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Effect of Implementation of Cue Based Feeding Technique on Premature Infant Feeding Outcomes and Parent Satisfaction

تأثير التغذية القائمة على العلامات على نتائج تغذية الأطفال المبتسرين ورضاء الأبوين

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Abstract
Background: *Premature infants faces numerous challenges in their feeding due to immaturity of the body system, so, in the premature infant, oral feeding skills must be learned and require that the caregiver work with the infant to develop effective feeding abilities. In addition to the development of effective and safe oral feeding skills, must beimportant nursing care goaland a significant clinical focus.**Aim:***The aim of this study wasto evaluate the effect of implementation of cue based feeding technique on premature infant feeding outcomes and parent satisfaction.**Design:***A quasi- experimental pre and post intervention was utilized in this study*. ***Setting:*** *This study was carried out in ten incubators and/or beds in the tertiary care of neonatal intensive care unit(NICU) at Mansoura University Children's Hospital.* ***Sample:****The sample composed of 68 premature infants and their mothers after fulfilling the inclusion criteria. The samplewas divided into two groups, the experimental (34) and the control group (34).Tools: Data were collected through the following tools:(1) Which included two parts: a-Demographic characteristics of premature infants. b-Premature infants feeding data. (2) Interview questionnaire sheet, it consisted of: a-Socio-demographic data of mothers. b- Questionnaire to assess the mothers' knowledge about cues based feeding. (3): Parent satisfaction tool, and (4): Infant-driven feeding scale.* ***Results:*** *The present study revealed that, premature infant in both groups having problems during feeding but after intervention there was a statistical decrease of problems in the experimental group. There was a statistically significant differences, regarding to the readiness ofinfants to nipple feed and quality of nippling (P<0.05) between both groups after intervention and there was highly statistically significant difference (P<0.001) between both groups post intervention in relation to the studied premature infants' feeding outcomes (weight gain, head circumference &time to full nippling) and length of hospital stays. Also the study revealed that more than three quarter (82.4%) of studied mothers in experimental group were satisfied as compared with more than one quarter (29.4%)of studied mothers in control group were satisfied, there was a highly statistically significant difference between both groups (P<0.001).* ***Conclusion:*** *The present study concluded that, premature infants who were feed by cue based feeding technique exhibited weight gain and their parent exhibited more satisfaction.**The study recommended**that theeducational intervention program should be implemented inNICUto improve nurses' knowledge and practice about infant cue based feeding technique, as well as future plans for re-educating the mothers on the infant's cues based feeding technique.*

Key words*: Premature infant, oral feeding, cue based feeding technique, parent satisfaction*

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I. Introduction

Premature infants have immature gastrointestinal systems and neuromuscular and this demonstrate of many challenges in their feeding. In contrast to full term infants, who are able to oralbreastfeed from birth, most premature infants got to be fed either byintragastric tube or by alternative methods (cup, spoon, etc.) during the first few weeks of life. The timing and frequency of such feeding methods are usually determined by healthcare providers rather than by the premature infants themselves**(1).**

Oral feeding is a skill that is automatically activated in the full term infant, however, in the premature infant, oral feeding skills must be learned and requires that the caregiver work with the infant to develop effective feeding abilities **(2).**Theability to feed orallyis crucial for newborns. Adequate and safe oral feeding depends on complete development of (sucking, swallowing, breathing & their coordination), to minimize oxygen desaturation, apnea,bradycardia,aspiration and improve feeding potency.Premature infants must be fed by orogastricor nasogastric tubes till they develop their ability to orallyfeeding. Many studies have revealed that,

oral feeding is thatthe most complicatedneonatal behavior that requiring the physiological coordination of cardiorespiratory, gastrointestinal and neurological systems**(3&4).**

Neurodevelopmental pathways could also be negatively altered in a premature infant experiencing stressful feedings. Stress happens once an infant is forced to finish known volume of feeding to keep with a schedule despite the absent of demonstration of readiness cues. Stressful feedings have the tendency to result in not only short term complications,but longfeeding inadequacies e.g. dysphagia and oral aversion **(5).**The premature infant is usually diagnosed with failure to thrive, this is often could also be a common diagnosis for premature infants as a direct result of unknown diagnoseddysphagia and feeding disorders in the neonatal intensive care unit (NICU) **(6).**

Cue based feeding is a feeding technique, where the infants direct how and when can eat by exhibit specific feeding cues and feeding reflexes. Feeding cues, e.g. rooting reflex, or suck on fingers are known asterm cues, wherever the infant indicates that he's ready to receive oral feeding**(7).**Cue based feeding may be help in the establishment of independent oral feeding, weight gain, earlier hospital discharge and improve parent experience. Decreasing length of hospital stay has a direct impact on hospital cost **(8).**

Cue based feeding for premature infants is currently recommended as a technique to increase the period of breastfeeding in the UNICEF child friendly hospital initiative ten steps to successful breastfeeding into NICU**(9).** There is also alternative advantages for the family and caregivers, principally permitting parents to feel additional directlyattached with their infant's feeding and increasing their confidence and skills to recognize and respond to their infant's feeding needs throughout their hospital stay and on the far side, increased parental satisfaction may be a key quality indictor in evaluating the effectiveness of family centered care in NICUservices **(10).**

Cue based feeding techniquehasstressed the caregiver's role in feeding skills development. Through assessing the feeding readiness and infant's feeding ability, caregivers would be able to effectively andsafelyguide premature infant toward achieving oral feedingcompetency**(11)**.

