EFFECT OF WEE CARE ON PHYSICAL GROWTH AND BEHAVIORAL RESPONSES OF PRETERM NEONATES

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ABSTRACT

Background: Wee care is an essential element for caring of preterm neonates in intensive care units. It decreases mismatching between intrauterine and extra uterine life which improves physical growth and neuro-behavior stability of preterm neonates. **Aim**: is to determine the effect of wee care on physical growth and behavioral responses of preterm neonates. **Subjects and method: Design:** A quasi experimental design was used to accomplish this study. **Setting:** The study was conducted at the Neonatal Intensive Care Unit at Alexandria University Children's Hospital at Smouha. **Subjects:** A convenient sample of 60 preterm neonates were selected to perform the current study. **Tools:** Three tools were used for data collection, Tool I: Characteristics and clinical data of preterm neonates' record, Tool II: Preterm neonates physiological parameters and physical growth record. Tool III: Assessment of Preterm Infants` Behavior Scale (APIB). **Results:** the result of the current study revealed that the preterm neonates of the study group have more means of weight gain than the control group with statistically significant differences. Statistically significant differences were found regarding total score of behavior responses of preterm neonates between the study and control groups in day 1 and day 21. The study group had higher mean of oxygen saturation and lower means of respiratory rate within normal range compared to the control groups **Conclusion:** The study concluded that application of wee care for preterm neonates in neonatal intensive care unit enhance weight gain, improve autonomic visceral responses, and improve behavioral organization. **Recommendations:** Application of Wee care for preterm neonates should be included in the updated policy of neonatal intensive care units. It should be incorporated as a part of the routine care for preterm neonates.

***Keywords*:** Behavioral responses, Physical growth, Preterm neonates, Wee care.

INTRODUCTION

Prematurity is considered the main reason for admission of neonates in neonatal intensive care units (NICUs) and is still the major cause of neonatal morbidity and mortality (Basiri et al., 2015). It is considered the second leading cause of death in neonates after congenital anomalies. According to WHO, every year, approximately 10.6% of all live births globally are preterm and nearly 18 deaths per 1000 live births were preterm. Moreover, preterm birth rate constituted 13% per 100 live births in Egypt (WHO, 2018).

Delivery of preterm neonates removes them from protected environment to more hazards settings of neonatal intensive care units (NICUs). Neonatal Intensive Care Unit is a highly stressful setting with various environmental stressors such as separation from parents, frequent invasive and unpleasant maneuvers, loud sound, and intense light (Altimier & Phillips., 2016). In addition, changing positions from full intrauterine flexion to supine and extension, and excessive improper handling of preterm neonates, cause adverse effects consequences on the immature nervous system and cause disruption in the preterm neonate's development and function of the brain (Liu et al., 2016). Inadequate feeding capabilities in preterm neonates often lead to poor nutritional status and growth failure with their consequences on the subsequent stages of growth and neuro-developmental milestones (Soleimani et al., 2020). Despite the innovative interventions in the medical field lead to a significant survival of preterm neonates and manage their complications, preterm neonates, remain vulnerable for abnormal behavioral responses, neurological complications and overall poor health status. Subsequently, neonatal care during NICU hospitalization should be modified through cost-effective interventions such as Wee Care (Altimier et al., 2015; Spence et al., 2010).

Wee care is a holistic approach based on a recently developed Neonatal Integrative Developmental Care Model. It describes seven core measures for neuro-protective developmental care of premature neonates. The seven core measures encompass the healing environment, partnering with families, positioning and handling, safeguarding sleep, minimizing stress and pain, protecting skin, and optimizing nutrition, (Altimier et al., 2015). Wee care is essential for caring of preterm neonates and their families. It supports developing of the brain, facilitates normal neurological and physical development, enhances

physiological stability, protects sleep rhythms and prevents disability (Soleimanim et al., 2020).

The healing environment is considered the first core measure of wee care. It involves the physical environment of space, privacy, and safety, as well as the sensory environment which includes the tactile vestibular, olfactory, gustatory, auditory, and visual stimulation (Altimier & Phillips., 2016). Wee neuroprotective developmental care maintains a private and safe environment for the preterm neonates and their family. Providing soft, gentle touch in all interactions and facilitating kangaroo care as soon as possible after birth enhance the healing environment in NICU (Blencowe et al., 2013).

Basically, parenting with the family is the second core measure of wee care. Family centered care is an evidence-based best practice model that aims to minimize the negative effects of care provided in NICUs. It also maximizes preterm neonates and their families` outcomes, enhances the neurodevelopment of the preterm neonates through holistic interventions that support both the preterm neonates and their family (Aita et al., 2017). Moreover, creating an effective partnership between professionals and families is important to strengthen their neonate's experiences in the NICU. The parent should be also encouraged to develop confidence in their own abilities to continue providing care for their preterm neonates after going home (Altimier & Phillips, 2016).

Therapeutic positioning and handling of the preterm neonates during nursing care is a fundamental mainstay of wee care. Frequent handling and touching can interrupt sleep causing decreased weight gain, decreased state regulation. Handling of preterm neonates should be done with slow, gentle, modulated movements, with the preterm neonate`s extremities flexed and contained, which may require a four-handed technique. Secure therapeutic positioning such as nesting and swaddling improves rest, supports optimal growth, and helps to normalize neurobehavioral organization (Altimier & Phillips., 2016).

