies suggested that holding, rocking and skin-to-skin contact have been shown effectively to modulate the pain responses of infants during a heel stick procedure, which markedly reduce crying and grimacing during and after an invasive procedure. Although a little is known about these pain-relieving mechanisms, the function of mother–infant interaction serves as a means of preventing and/or reducing pain and stress among infants.[7]

Also the present study used type of crying as an indicator of pain; the analysis of pain into three components (audible cry, free cry and end cry) provided us with objective assessment tools. So we found that breast-feeding was associated with significantly reduced total crying time in infants receiving an immunization injection. Also the time of audible cry in the intervention group was (16.7%) as opposed to (65.3%) in the control group, which represent the most intense pain from immunization injection. So, the analysis of type of crying is not only a crude tool for assessment of distress in infants but also an objective measurement for pain intensity, which represent the sedative effect of breast-feeding. In addition, oral tactile stimulation acts via activation of endogenous opoids pathway of pain.[11] However, the present study do not allow us to investigate which component of the suckling acts contributes to the most the analgesic, but we investigate the end product of interaction between breast-feeding acts and elimination of pain sensation. Another support for those results was expressed by Blass[6] who mentioned that component of nursing, suckling, complex in addition to various tastes and flavours of milk causes analgesic as well as milk protein and fats reduce crying, grimacing, heart rate, oxygen saturation and other physiological pain index in full-term infants. So we explore the clinical efficacy of breast-feeding as an analgesic in the immunization clinic as a supplement to

the natural practice of infant-soothing effect practiced by mothers and single nurse practioner.

Infants of intervention group mostly experienced no hurt or little hurt pain (13% and 16.7% respectively) during the procedure. This result is consistent with that of Gray *et al.*[10] who found that eight of 15 infants fed by their mothers during immunization procedure did not cry at all, and crying was reduced by 83% as compared with control infants. In contrast there is another sector of intervention group 13.3% compared with 16.7% of infants between intervention and control groups have a hurt whole lot and 10%, 20% have hurt worst. This can be interpreted as the immunization have been administered, but the distress they engender has not been examined with the attention or rigor that might be predicted on the basis of their frequency (Barclay, 2007).[3] In addition, infants in the intervention group were easily sucking and swallowing their mother milk during and after the immunization without the problems of aspiration, vomiting, cyanosis or respiratory changes during the procedure.

The study revealed that there is a significant difference in heart rate between the intervention and control groups. This is another indicator for the efficacy of the intervention or using breast-feeding as a soothing effect for pain reduction during invasive procedure. This result is consistent with that of Gray *et al.*[9] who reported that breast-feeding can prevent increased heart rate in full-term neonates. In contrast, a discrepancy was shown by Grunau *et al.*[14] who studied 136 infants for identifying their pain reactivity after recurrent heel sticks procedure and heart rate. The researchers observed higher resting heart rate expressed for early and frequent pain exposure in youngest infant, which was associated with the development of perceptual state of stress. In addition Taddio *et al.* [15] reported an exaggerated response to pain associated with routine immunization in full-term male newborn previously exposed to circumcision without anaesthesia.

We concluded from this study that breast milk, sucking, skin-to-skin contact and holding during immunization decrease the behavioural signs of pain (crying) as well as the physiological signs (heart rate). So, breast-feeding has a soothing effect to reduce pain during immunization and is very effective, convenient, safe to implement, readily available as well as easy for nurses to supervise. This pain reduction approach can be easily adopted as a part of standard immunization injection programmes.

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