Significant of study

The complexity of oral feeding skills results in an infant's inability to wean from tube feeding may lead to delay hospital discharge and mother infantbonding, whereas increasing maternal stressand medical care cost. There are two problems caregivers face once when giving oral feeding such as premature infant inability to end their feedings safely due to fatigue or physiological instability and achieving an appropriate rate of independent oral feeding **(12).** Since persistent feeding problems canhave important consequences for premature infants and their families, the development of effective and safe oral feeding skills, must be important nursing care goal and a significant clinical focus, throughout the last weeks of hospitalization **(11).**

Premature infant's ability to orally feed well is closely associated with the caregiver's abilities to recognize and reply to the infant's behavioral nonverbalcommunication. Most common cues include quiet wakefulness, fingers' sucking andhand to mouth gestures. Crying is a last feeding cues, mouthing, tongue gesture, arm waving, kicking, stretching, cycling legs and grunting were often exhibited before crying. Waiting for premature infants to cry before feeding would possibly mean caregiver has already missed key initial feeding cues and will end in poor latching in breastfed infants, also gulping and air swallowing. For a premature infant, crying for feeds wastes energy and effort additionally as increasing stress level at such a vulnerable developmental stage. If the standard of oral feed takes priority more than the quantity ingested, feeding skills would possibly develop pleasurably and at the infant's own pace, improving the parents' expertise of nurturing their premature infants and their satisfaction of infant care **(13**). Hopefully, this study would provide a cue based feeding technique that might improve the premature infants' outcomes and parent satisfaction in NICU.

Aim of study

The aim of this study was to evaluate the effect of implementation of cue based feeding technique on premature infant feeding outcomes and parent satisfaction.

Operational definition:

-Time to full nipple feeding: It's defined as the period in days from admission to accomplishment of full oralbottle feeding without nasogastric or orogastric support for enteral feeding.

-Infantdriven feeding (infant cue feeding): It's a method of feeding infants in response to feeding readiness cues and showed oral feeding ability.

-**Scheduled interval feeding:** It's defined as regular feeding infants either orally or through an intragastricfeeding tube at three to four hourlyintervals tocomplete a prescribed intake.

Research hypotheses

To achieve the aim of this study, the following hypotheses were tested:

H_1: That cues based feeding technique will decrease the premature infant problems during the oral feeding.

H_2: That cues based feeding technique will improves the premature infants feeding cues as measured by readiness scale, quality nippling scale and caregiver technique scale and that there will be a statistical significance difference between the experimental and control group.
H_3: There will be a significant improvement in premature infant feeding outcomes as measured by increase body weight, increase head circumference and time to full nipple feeding after implementation ofcues based feeding technique.
H_4: There will be a significant improvement in mean knowledge scores of mothers andmean parent satisfaction scores after implementation cues based feeding technique.

II. Subject and Methods

Research design:
A quasiexperimental pre-test and post-test research design was utilized in this study.
Setting:
This study was carried out in twelve incubators and/or beds in the tertiary care of neonatal intensive care unit at Mansoura University Children's Hospital,while, health care provided for cases who are prepared for discharge.
Sampling:
-Sample size
According to **Messer (14)** who studied "Infant-driven feeding vs.scheduled feeding: theeffect on hospital length of stay". A previous study showed that the infant birth weight in the intervention group and the control group was (1450.71±217.77 & 1249.0 ±213.833respectively). Considering level of significance of 5% and power of study of 80%, and mean difference of 150 gm is satisfactory, the sample size can be calculated using the following formula:
$N = [(Z_{\alpha/2} + Z_{\beta})^2 \times \{2(SD)^2\}]/ (\text{mean difference between the two groups})^2$
Where:
SD = standard deviation
$Z_{\alpha/2}$: This depends on level of significance, for 5% this is 1.96
Z_{β}: This depends on power, for 80% this is 0.84
Therefore
Sample size (n) = $[(1.96 + 0.84)^2 \times \{2(217.77)^2\}]/ (150)^2$=33.05
The sample size needed for each group is 34.
Based on the abovementioned formula, the sample composed of 68 premature infants and their mothers. They are divided randomly to 2 identical groups, the experimental (34) who receivecuebasedfeeding pattern,and the control (34) who receive schedulefeeding pattern,based on thepolicy ofNICU. Study samplewas selectedafter fulfilling the inclusion criteria such as,gestational age less than 37weeks of gestation, birth weight less than 2500 grams, both gender, who are deemed feeder/growers (as evidenced by decreasing IV fluids, increasing enteral feedings, showing cues for oral feeding). While premature infants who have gastrointestinal tract malformations, neurological defects and required longer ventilator support were excluded. Mothers' inclusion criteria: mothers of having premature infants regardless their age and educational level and attending the previously mentioned setting to manage their infants.

Tools and techniques of data collection
Tool (I):
1- Demographic characteristics of premature infants: That collectedfrom premature infant's medical and nurses' sheets e.g. gender, diagnosis, gestational age, birth weightandhead circumference on admission.
2- Premature infants feedingdatainclude:(a) Premature infant's age at which enteral feeds were initiated. (b) Premature infant's age at which full enteral feeds were achieved.(c) Premature infants age at first nipple feeding by bottle. (d) Premature infants age at full oral feedings by breast or bottle.(e) Number of incidents of apnea,bradycardia, desaturation, number of incidents of gagging, choking during oral feedings (daily total).
3- Feedingoutcomes criteria include: weight andhead circumference at discharge, time to full nippling and length of hospital stay.
Tool (II): Interview questionnaire sheet:
It was designed by researchers after reviewing related literature **McCormick et al. (15)**,it was written in simple Arabic language and it includes the following:
1-Socio-demographic data of mothers: such as age, residency, level of education, mother's job and family size.
2- Questionnaire to assess the mothers' knowledge: It was developed by **McCormick et al. (15),** it was consisted of 21 questions, open, closed ended and multiple choice questions related to feeding cues, hunger cues e.g.going from a sleep to awake state, hands to mouth, suckingmovement, sucking on pacifier and rooting.Infant feeding readiness cues and nipplingquality.This tool was used before and after implementation of the cuebased feeding technique intervention.

Scoring system

The scoring system for mothers' knowledge was developed; the correct answer was given the score (1) and incorrect or unknown answer was given score (zero). The scores obtained for each question was summed up to get the total score for the mothers' knowledge, the total score was computed out and converted into percentage and categorized into: Less than 50% is considered poor, 50% to less than 65% is considered average and 65%or more is considered good.