Safeguarding sleep by promoting a quiet environment to ensure uninterrupted sleep cycle is the fourth core measure of wee care. It is important for early neuro-sensory development. It also promotes healing and growth, energy restoration and maintains homeostasis of the body of preterm neonates. Sleep, deprivation during early neonatal period has determined great impact on the brain development. So alleviating stress by clustering

nursing activities together to reduce the handling that preterm neonates receive and promote sleep (Bonanet al., 2015; Altimier & Phillips, 2016).

Neonatal stress has great impact on preterm neonates; it increases energy expenditure, impairs physiologic stability, and alters brain development. Therefore, proper nursing interventions during painful procedure such as containment and non-nutritive sucking as the fifth integrated part of wee care is effective in relieving pain, decreases sleep disruption time and maintains physiological parameters of preterm neonates (Spence et al., 2010; Altimier & Phillips, 2016).

Maintaining the integrity of the skin during intensive care unit is the sixth core measure of wee care. Skin is a protective barrier of the internal organ. Skin ulcer, trauma and burn could impair its function so skin care is a concern of nurse in NICU includes bathing, change position every 2 hour, use minimal adhesive tape, and adjust the humidity of incubator (Karlsson et al., 2012; Faria & Kamada, 2018).

Optimizing nutrition is the seventh core measure of wee care. Breastfeeding should be promoted and supported to ensure optimal nutrition for all preterm neonates whenever possible. It is the single most powerful and well-documented neuroprotective developmental care modality that reduces the risk of common causes of preterm morbidity(Hendricks & Mayers 2014).

Neonatal intensive care nurses play curial roles in providing wee neuro-developmental care in NICUs. They should provide containment, support boundaries, and flexed positioning, to simulate the uterine position. They also should minimize stress and pain, safeguard sleep, protect skin and optimize nutrition of preterm neonate. Additionally, they should integrate wee care daily in caring of preterm neonates in NICUs to increase the chances of achieving optimal physical, neurological ,cognitive, and emotional outcomes (Demirel et al., 2012 ;Altimier& Phillips, 2016).

AIM OF STUDY

This study aims to determine the effect of wee care on physical growth and behavioral responses of preterm neonates.

Operational Definition

Wee care: it refers to numerous approaches which simulate the intrauterine environment. It encompasses 7 nuero-protective core measures that intend to support the brain development, and promote growth and maturation of preterm neonates.

Research Hypotheses

H1- Preterm neonates who received wee care exhibit improved physical growth than those who do not.

H2- Preterm neonates who received wee care exhibit organized behavior responses than those who do not.

SUBJECTS AND METHOD

(1) TECHNICAL DESIGN

Research Design

A quasi-experimental design was used to accomplish this study.

Settings:

This study was conducted at Neonatal Intensive Care Unit of Alexandria University Children Hospital at Smouha.

Subjects:

A convenient sample of 60 preterm neonates who fulfilled the following criteria comprised the study subjects:

1- Gestational age 28 to < 37 weeks.

2-Birth weight less than 1500 grams (VLBW).

3- Frist day of delivery.

4- Free from congenital malformations and neonatal infection.

The preterm neonates were randomly assigned into two equal groups (30 neonates for each). The neonates of control group received routine care in neonatal intensive care unit and the neonates of study group received wee care.

Sample size was estimated according to Epi-Info program using the

Following parameters:

- Population size =100 neonates
- Expected frequency = 50%
- Acceptable error =10%
- Confidence coefficient =95%

- Minimum sample size = 55 neonates.
- The final sample size was 60 preterm neonates.

Tools for data collection:

Three tools were used to collect data for the preterm neonates.

Tool I: Characteristics and Clinical Data of Preterm Neonates Record.

This tool was developed by the researcher. It included: sex, gestational age, birth weight, diagnosis, method of delivery and duration of hospitalization,

Tool II: Preterm Neonates Physiological parameters and Physical Growth Record.

It was developed by the researcher after thorough review of recent and relevant related literature to assess preterm neonates' physiological parameters and physical growth. This tool consisted of two parts:

Part 1: **Preterm Neonates' Physiological Parameters**: it included oxygen saturation, heart rate and respiratory rate.

Part 2: Preterm Neonates' Physical Growth Measurements

It included weight in grams and mid-arm circumferences in centimeters.

Tool III: Assessment of Preterm Infants Behavior Scale (APIB)

This tool was developed by Als H et al. and adopted by the researcher to assess preterm neonates` behavioral responses (Als ,H et al., 1982). This tool included 2 items:

- Autonomic/ visceral system.
- State system and attention-interaction system.

The autonomic/ visceral system included respiration, color and visceral digestion, neuro-physiological responses. State system and attention-interaction system included state of regulation, orientation to auditory stimulus and alertness.

Scoring system:

It is a 3 points likert scale (0, 1, and 2).The autonomic/ visceral consisted of 4 domains the maximum total score is 8. Score of 5-8 all the four domains, represented normal behavioral response while score of 2-4 represented abnormal behavioral response and score of 1 represented definite abnormal behavioral response. Attention-interaction subsystem consisted of 3 domains and the maximum total score is 6. Score of 4-6 represented normal behavioral response, while score of 2-3 represented abnormal behavioral response and score of 1 represented definite abnormal behavioral response.