Tool (III): A parent satisfaction tool

A parent satisfaction tool, adopted from **Colaizy and Morriss(16),** it was utilized to evaluate satisfaction of parent when feed of their premature infant with cuebased feeding technique. Parents were asked using a 4-point Likertscale ranging from strongly agrees to strongly disagree about feelings of mothers with infant care. The responses of the parents were summed up and the total score were categorized as satisfied (scores ≥50%) or unsatisfied (scores <50%). This tool was administered post intervention before infant discharge from the NICU.

Tool (IV): Infantdriven feeding scales

It were adopted from **Ludwig andWaitzman (17),**it were utilized to assess readiness of prematureinfant to oral feeding,a method of nipple feedings documentationand a guide for intervention. It were consisted of 3 scales that should beutilized togethersuch as premature infant's readiness to oral nipple feeding and quality of nipplingscales, also the technique done by the mother during feeding the infant. It were utilized in incorporation with accurate observation and documentation of oral nippling quality,duration, time and types of nipple, provide the healthcare staff and mothers a clearer image about the oral feeding abilities ofpremature infant.

Feeding readiness scale

Developed by **Ludwig and Waitzman (17),** itevaluates the infant's behavioral cues forfeedingreadiness. Based upon the readiness assessment determine the appropriateness of offering oral feeding either by bottle or by breast feeding with the mother and determine whether or not, the feeding was a safe and positive experience for the infant.

Scoring system

Score (1)wheninfantdrowsy, alert or fussy before routine care, rooting, takes pacifier and hands to his mouth. Also, good muscles tone. Score (2)if infantalert or drowsy once they are handled for care, sometimes rooting reflex and takes pacifier, with adequate muscles tone.While score (3) if infantbriefly alert with care, no rooting reflex and no change in muscles tone. Score (4) if infant sleeps during routineinterventions, no hunger signsadditionally, no change in muscular tone. Finally score (5) when infant wasneed moreoxygenationduringroutine intervention, also, may be havingbradycardia, apnea, and is tachypneicmore than beforeroutine care.

Score 1 and 2 indicate infant ready to bottle or breast feeding, while score 3 and 4 indicate limited bottle or breast feeding and score 5 indicate infant need gavage feeding only.

Quality of nipplingscale

The scale developed by**Ludwig and Waitzman (17),**it was usedto observe, assess and document the infant's feeding cues by using one to five score. While if thecalculated amount of milk istaken among twenty minute was considered effective oral feeding.

Scoring system

Score (I) infant should demonstrate a powerfulcoordinated sucking throughout the oralfeeding experience. Score (2) nipples with a strong coordinated sucking at the beginning of oral feeding but fatigue can be occur at the end of feeding. While score (3) indicated that an infant with a regular suckingwithuncoordinating the swallowing. Score (4) nipples with inconsistentanda poor suckingwith low rhythm or without rhythm, also, may be needs rest periods throughout the feeding. Score (5) when the infant is incapable andnot able to coordinate between sucking, swallowing and breathing, which might causesignificant decrease of heart rate or apnea. Continuous assessment and document of the scores should be done until the infant was taken full oral feeding without gastric tube feeding support.

Total scoring system for quality of nippling:Score (1) indicate oral feeding is well, score (2) and (3) indicate oral feeding fair, while score (4) indicate oral feeding poor and score 5 indicate infant unable to oral feeding safely.

Caregiver Techniques Scale

The scale was developed by**Ludwig and Waitzman (17),** it aid in feeding, it considered as a parameter for the health careproviders to determine which technique was needed to support the premature infant during oral feeding so that,mothers should be taught to apply them effectively ifrequired at home, appropriate caregiver techniques includes:

a-External pacing,was used if an infant unable to independently coordination between sucking, swallowing and breathing.It's used when nurse observethat the premature infant unable to breath or was flooded with milk, through permitting milk to return inside the bottle with the nipple still inside the oral cavity.

b-Modified side lying is usually the appropriate technique was used for premature infants duringoral feeding. Infant in side lying position with headhigher than the infant's feet to decrease risk of choking.
c-Support of the chin was used to prevent of the nipple released outside the mouth with every suck movementalso,this technique may assist in removing of the nipple at the end of feeding.
d- Support of the cheek wasmostly applied to reduce oral cavity space for higher oral cavitypressure and suction. Cheek support is alsogiven throughbilaterally orunilaterally support by the fingers of caregiver.
e-Oral stimulation exercises, the caregiver wear gloves and dipped her finger in the milk, after that put it inside infant's mouth. Thistechnique is used throughout scheduled tube feeding to promote the coordination between sucking,swallowing and breathing. Premature infants should be assessed witheachoral feeding for used ofcaregiver techniquesand documentation on feeding record.
Caregiver technique scalewas completed in alphabetic letters to differentiate it from premature infants' responses, increased numbers of techniques selected indicate less readiness of infant to orally feed and /or feeding that could be unsafe.

Validity and reliability of tools

Tool 1and 2were reviewed by a panel of three expertise in the pediatric nursing before introduce it to the participants to ensure its validity and their comments were considered. While the third and fourth tools were standardized, thereliability of third tool was tested giving Cronbach's α of 0.849 and thereliability of fourth tool wastested giving Cronbach's α of 0.827.

Ethical considerations

An official permission gained from the director of hospital and the head of the NICU after an explaining the aim, tools, duration and the usefulness of the study. As well as approval oral consent was gainedfrom the mothers of premature infants after explaining the aim, the usefulness and the time/duration of the study. They were assured about the confidentiality of the collected data. The researchers informed the mothers about their right to withdraw from the study at any time and their rights to accept or reject their infant's participation without interference with the care provided to their infants.

Pilot study

It was done on ten percent of the studiedpremature infants and their mothers (n=7mothers and 7premature infants) to assess the feasibility, clarity and applicability of the tool and some modifications were done. Mothersand premature infants in the pilot were not included in the study.

Field of work

Data collection of the present study was carriedout over duration of seven months from first of May 2016 till the end of November 2016. The researchers were available in the study setting 3days per week from 9 A.m. to 12 p.m. Each mother was individually interviewed using the previously mentioned study tools. The questionnaire and the answers were marked by the researchers; 15minutes was needed to complete the questionnaire. The study subject divided into two groups, the experimental (the infant's cues based feeding) group, in this group the oral feeding wasstartedbased on the infant's hunger cues and finished when the infantsshow satisfaction. In addition to mothers of this group receive educational intervention about infant cues based feeding. The control (the scheduled interval feeding) group, feeds are given to the premature infant at scheduled regular intervals regardless the infant's hunger cues or sleep time, a sleepy premature infant are awakened to oral feed and if they were not wakened sufficiently, fed them through thegastric tube feeding. The premature infants in both groups have received the same types of milk.

The application of cue based feeding technique intervention was carried out in four phases:

1-The assessment phase: Consisted of the pre and post-test for assessing mothers' knowledge about feeding cues using tools (2), assess of premature infant feeding readiness using the infantdriven feeding scales which consisted of 3 scales "feeding readiness for oral feeding, caregiver techniquesand quality of nippling", assess of premature infant body weight, head circumference were done pre and post intervention and time to full nippling was done post intervention only.Prematureinfants were assessed using tools (1&4) with every feeding and scores were documented on the premature infant feeding evaluationrecord, which was developed by researchers. Once premature infantbecomephysicallystable, mature and that was coordinated with feeding readiness standard, oral feedingshould bebegin.

2-The planning phase: Involved designing the infant cues based feeding topicswhich organized according to priority of mother'sneeds.The content was composed of gestational development of feeding cues, infant hunger cues, feeding evidence protocol and benefits of practice change, all of this for educate themabout feeding cues recognition, and appropriate feeding techniques.

3- Implementation phase:Cue based feeding intervention was carried out through 3 phases:

Phase I: Concentrated on educational intervention, mothers were participated in three educational sessionsthreetimes/week. Onesession cover the theoretical part which included on infant cues based feeding technique, educate the mother how to assess the infant's for potential feeding on demand and two practical sessions to cover practice regarding infant feeding. Every session took about 20- 30 minutes using many teaching methods such as lectures and group discussion, practical demonstration and redemonstration. Teaching media such as a video, power point presentations and hand out; mothers were interviewed in a private room.

Phase II: After completion of educationalsessions for all mothers to assure consistency of feeding guidelines, phase II was started. Premature infantswere observed their readiness for oral feeding by the researchersusing tool 4, which consisted of three scales (feeding readiness, caregiver technique and quality of nippling), the premature infantwhoobtainedscore (1) in readiness for feeding scale and in quality of nippling scale, indicate that infant ready to oral feeding and well nippling.While increased number of caregiver techniques selected indicates less readiness to orally feed. The researchers were trained premature infants for non-nutrient sucking through the researchers' finger during enteral feeding.

Phase III: In this phase the premature infant wasfeed orally in response to cues of oral feeding such as rooting reflex and/or sucking on their fingers. Oral feeding was stopped based onsatisfaction cues, like asleep and/or unable to keep up sucking of milk. If infants did not pretendcues of oral feeding within 5 hours should be aroused to feed orally or given a prescribed volume of milk throughgavage feeding tube. This cuesbased feeding technique was applied for two weeks before premature infants discharge from NICU and the researchers was educated the mother to apply this technique at home after discharge, also the staff nurses working in NICU was educated about of infant cuesfeeding technique to apply it throughout the routine care for infants in experimental group, through explain and demonstration of this technique.

4-The evaluation phase:

Comparison between the experimental and control group's findings was done to evaluate the effect of application of a cues based feeding technique on premature infants feeding outcomes and parent satisfaction post intervention.

Statistical Design

All Data was analyzed using SPSSfor windows version 20.0 (SPSS, Chicago, IL). Continuous data were expressed in mean ±standard deviation (SD) while categorical data were expressed in number and percentage. The differences between two groups were determined using Student's t test for variables with continuous data and chi-square test for variables with categorical data. Statistical significance was set at $P<0.05$ and highly statistical significance at $P<0.001$.

III. Results

Table (1) showed that, more than half of the studied premature infants (55.9%) were girls in experimental group and (52.9%) were boys in control group. The tableshowed that less than half (44.1% &47.1%)respectivelyof the studied premature infants in experimental and control groups were diagnosed with jaundice followed by respiratory distress syndrome (RDS), more than one third (41.2% & 35.3%) respectively then sepsis with a mean gestational age31.3 ±2.5weeks in the experimental group and 31.4 ±3.6weeks in control group. Mean birth weight of 1712.7 ±253.3gm in experimental group and 1792.7 ±201.2gm in the control group. The mean premature infants age at which enteral feeds were initiated was 2.4±0.5days in experimental and2.0±0.9days in control group, thedifference was astatisticalinsignificantbetween the both groups ($P>0.05$). While mean premature infant age at which full enteral feeds were achieved was 11.8 ±2.8days in experimental and 13.8 ±2.9days in control group. Thedifferencewas a statistical significant between two groups ($P<0.05$). The mean premature infant age at first nipple feeding by bottle was 16.9 ±1.5 days in experimental and 18.6 ±1.0 days in control group, while premature infant age at full oral feedings by breast or bottle was 22.6 ±2.0days in experimental and 31.0 ±2.2 days in control group. Thedifferencewas high statistical significant between both groups ($P<0.001$).

Table (2) revealed that, premature infants in both groups werehavingproblems during the oral feeding, there was no statistical significant difference between both groups before intervention, while after intervention, thedifferencewas a statistical significant between both groups ($P<0.05$).