(II) OPERATIONAL DESIGN

The operational design includes content validity, reliability of the tool, pilot study and field of work.

Tool validity:

Tools were tested for their content validity by five experts in pediatric nursing field and their validity was 0.997.

Reliability:

Reliability of tools was ascertained by using Cronbach's alpha coefficient test, and reliability was 0.995.

Pilot study:

A pilot study was carried out on six preterm neonates (10% of sample) to test feasibility, applicability, and clarity of the tools. No modifications were done. Those preterm neonates were excluded from the study subjects.

Field of work

- Approval from the Ethical Nursing Research Committee of the Faculty of Nursing was obtained before conducting this study.
- An official permission to conduct study was obtained from the responsible authorities of Neonatal Intensive Care Unit (NICU) of Alexandria University Children Hospital at Smouha to conduct the study after explaining the aim of the study.
- Tool I and Tool II were developed by the researcher after the reviewing of recent and relevant literatures.
- Preterm neonates' characteristics and clinical data were obtained at initial contact in first day of life for control and study group using tool I.
- Initially preterm neonates were assessed for physiological and physical growth parameters on the first day of life as baseline data using tool I and II.
- Preterm neonates were assessed for behavioral responses on the first day of life as baseline data using tool III.
- For the study group:
- Wee care was performed to preterm neonates three times per day (in the morning, in the evening and in the afternoon) starting on day 1 of life up to day 21 of life.

- Wee care was applied to preterm neonates included 7 nuero- protective core measures as follows:

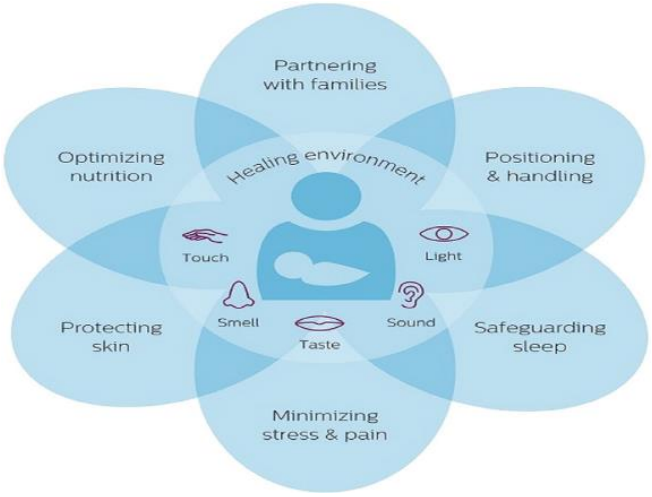

Figure (1): Neuro Protective Core Measures

Source: Altimier, L., Kenner, C., & Damus, K. (2015). The effect of a comprehensive developmental care training program on seven neuroprotective core measures for family-centered developmental care of premature neonates. *Newborn & Infant Nursing Journal*. 15:6:10.

Neuro-protective measures:

1-Healing Environment Core:

1-.a. Decrease noise and maintain quite environment were applied as follows:

- The noise level and the sound of monitors alarm in the intensive care unit were controlled at 80 decibels using I phone application for measuring the noise level.
- Sound of the cardiac monitors and pulse oximeters were reduced to the lowest level.
- The doors of incubators were closed softly.
- No objects were placed on top of incubators.
- The alarms were silent as soon as practicable.
- Earmuffs were put for preterm neonates during excessive noisy procedures.

1-.b. Reduce light as follows**:**

- Direct light was decreased, and the upper part of the incubator was covered.
- The glass sticker was put on the window to decrease effect of sun rays on the preterm neonates.

- The eyes of preterm neonate were covered during focused lighting medical procedures.
- The nurse`s hand was used during focused lighting medical procedures \examination to cover the eye of preterm.

1-.c. Maintain touch

Preterm neonate received tactile stimulation when carried by the mother through Kangaroo Care.

1-.d. Stimulate neonate taste and smell

Taste and smell stimulations of preterm neonate were performed by the using of piece of cotton socked by breast milk before each feeding.

2-Parenting and family Core:

- Respect the dignity of both parents, share information, encourage participation, and collaboration in infant`s care.
- Educate parent about discharge plan.

3-Positioning and Handling Core:

2 – .a. Positioning

The nesting positions were performed as follows:

- A nest was created by a hand towel to support both sides of preterm neonate forming U shape under the buttocks.
- The preterm neonates were positioned in frog position as the upper and lower extremities were be flexed similar to the intrauterine position.

2 – .b. Handling of preterm neonate

- Swaddling of preterm neonate was performed during handling by rapping preterm neonate in fabric cloth in flexed fetal type position.
- Kangaroo care was applied as follows:
  - The technique of Kangaroo Care was explained to the mother.
  - Privacy was provided for the mother.
  - Preterm neonates' clothes were removed except the nappy.
  - The mother was set comfortably and was asked to open her clothes.
  - The preterm neonate was picked up and was placed on the chest of her mother, with legs and arms in a flexed position and head to one side.

- The preterm neonate was covered with a blanket and a hat to maintain his body temperature.

4-Safeguarding Sleep Core:

Neuro-protective strategies safeguarding sleep were provided as follows:

Bright lights, loud noises, and unnecessary physical disturbing activities were reduced to protect the sleep cycles.

5-Minimizing Stress and Pain Core:

- Soothing interventions (**containment)** to minimize stress and pain were applied by gently placing a caregiver hand on the preterm neonate head and back during painful procedures.
- Non-nutritive sucking was provided by using the pacifier and preterm neonates was allowed to suck.

6-Protecting skin core:

Skin protection core was provided as follows:

- Skin was kept clean and dry.
- Humidity of incubator was adjusted according to preterm neonates` age and weight.
- The amount of adhesives tape was limited in the NICU whenever possible.
- Gentle care was used whenever tape is removed.
- The skin condition was monitored every shift.

7-Optimizing Nutrition Core

- Preterm neonate positioned at the breast as early as possible to stimulate lactation.
- Sufficient time and support during breast feeding were provided.
- Expressed breast milk was given to preterm neonates in case of gavage feeding.

✓ Avoid high doses of sedative and depressing drugs that can depress

-Preterm neonates in control group received routine care in the NICU unit.

-Physiological and physical parameters were assessed for each preterm neonate in the study and control groups three times a day at the end of 1st, 2nd and 3rd weeks of life.

-Behavioural responses were assessed for each preterm neonate in the study and control group three times a day at the end of 1st, 2nd and 3rd weeks of life.

-Data was collected over a period of 6 months from the beginning of May 2020 to the end of October 2020.

Ethical considerations:

- Informed written consent from all parents of preterm neonates was obtained after explanation the purpose of the study.
- Parents had the right to refuse the participation of their neonates and to withdraw from the study at any time.
- Data privacy and confidentiality of the collected data were assured.

7- •Protect the eyes from direct light exposure and maintain low levels

Data Design:

Collected raw data were revised, coded, and transferred into specially designed formats suitable for computer feeding and they were entered into IBM SPSS software package version 20.0. Qualitative data were described using numbers and percentage. Quantitative data were described using range (minimum and maximum), mean, and standard deviation.

- Following data entry, checking and verification processes were carried out to avoid any errors during data entry.
- Analysis and interpretation of data were conducted.
- Chi-square test, Fisher's Exact or Monte Carlo correction.
- F-test (ANOVA), ANOVA with repeated measures, Friedman testto compare between more than two periods or stages.
- Cranach's Alpha to assess reliability of the study, and Pearson coefficient to assess validity of the study.
- Significance of the obtained results was judged at $p \leq 0.05$ level.

RESULTS

Table (1): illustrates the characteristics of the preterm neonates. Male preterm neonates constituted 50% and 53.3% among the study and the control group respectively. It was found that the mean gestational ages of preterm neonates in the study group and the control groups were 31.9±1.4 and 30.0±1.0 respectively.

The same table illustrates that the birth weight among preterm neonates of the study and the control groups ranged between 1000 to less than 1400 with mean weights 1300±150 and 1200±160 grams among the study and the control groups respectively. Furthermore, it

was found that the mean mid arm circumferences were 70.2±2.5 and 68±3.0 among the study and the control groups respectively.

The clinical data of preterm neonates was presented in **table 2**. The table portrays that slightly more than half of preterm neonates in the study group (56.7%) were hospitalized for less than 21 days compared to 30.0% of control group with mean 31.8±6.0 in the study group and 35.0±9.4 in the control group. The table also illustrates that 70.0% and 83.3% of preterm neonates among study and control groups respectively were delivered by cesarean section.

Physical growth parameters among the preterm neonates were illustrated in **table 3**. Concerning preterm neonates weight the table shows that the mean weights of preterm neonates increased within the study group from day 1 to day 21. There were statistically significant differences, where p <0.0001. Furthermore there were statistically significant differences between the study and control groups in 7^{th},14^{th} days and day 21 where p=0.005,p=0.003,p= 0.001 respectively.

Regarding mid-arm circumference, there were statistically significant differences between 1^{st} day and day 21 within the study group where p <0.0001. Furthermore there were statistically significant differences between the study and control groups in 7^{th},14^{th} days and day 21 where p=0.009,p=0.006,p= 0.000 respectively.

Table (4): presents behaviors responses of preterm neonates regarding autonomic\visceral system among the study and the control groups.

Concerning color of preterm neonates, it was obvious from the table that, 46.7% of preterm neonates among the study group who had pink color at the 1^{st} day increased to 73.3 % at day 21. On the other hand, 20% of preterm neonates among the control group who pink in color at first day had decreased to 13.3% at day 21. Moreover slightly more than half of preterm neonates among the study group (53.3%) who was pink but changed rapidly with slow recovery in 1^{st} day declined to 26.7% in day 21 compared to 63.3% of preterm neonates among the control group at 1^{st} day who increased to 80% at day 21. Statistically significant difference was found among the study and the control groups where (p<0.0001).

Regarding respiration of preterm neonates, it was found that, 40.0% of preterm neonates among the study group who had occasional apnea on the first day decreased to 23.3% on day 21 whereas, 63.3% of preterm neonates among the control group who had occasional apnea

on the 1st day did not change on day 21. Statistically significant difference was found between the study and the control groups where (p<0.0001).