Table (3) showed the percentage distribution of the premature infants as regards feeding cues in both experimental and control groups. It was clarified that there were no statistically significant differences betweenboth groups before intervention, while after intervention, majority (88.2%) of premature infants in experimental group had readiness cues for oral feeding compared with less than two third (61.8%) in control group. As regards thequality of nippling the present study revealed that (58.9%, 38.2% & 2.9%) were well, fair and poor respectively in experimental group compared with (29.4%, 58.9% &11.8%) were well, fair and poor respectively in control group. Thedifferencewas a statistical significant between both groupspost intervention ($P<0.05$). As regards the caregiver technique the present study revealed that half (50%) of premature infant in experimental group do not need caregiver technique during oral feeding compared with less than onequarter(

20.6%) in control group and there was no statistically significant difference between both groups in pre and post intervention P value at (0.732&0.218) respectively.

Table (4) illustrated that, there was no statistical significant difference between both groups before intervention, while post intervention there was a highly statistically significant difference (P<0.001)between both groups in relation to the studied premature infants' weight and there was a statistically significant difference (P<0.05)between both groups regarding to head circumference,In addition there was a highly statistical significance difference between both groups (P<0.001) regarding to time to full nippling and length of hospital stays.

Table (5) This table revealed that, less than three quarter of studied mothers (70.6%) in experimental group and less than two third of mothers(61.8%) in control group were in the age group from 20-<30 years. In addition, half of mother (50%) in experimental group and more than half (52.9%) in control group were secondary educational level. As regards mothers' job, more than half of the mothers (55.9% &58.9%) respectively in experimental and control groups were housewives. In relation to their mothers' residency, it was observed that, more than half (58.9%&52.9%)respectivelyin experimental and control groups were rural residency. Regarding to family size, the present study revealed that, (52.9%&47.1%) of studied mothers in both groups respectively their family size were four persons. There was no statisticaldifferences between the two groups (P>0.05).

Figure (1): Illustrated that,none of the mothers participated in this study had any knowledge about the infants cues based feeding before the intervention. While, after the intervention, less than two third (61.8%) of the mothers in experimental group had good knowledge about the infants cues based feeding compared with the mothers in the control group still had no good knowledge. The differences between the two groups after intervention were highly statistical significant (P<0.001).

Figure (2): Clarifiedparents' satisfaction about their infants'cues based feeding technique post intervention. It was clear that, more than three quarter (82.4%) of studied mothers in experimental group were satisfied as compared with less than one third (29.4%) of studied mothers in control group were satisfied. Thedifferencewas a high statistical significant between both groups(P<0.001).

Table (1): Demographic characteristics andfeeding data of the premature infants in both control and experimental groups (n=68).

Variables	Experimental (n=34)		Control (n=34)		Chi square test	
	N	%	N	%	X^2	P
Gender						
Boy	15	44.1%	18	52.9%		
Girl	19	55.9%	16	47.1%	0.530	0.467
Diagnosis						
RDS	14	41.2%	12	35.3%		
Sepsis	5	14.7%	6	17.6%		
Jaundice	15	44.1%	16	47.1%	0.148	0.929
Gestational age (wks)	31.3 ±2.5		31.4 ±3.6		0.165	0.870
Birth weight (gm)	1712.7 ±253.3		1792.7 ±201.2		1.442	0.154
Preterm infants age at which enteral feeds were initiated	2.4 ±0.5		2.0 ±0.9		1.894	0.063
Preterm infants age at which full enteral feeds were achieved	11.8 ±2.8		13.8 ±2.9		2.899	0.005*
preterm infants age atfirst nipple feeding by bottle	16.9 ±1.5		18.6 ±1.0		5.761	<0.001**
Preterm infants age at full oral feedings by breast or bottle	22.6 ±2.0		31.0 ±2.2		16.593	<0.001**

(*) statistically significant at P≤0.05.(**) Highly statistically significant at P≤0.001

Table (2): Premature infant problems during the oral feeding in both control and experimental groups (n=68).

Variables	Experimental (n=34)		Control (n=34)		Chi square test	
	N	%	N	%	X^2	P
Pre						
Apnea	4	11.8%	5	14.7%		
Bradycardia	7	20.6%	6	17.6%		
Desaturation	5	14.7%	6	17.6%		
Gagging or choking	13	38.2%	13	38.2%		
Nothing	5	14.7%	4	11.8%	0.39	0.983
Post						
Apnea	2	5.8%	5	14.7%		
Bradycardia	3	8.8%	5	14.7%		
Desaturation	2	5.8%	5	14.7%		
Gagging or choking	6	17.6%	11	32.4%		
Nothing	21	61.8%	8	23.5%	10.37	0.035*

(*) statistically significant at P<0.05

Table (3): Premature infants feeding cues in both control and experimental groups (n=68).

Variables	Experimental (n=34)		Control (n=34)		Chi square test	
	N	%	N	%	X^2	P
Readiness scale						
Pre						
Ready	19	55.9%	20	58.9%		
Limited	15	44.1%	14	41.2%		
Gavage only	0	0%	0	0%	0.06	0.970
Post						
Ready	30	**88.2%**	21	**61.8%**		
Limited	4	11.8%	13	38.2%		
Gavage only	0	0%	0	0%	6.353	0.012*
Quality nippling scale						
Pre						
Well	7	20.6%	8	23.5%		
Fair	22	64.7%	21	61.8%		
Poor	5	14.7%	5	14.7%		
Unable to nipplling	0	0%	0	0%	0.09	0.993
Post						
Well	20	**58.9%**	10	**29.4%**		
Fair	13	38.2%	20	58.9%		
Poor	1	2.9%	4	11.8%		
Unable to niplling	0	0%	0	0%	6.618	0.037*
Caregiver techniquescale						
Pre						
External pacing	9	26.5%	7	20.6%		
Modified side lying	3	8.8%	4	11.8%		
Chin support	2	5.8%	5	14.7%		
Cheek support	3	8.8%	5	14.7%		
Oral stimulation	15	44.1%	11	32.4%		
Nothing	2	5.8%	2	5.8%	2.794	0.732
Post						
External pacing	5	14.7%	6	17.6%		
Modified side lying	2	5.8%	3	8.8%		
Chin support	3	8.8%	4	11.8%		
Cheek support	2	5.8%	5	14.7%		
Oral stimulation	5	14.7%	9	26.5%		
Nothing	17	**50%**	7	**20.6%**	7.029	0.218

(*) statistically significant at P≤0.05.