The same table shows that 80% of preterm neonates of the study group who had grunt bowel movement and strain on the 1st day declined to 0% on day 21. Whereas, 63.3% of preterm neonates at 1st day in control group decreased to only 26.7 at day 21. Statistically significant difference was found between study and control groups where (p<0.0001).

Regarding neurophysiological responses of preterm neonates, it was found that 80% of the preterm neonates who had abnormal twitch and jerk among the study group on the 1st day declined to 10% on day 21. Whereas, 63.3% of preterm neonates among the control group increased to 80% at day 21. Statistically significant difference was found between the study and control groups where (p<0.0001).

Table (5): illustrates behavior responses of preterm neonates regarding attention-interaction system.

Concerning state regulation, it was found that 53.3% of preterm neonates among the study group who had active awake with fussing, stressed and hyper alert state on the 1st day declined to 26.7% on day 21 compared to 63.3% of control group on the1st day who increased to 80% on day 21. Statistically significant difference was found between the study and the control groups (p<0.0001).

Regarding orientation to auditory stimulus, it was found that 40% of preterm neonates among the study group who focused briefly to stimulus and followed with jerky eye movements on the 1st day declined to 23.3% on day 21 while 63.3% of preterm neonates among the control group on the 1st day had no change on day 21. There was a statistically significant difference between the study and the control groups (p<0.0001).

Concerning alertness to stimulus it was found that 80% of preterm neonates among the study group on the 1st day who were alert briefly or had delay response declined to none of them on day 21 while, 63.3 % of preterm neonates among the control group on the 1st day declined to only 26.7 % on day 21 with statistically significant difference was found between the study and the control groups (p<0.0001).

Table (6): presents total score of behavior responses of preterm neonates among the study and control groups on the 1st, 7th, 14th days and on day 21. It was found that, 20% of preterm neonates among the study group exhibited normal behavior responses before

application of wee care on the first day, and this percent increased to 36.7% and 83.3% on the 7th and 14th days respectively. Moreover on day 21 all preterm neonates among the study group exhibited normal behavior responses. On the contrary, 26.7% of preterm neonates among the control group exhibited normal behavior responses, and this percentage decreased to 20% and 23.3% on the 7th day and on day 14 respectively. Unfortunately, further decrease was found among those preterm neonates on day 21 as only 3.3% had normal behavior responses.

In relation to abnormal behavior responses, it was found that slightly more than two thirds of preterm neonates among the study group (63.3%) demonstrated abnormal behavior responses on the first day, and this percentage dropped to zero on day 21. On the other hand, 66.7%% of preterm neonates among the control group who demonstrated abnormal behavior responses on the first day decreased to 56.7% on day 21.There were statistically significance differences between the two groups where ($p<0.0001$).

Table (7): illustrates the mean physiological parameters of preterm neonates among the study and control groups.

Concerning the mean of oxygen saturation of preterm neonates, it was found that the mean of oxygen saturation on day 1 before application of wee care among the study and control groups were 92.5±2.5 and 91.2±3.0 respectively. The mean of oxygen saturation of preterm neonates among the study group increased on the 7th,14th days and on day 21 with means were 93.5±4.2, 94.0±2.2 and 94.0±3.4 respectively compared to preterm neonates among the control group where the mean of oxygen saturation decreased on the 7th ,14th days and on day 21, with means were 90.2±1.0 , 90.2±1.0 and 91.2±1.0 respectively. Statistically significant difference was found within the study group between the 1st day and the day 21 ($p=<0.0001$). Furthermore statistically significant difference was found between the study and control groups on the 7th, 14th and on day 21 ($p=0.001$, $p=0.000$, and $p=0.001$) respectively.

Regarding the mean of respiratory rate of preterm neonates, it was found that the mean of respiratory rate on day 1 before application of wee care among the study and control groups were 50.5±3.5 and 49.8±4.2 respectively. The mean of the study group decreased within normal range on the 7th,14thand on day 21 , with means were 48.0±6.2 , 49.0±3.1 and 47.0±4.4 respectively compared to the mean of respiratory rate among the control group which increased on the 7th ,14th and on day 21 , with means were 55.2±3.1 , 57.2±2.3 and

55.2±2.1 respectively. Statistically significant difference was found among the study group between the 1st day and day 21 (p=<0.0001). Furthermore statistically significant difference was found between the study and control groups on the 7th, 14th and on day 21 (p=0.001, p=0.000, and p=0.001) respectively.

Table 1: Characteristics of the Preterm Neonates

Characteristics	Study group (n=30)		Control Group (n=30)	
	No.	%	No.	%
Gender ● Male ● Female	 15 15	 50.0 50.0	 16 14	 53.3 46.7
Gestational age Min –Max Mean ± S.D	 29-36 31.9±1.4		 28-35 30.0±1.0	
Birth weight (grams) Min –Max Mean ± S.D	 1150-1300 1300±150		 1000-1400 1200±160	
Mid-arm circumference (mm) Min –Max Mean ± S.D	 60.5-86.5 70.2±2.5		 61.0-84.5 68±3.0	

Table 2: Clinical Data of the Preterm Neonates

Clinical data	**Study Group (n=30)**		**Control Group (n=30)**	
	No.	**%**	**No.**	**%**
Duration of hospitalization (days) 21- 28- ≥ 35	 17 6 7	 56.7 20.0 23.3	 9 5 16	 30.0 16.7 53.3
Min –Max	24-56		24-60	
Mean ± S.D	31.8±6.0		35.0±9.4	
Current diagnosis ● Prematurity ● Jaundice ● Sepsis ● Infant of diabetic mother	 13 10 2 5	 43.3 33.3 6.7 16.7	 14 8 4 4	 46.7 26.7 13.3 13.3
Type of delivery ● Normal delivery ● Cesarean Section	 9 21	 30.0 70.0	 5 25	 16.7 83.3

Table(3): Mean Physical Growth Parameters among the Preterm Neonates.

Physical Growth parameters	**Study Group (n=30)**	**Control Group (n=30)**	**Significance**	
	Mean±SD	**Mean±SD**	**F**	**p**
Weight (grams)				
Day 1	1252.8±151.0	1352.8±271.2	0.515	0.928
Day 7	1300.0±207.2	1290.0±207.0	0.125	0.005*
Day 14	1551.2±240.2	1421.2±240.1	0.242	0.003*
Day 21	1662.8±300.0	1502.8±260.0	0.406	0.001*
Sig between 1st day and 21th days	<0.0001*	0.101		
Mid-upper arm circumference(mm)				
Day 1	70±6.0	68±6.0	1.150	0.101
Day 7	70±6.3	69±8.3	1.697	0.009*
Day 14	71±7.2	69±9.2	0.471	0.006*
Day 21	72±1.2	70±1.2	0.514	0.000*
Sig between 1st day and 21th days	<0.0001*	2. 03		

Sig: P-value for paired t-test F: ANOVA test *significant at P≤0.05

Table (4): Behavioral Responses of Preterm Neonates Regarding Autonomic/ Visceral System among Study and Control groups.

Autonomic/ Visceral System Assessment	Study Group (n=30)				Control Group (n=30)				Significance p
	1st day		21th day		1st day		21th day		
	No.	%	No.	%	No.	%	No.	%	
Color									
● Pink	14	46.7	22	73.3	6	20.0	4	13.3	
● Pink but changes rapidly with slow recovery.	16	53.3	8	26.7	19	63.3	24	80.0	
● Pale, cyanotic	0	0.0	0	0.0	5	16.7	2	6.7	<0.0001*
Sig between 1st day and 21th days	<0.0001*				0.120				
Respiration									
● Regular stable respiratory rate.	18	60.0	23	76.7	6	20.0	6	20.0	
● Occasional apnea.	12	40.0	7	23.3	19	63.3	19	63.3	
● Gasping, frequent apnea, unstable respiratory rate	0	0.0	0	0.0	5	16.7	5	16.7	<0.0001*
Sig between 1st day and 21th days	<0.0001*				0.120				
Visceral									
● Absent Gasro-esophageal reflex	4	13.3	30	100.0	6	20.0	0	0.0	
● Grunt bowel movement and strain	24	80.0	0	0.0	19	63.3	8	26.7	
● Vomiting and feeding intolerance	2	6.7	0	0.0	5	16.7	22	73.3	<0.0001*
Sig between 1st day and 21th days	<0.0001*				0.120				
Neuro-physiological responses									
● Stable	4	13.3	27	90.0	6	20.0	4	13.3	
● Abnormal twitch and jerk	24	80.0	3	10.0	19	63.3	24	80.0	
● Flaccid on stimulation	2	6.7	0	0.0	5	16.7	2	6.7	<0.0001*
Sig between 1st day and 21th days	<0.0001*				0.120				
Min -Max	4-6		6-8		2-4		2-4		
Mean±SD	4±2.0		8±0.0		4±1.0		4±1.2		

Sig: P-value for paired t-test F: ANOVA test *Significant at P≤0.05

Table(5): Behavior Responses of Preterm Neonates Regarding Attention-Interaction System among Study and Control Groups.

Attention-Interaction System Assessment	**Study Group (n=30)**				**Control Group (n=30)**				**Significance p**
	1st day		**21th day**		**1st day**		**21th day**		
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	
State regulation									
● Awake alert	14	46.7	22	73.3	6	20.0	4	13.3	
● Active awake with fussing, stressed and hyper alert state.	16	53.3	8	26.7	19	63.3	24	80.0	
● Intense rhythmic crying with irregular breathing.	0	0.0	0	0.0	5	16.7	2	6.7	<0.0001*
Sig between 1st day and 21th days	<0.0001*				0.120				
Orientation to auditory stimulus									
● Focuses on stimulus and follows with continuous head movement.	18	60.0	23	76.7	6	20.0	6	20.0	
● Focus briefly to stimulus and follows with jerky eye movements.	12	40.0	7	23.3	19	63.3	19	63.3	
● Does not focus on or follow stimulus	0	0.0	0	0.0	5	16.7	5	16.7	<0.0001*
Sig between 1st day and 21th days	<0.0001*				0.120				
Alertness to stimulus									
● Always alerting and orientating.	4	13.3	30	100.0	6	20.0	0	0.0	
● Alerting briefly /delay response.	24	80.0	0	0.0	19	63.3	8	26.7	
● Rarely or never response.	2	6.7	0	0.0	5	16.7	22	73..3	<0.0001*
Sig between 1st day and 21th days	<0.0001*				0.120				
Min -Max	3-6		4-6		2-3		2-3		
Mean±SD	3±2.0		6±0.0		2±1.0		2±1.0		

Sig: P-value for paired t-test F: ANOVA test *Significant at P≤0.05

Table (6): Total Score of Behavior Responses of Preterm Neonates among the Study and Control groups at 1st, 7th, 14th days and day 21.