Table (4): Premature infants cues based feeding outcomes in both control and experimental groups (n=68)

Variables	Experimental (n=34) Mean ±SD	Control (n=34) Mean ±SD	T test T	P
Pre weight (gm)	2123.4 ±259.8	2100.5 ±278.4	0.349	0.728
Post weight (gm)	2707.5 ±223.2	2271.5 ±194.8	8.3750	<0.001**
Pre Head circumference(cm)	31.7 ±1.1	31.3 ±1.9	0.999	0.322
Post Head circumference(cm)	33.9 ±0.8	32.6 ±2.3	3.045	0.003*
Time to full nippling(days)	16.4 ±2.8	29.5 ±5.9	11.785	<0.001**
Length of hospital stays(days)	25.3 ±9.1	37.3 ±9.4	5.391	<0.001**

(*) statistically significant at P<0.05.**(**)** highly statistical significance at P<0.001**.**

Table (5): Distribution of the studied mothers according to their characteristics in both groups(n=68).

Variables	Experimental (n=34)		Control (n=34)		Chi square test	
	N	%	N	%	X2	P
Age (years)						
< 20	5	14.7%	4	11.8%		
20-< 30	24	70.6%	21	61.8%		
30- <40	5	14.7%	8	23.5%	0.989	0.610
Educational level						
Illiterate	1	2.9%	0	0%		
Primary	2	5.8%	2	5.8%		
Preparatory	6	17.6%	5	14.7%		
Diploma	17	50%	18	52.9%		
Higher education	12	35.3%	10	29.4%	0.621	0.961
Mother's job						
Housewife	19	55.9%	20	58.9%		
Employee	15	44.1%	14	41.2%	0.06	0.806
Residence						
Urban	14	41.2%	16	47.1%		
Rural	20	58.9%	18	52.9%	1.679	0.195

Family size/ person						
Three	4	11.8%	6	17.6%		
Four	18	52.9%	16	47.1%		
Five	11	32.4%	12	35.3%		
> five	1	2.9%	0	0%	1.561	0.668

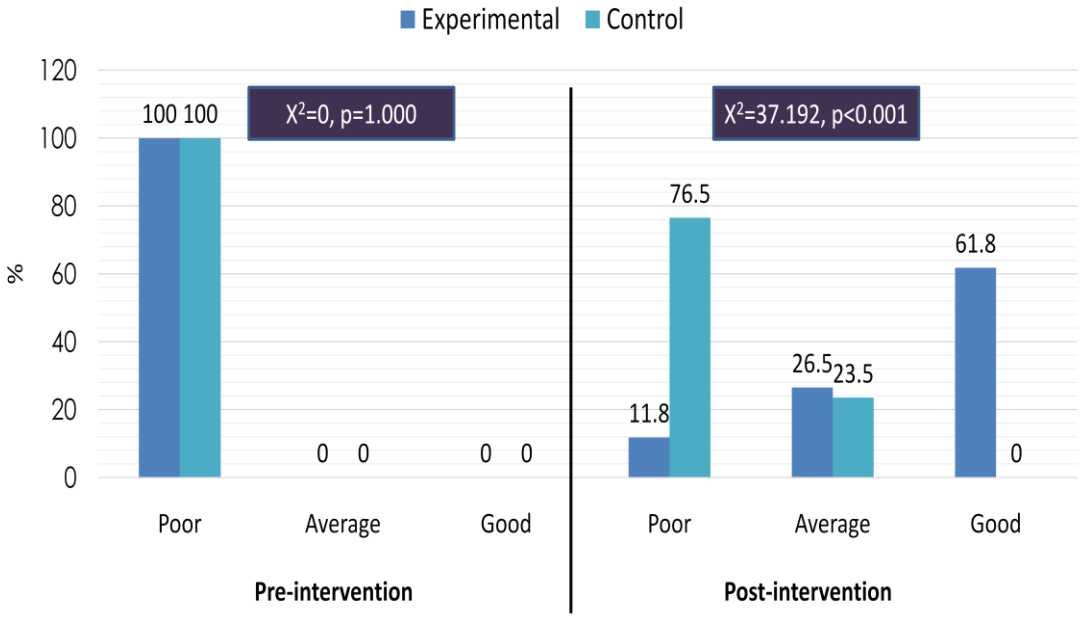

Figure (1): Distribution of total mothers' knowledge about infants cuesbased feeding in both groups post intervention (n=68)

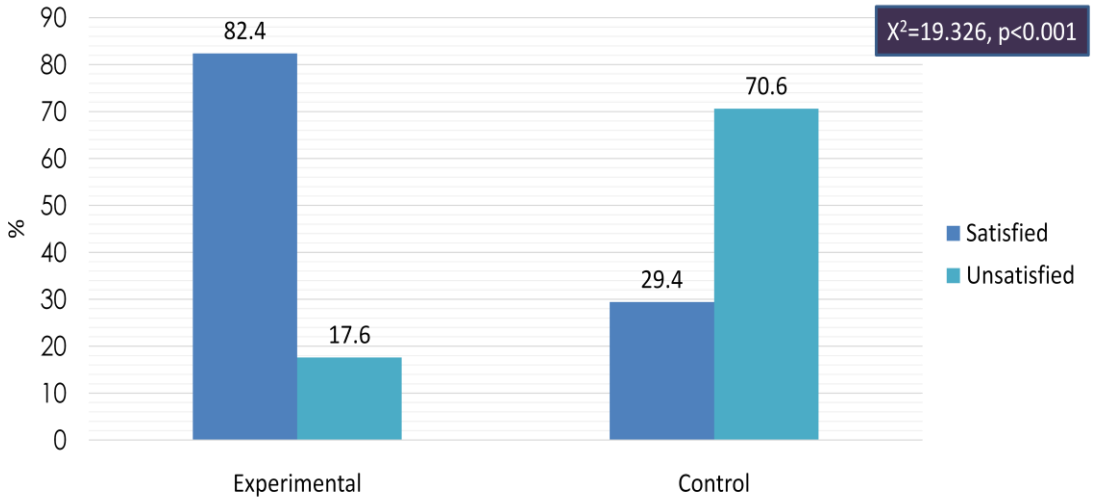

Figure (2): Parents satisfaction about their infants cues based feeding technique post intervention in both experimental andcontrolgroups (n=68)

IV. Discussion

Cue based feeding is a feeding technique, wherever the infant directs when and the way can eat by exhibit specific feeding cues and eating reflexes. Behavioral cues, such as, sucking on fingers, or rooting, also are known as approach cues, wherever the infant indicates that it's ready to receive feeding **Shaker (18).**Cue based feeding permits caregivers to guide infants toward successful feeding, instead of force them, when apply a cue based feeding protocol, nurses are be able to evaluate the neurological, physiologicalandbehavioral components of feeding readiness **Cormier (19)**.Therefore the aim of this study was to evaluate the effect of implementation of cue based feeding technique on premature infant feeding outcomes and parent satisfaction.

Regarding to demographic characteristics of both groups of the study **(Table 1),** the present study showed that there was noa statisticalsignificance difference between both groups of the study regarding to gender. Most cases admitted to NICU diagnosed with jaundice followed by respiratory distress syndrome and

sepsis in experimental and control groups, this result was supported by **McClure (20),** who studied "An evidence based approach to feeding the late preterm infant, in Seton Hall University". Who reported that preterm infants between 34 and 37 weeks of gestation have high incidence of hyperbilirubinemia, respiratory distress, temperature instability and hypoglycemiaand increase high risk for sepsis. This may be due to immaturity of the body system of the premature infant and increased of jaundice, respiratory distress and infection.

Regarding to gestational age there was no a statistical significance difference between both groups, this result was in agreement with **McClure (20),** who stated that feeding difficulties, pathological jaundice, infection and failure to thrive, were most common causes for readmission of preterm infants. This may be attributed to the premature infants were liable to many health problems like jaundice, infection and feeding difficulties which increase the incidenceof admission. The present study demonstrated that there was a statistical significance enhancement in the experimental group post intervention regarding to premature infants age at which full enteral feeds were achieved, premature infants age at first nipple feeding by bottle and premature infants age at full oral feedings by breast or bottle, this result was consistent with**Drenckpohl et al. (21),** who studied "Outcomes from oral feeding protocol implemented in the NICU in University of IllinoisCollege of Medicine at Peoria".They reported that, infants treated based on the new oral feeding protocol started oral feedings one week earlier (P= 0.05) and at an earlier gestational age than those on the old protocol (P=0.38), the new oral feeding protocol group had oral stimulation ordered for the infants, more than infants on the old protocol group, there wasa statistical significant difference between both groups (P= 0.003). This may be due to effect of cuebasedfeeding technique interventionon improvement and coordination of breathing, sucking and swallowing. The researchers were trained premature infants for non nutrient sucking through the researchers' finger during enteral feeding.

Oral feeding is the most complex neonatal behavior,requiring the physiological conjunction of important body systems and the coordination of sucking, swallowing and breathing **Bertoncellietal.**(**3).**Due to the complexity of oral feeding skills, several feeding problems for premature infants are related to the deficiency of a suck, swallow and breathe coordination. Regarding premature infants problems during the oral feeding **(Table 2),** the present study showed that premature infants in both groups before intervention were face problems like apnea, bradycardia, desaturation and gagging or choking during feeding, while after cues based feedingtechnique intervention there was decrease in problems in the experimental group than in control group. This result was in agreement with **Shaker (11),** who studied "Feed me only when I'm cueing: moving away from a volumedriven culture in the NICU in Florida hospital, Orlando".who reported that feeding problems can have significant sequel for infants and their families, the development of effective and safeoral feeding skills, must be a major clinical focus, and nursing care aim, during the final weeks of hospitalization.This was might due to the effect of infant cues feeding intervention on increasing the parents' awareness about the feeding problem and how to feed premature infant safely, also infant readiness for oral feeding, alert and well nippling this lead to infant oral feeding more safely.

Hence the research hypothesis (H_1) which stated that cues feeding intervention decrease the premature problem during the oral feeding was justified.

As regards premature infants feeding cues in both groups **(Table 3),** the current study demonstrated that there was no a statistically significant difference between both groups before intervention, while after intervention the majority of premature infants in experimental group had increase readiness cues for oral feeding and increase the quality nippling. Also regarding the caregiver technique the present study revealed that half of premature infants in experimental group do not need caregiver technique during oral feeding compared with less than one quarter in control group. This result was in consistent with **Newland et al.** (**22),**whostudied "Implementation of cuebased feeding in a level III NICU, inMetropolitan". They reported that, by evaluating the feeding readiness and feeding ability, caregivers could be able to effectively and safely guide premature infants toward achieving feeding competency. Proper, consistent assessment of feeding readiness wouldhelp caregivers in deciding when it'sconvenient to offer oral feedings to a premature infant. Accurately assessment of feeding readiness cues, reinforce active social interaction between the caregiver and the infants and this relationship increased feeding acquisition. In addition to**Nyqvist et al.** (**9),** who studied "Expansion of the baby friendly hospital initiative ten steps to successful breastfeeding into neonatal intensive care: experts group recommendations, in Uppsala, Sweden". They added that cuebased feeding for preterm infants is now recommended as a method to increase the duration of breastfeeding in the UNICEF babyfriendly hospital initiative 10 steps to successful breastfeeding into neonatal intensive care. This might due to applying an infant feeding technique based on feedingreadiness cues from the infants could promote a positive experience for the infant, thereby avoiding negative feeding behaviors. Cuebased feeding lets caregivers to guide infantstoward successful feeding, instead of force them. Cue based feeding also permits for more parent involvement and enhances both breast and bottle feeding.