Behavior response	**Study Group (n=30)**								**Control Group (n=30)**								**Significance p**
	1st day		**7th day**		**14th day**		**21th day**		**1st day**		**7th day**		**14th day**		**21th day**		
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	
● Normal behavior responses.	6	20.0	11	36.7	25	83.3	30	100.0	8	26.7	6	20.0	7	23.3	1	3.3	
● Abnormal behavior responses.	19	63.3	18	60.0	5	16.7	0	0.0	20	66.7	20	66.7	10	33.3	17	56.7	
● Definite abnormal behavioral response.	5	16.7	1	3.3	0	0.0	0	0.0	2	6.6	4	13.3	13	43.3	12	40.0	<0.0001*
Sig between 1st day and day 21	<0.0001*								0.120								

Sig: P-value for paired t-test *Significant at P≤0.

Table(7): Mean Physiological Parameters of Preterm Neonates among the Study and Control groups

Mean Physiological Parameters	**Study Group (n=30)**	**Control Group (n=30)**	**Significance**	
			F	**p**
	Mean±SD	**Mean±SD**		
Mean Oxygen Saturation				
Day 1	92.5±2.5	91.2±3.0	3.312	0.928
Day 7	93.5±4.2	90.2±1.0	1.325	0.001*
Day 14	94.0±2.2	90.2±1.0	5.242	0.000*
Day 21	94.0±3.4	91.2±1.0	3.226	0.001*
Sig between 1st day and 21th days	<0.0001*	0.122		
Mean Heart Rate				
Day 1	140±14.5	139±14.5	0.515	0.928
Day 7	146±8.2	137±8.2	0.125	0.005*
Day 14	148±9.2	167±9.2	0.242	0.003*
Day 21	148±12.0	135±9.0	0.406	0.000*
Sig between 1st day and 21th days	<0.0001*	0.210		
Mean Respiratory Rate				
Day 1	50.5±3.5	49.8±4.2	3.412	0.318
Day 7	48±6.2	55.2±3.1	1.325	0.001*
Day 14	49±3.1	57.2±2.3	2.242	0.000*
Day 21	47±4.4	55.2±2.1	1.226	0.001*
Sig between 1st day and 21th days	<0.0001*	0.120		

Sig: P-value for paired t-test *Significant at P≤0.05

DISCUSSION

Preterm neonates experience long term neurodevelopmental complications because of their prematurity and their medical condition that needs long-term management in a neonatal intensive care unit (NICU). Furthermore, the consequences of their need for life-saving care, which exposed them to several stressors that deplete their resources and often result in problematic functioning and poor developmental outcomes (Montirosso et al ., 2017). So, it is reasonable to incorporate neuroprotective strategies that promote preterm neonate neurological, physical and emotional developmental and prevent disability (Altimier and Phillips, 2016).

Premature neonates born with an immature physiological status make them more likely to be admitted to NICU and increase their hospital stay (Lee E & Lee S, 2018; Sarapuk et al., 2017). The finding of the current study revealed that more than one half of preterm neonates who received wee care had short hospital stay compared to less than one third of preterm neonates in the control group. This could be explained by the fact that the

application of wee care in NICU could improve the development and medical outcomes of preterm neonates which result in short hospital stay. This result is in line with the result of Hasanpour S et al., (2017) who found that the overall duration of hospital stay was significantly shorter in the group who received developmental care compared to the control group (Hasanpour et al.,2017).

Impaired physical growth is one of the major problem of preterm neonates because they are placed in an environment that is different from the maternal uterus and also their low birth weight (Lucas, 2015). The findings of the current study reflected that weight of preterm neonates in wee care group increased more than that of the preterm neonates of the control group. This could be explained in the light of the fact that enhancing healing environment as a part of wee care which incorporates Kangaroo mother care improves neonate weight. Moreover reduction of environmental stressors provides unlimited light exposure and facilitates sleep which in turn stimulates growth hormone secretion during sleep and increases body weight (Lucas, 2015). From another perspective increasing weight among preterm neonates in wee care group could be due to the tactile stimulation activation of vagal afferent and efferent pathway involved in the parasympathetic control of gastro-intestinal system (Diego et al., 2014) .This result is similar to the result of Lee E & Lee S.,(2018) ; Sarapuk I et al., (2017) who found that the body weight of the group, who received the neurodevelopmental treatment significantly improved compared to the control group (Lee E and Lee S, 2018, Sarapuk et al.,2017). On the other hand, this result is contradicted with the finding of Hasanpour S et al., (2017) who reported that no significant differences were observed between both groups in terms of neonatal growth parameters (Hasanpour et al ., 2017).