Hence research hypothesis (H_2) which stated that cues based feeding techniquewill improves the premature infants feeding cues as measured by readiness scale, quality nipplingscale and caregiver technique

scale.And that there will be a statistical significance difference between the experimental and control group were approved.

The outcomes of thecues based feeding technique intervention can be measured by weight gain, increase headcircumference, time to full nipple feeding and decrease length of hospital stay **(Table 4)**, the results of the present study demonstrated that there was a statistically significant difference between both groups. The experimental group of cues feeding demonstrating a higher weight gain, greater head circumference, decreases the time to full nipple and length of hospital stay than the control group. This result was in agreement with literature **California Perinatal Quality Care Collaborative(23),** which studied "Optimizing length of separation (LOS) collaborative, in Sacramento, California".They showed that cue based feeding protocolshave improved premature infants' feeding outcomes, primarily by lowering the stress of oral feeding and decreasing the amount of time required for oral feeding acquisition,decreasing the time required to acquire oral feeding competences, decreases length of hospital stay and therefore the length of motherinfant separation. Additionallyto**Messer (14),** who studied "Infant driven feeding vs. scheduled feeding: The effect on hospital length of stay in Walden".Who reported that the infants fed consistent witha protocol based on the infant's readiness cues will decrease thelength ofstayor separation of the infant. This may be due to cues based feeding facilitatethe premature infant to regulate self behavior which leads to decrease of stress, adversely to the scheduled feedings might alter the infant's selfregulating behavior resulting inincreased stress and hindering of weight gain, growth, and development, thereby delaying discharge.

So, research hypothesis (H_3) which stated that there will be a significant improvement in infant feeding outcomes as measured by weight gain, increase head circumference and time to full nipple feeding after implementation of intervention was accepted.

As regards the studied mothers' characteristics**(Table 5),** the findings of the present study revealed that, less than three quarter of studied mothers in experimental group and less than two third of mothers in control group were in the age group from 20-<30years. In addition, half of mother in experimental group and more than half in control group have secondary school and more than halfof the mothers in both groups were housewives, there was no significant difference between both groups (P>0.05).This finding was in agreement with **Küçükoğlu and Çelebioğlu (24),** who studied "Effect of naturalfeeding education on successful exclusive breastfeeding and breastfeeding selfefficacy of lowbirthweight infants intwo hospitals located in the Eastern Turkey". They found that, less than three quarterof studied mothers in experimental group and less than two third of mothers in control group were in the age group from 19-<30years,in addition to more than half of studied mothers have primary education while, more than three quarterof studied mothers in experimental and control groups were housewives, there was no significant difference between both groups (P>0.05).

Parents of premature infants experience high stress levels, feelings of helplessness, and often lack adequate knowledge on how to interact with their premature baby, during hospitalization in the neonatal intensive care unit. Concerning mothers' knowledgeabout infantcues based feeding **(Figure 1)**.The present study demonstrated that less than two third of the mothers in experimental group had good knowledge about the infants cues based feeding technique compared with the mothers in the control group had no good knowledge, there werehighly statistical significant differences between both groups. This finding was consistent with **Shaker (11),** whostated that, the infant's ability to feed well is related to the caregiver's ability to know and reply to the infant's physiology and behavioral communication. In addition to **Newland et al.(22),** who mentionedthat each one of the mothers receiving education on infant cues feeding resulted in them being higher able to locate when the infant was ready to eat. This may be attributed to cues feeding intervention increase the mother knowledge, awareness and confidence regarding the premature infant feeding; also cue based feeding allows for a lot of parent participation and reinforce both breast and bottle feeding. The caregiver must pay attention to the cues and behaviors showed by the infant and respond accordingly to maintain successful interaction with the infant.

Regarding the parents' satisfaction about their infant's cues based feeding technique post intervention **(Figure 2)**. The present study revealed that more than three quarter of studied mothers in experimental group were satisfied when compared withmore than one quarter of mothers in control group were satisfied. This result was agreement with **Nair et al.(10),** who studied"Facilitators and barriers to quality of care in maternal, newborn and child health: A global situational analysis through metareview".They reported that the feeding cues program has benefits for the family and caregivers, primarily permitting parents to feel a lot of directly involved with their infant's care and increasing their skill and confidence to recognize and respond to their infant's needs throughout their hospital stay and beyond. Increased parental satisfaction could be a key quality indictor in measurement the effectiveness of family centered care in neonatal services. This might be attributed to the cues based feeding technique permits parent to participate in feeding infant additionally to parent teaching can be done more efficiently throughout cue based feeding and parents have reported a sense of satisfaction once they really perceive and understand how their infant learns to eat.

The above mentioned results proved research hypothesis (H_4) which revealed that there will be a significant improvement in post mean knowledge scores of mother and mean parent satisfaction scores of mothers after implementation of cues based feeding technique.

Finally, by evaluating the effect of implementation of cue based feeding techniqueon premature infant's weight gain and parent satisfaction, an improvement was noticed among the premature infant's weight gain and parent satisfaction. So, implementation of cue based feeding technique contributed to premature infant's weight gain and improves parent satisfaction.

V. Conclusion

The present study concluded that, cues based feeding technique decrease the premature feeding problems during the oral feeding and improve the premature infants feeding cues as measured by feeding readiness, quality nippling and caregiver technique scales. And there was improvement infant feeding outcomes and parent satisfaction. These results support the proposed study hypotheses.

VI. Recommendations

Based on the findings of the current study recommended that:

- Reapply of this study on large sample.
- Educational intervention program are recommended to improveNICU nurses' knowledge and practice about infant cues based feeding technique and all new staff members should be trained in infant cues based feeding throughout the orientation time.
- Future plans for reeducating the mothers on the infants cues based feeding technique to focus on cues based breast feeding after the transition home for late preterm infants.
- Future researches could focus on the effect of the infant cues based feeding technique on the premature infants' long term outcomes at home post discharge.

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