Exposing preterm neonates in NICU to prolonged excessive noise and interrupted environment lead to increaseing the risk of change of physiological responses, hearing loss, brain impairment and complications of sensory development (Edwards & Austin, 2016). The finding of present study illustrated that more than half of neonates among the control group had apnea compared to one quarter of preterm neonates among the study group who received wee care. This could be explained by the fact that excessive auditory stimulation creates negative interrupted environment that lead to alteration of respiration and apnea. Moreover controlling of external stimuli as well as minimal handling improves autonomic response and decrease occurrence of apnea (Lucas, 2015; Mohammed et al, 2018). This result is supported by Aita M ,et al (2017) who found that neurodevelopmental care significantly improve preterm infants' autonomic system (Aita et al ., 2017).The result also

revealed that the percentage of preterm neonates who had pink color in the study group was higher than the percent of preterm neonate of the control group. This could be justified by the fact that sensory stimulation via kangroo handling can increase the blood flow to the body tissue and the brain (Parsa et al., 2018).

Feeding intolerance is Prevelant among premature neonates due to gut immaturity (Yuan Z et al ., 2019).The findings of the current study reflected that none of preterm neonates who received wee care had vomiting and feeding intolerance compared to slightly less than three quarters of preterm neonates of the control group. This could be justified by the fact that non-nutritive sucking included in wee care facilitates the sucking behavior of neonates and improves digestion of enteral feeds through secretion of specific digestive enzymes mediated by vagal innervations of oral mucosa (Lucas, 2015). This result is congruent with Foster, et al (2016) who reported that preterm neonates who are received non-nutritive sucking were able to fully transfer to oral feeding faster than neonates of the control group (Foster et al ., 2016).

During hospitalization in NICUs, the preterm neonates are deprived of constant tactile stimulus of amniotic fluid received during intrauterine life. Moreover the biological risk of their prematurity and the exposure to varying touch stimulus during medical and nursing procedures place them at great risk for behavioral disorganization (Montirosso et al , 2017). The finding of the current study revealed that the preterm neonates of the study group who received wee care have more organized behavioral responses regarding state of regulation, orientation to auditory stimulus and alertness to stimulus compared to preterm neonates of control group. Regarding the total score of behavioral responses, the current study revealed that none of preterm neonates of the study group had abnormal behavior responses compared to more than half of the control group. This could be explained by the gentle handling with a soft voice or gentle touch as a part of the developmental care could promote state organization. In addition maintaining intrauterine position and promote healing environment could improve behavioral organization (Lucas, 2015).This result is in line with Aita M ,et al (2017) who found that neurodevelopmental care significantly improve preterm infants' attention-interaction system (Aita et al ., 2017).The result is also supported by Mohammed S et al (2014) who reported that application of developmental supportive care improve state of regulation , state of organization and motor activity(Mohammed et al ., 2014).

The finding of the current study reflected that statistically significant differences between preterm neonates among the study and the control groups concerning

physiological parameters. The results of the current study could be interpreted in the light of unique feature of KMC which provides direct skin-to-skin contact between the mother and their preterm neonates (Parsa et al., 2018). Moreover, tactile stimulation and containment are considered as forms of sensory stimulation techniques which are a part of wee care that can increase the blood flow to the body tissues and the brain; which in turn improve oxygen saturation. In addition, developmental care incorporated reduction of noise level and gently handling with a soft voice result in improving the physiological stability of preterm neonates and state organization (Lucas, 2015). This result is supported by Almdar D et al, (2019) who found that mean oxygen saturation value was higher in the intervention group than in the control group (Alemdar D & Inal S., 2019).The result is also in line with Bera A et al, 2014 and Mohammed R et al., 2018 who reported that developmental care ameliorate physiological parameters of neonates (Bera et al., 2014; Mohammed et al, 2018).

CONCLUSION

The finding of the present study concluded that the initiation of wee care for preterm neonates as early as possible was effective in improving weight gain, autonomic visceral responses and behavioral responses in preterm neonates.

RECOMMENDATION

Based on the current study results, it is recommended that:

- Updated policies related to Wee developmental care for preterm neonates should be included in neonatal intensive care units.
- Collaboration and continuing education for the staff in the NICUs (doctors, nurses, etc.) about neurodevelopmental supportive care are required to improve the quality of care provided for preterm neonates.
- Proper in-service training program for neonatal nurses about wee care is mandatory to update their knowledge and improve their performance.
- Wee care should be incorporated in neonatal intensive care unit as a part of the routine care for preterm neonates.

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تاثير الرعايه التطوريه المبكره على النمو البدنى والاستجابات السلوكيه للمواليد الخدج

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الخلاصة

المقدمه:تعتبر الرعاية المبكرة عنصرًا أساسيًا لرعاية الخدج في وحدات العناية المركزة حيث يقلل من عدم التطابق بين الحياة داخل الرحم وخارجها ،مما يحسن النمو البدني واستقرار السلوك العصبي للخدج. الهدف: هو تحديد تأثير الرعاية المبكرة على النمو البدني والاستجابات السلوكية للخدج. الطريقة: تم استخدام تصميم شبه تجريبي لإنجاز هذه الدراسة وقد أجريت الدراسة في وحدة العناية المركزة لحديثي الولادة بمستشفى الأطفال بجامعة الإسكندرية بسموحة. تم اختيار عينة ملائمة من 60 طفل حديثي لولاده لإجراء الدراسة الحالية. **الأدوات:** تم استخدام ثلاث أدوات لجمع البيانات ، الأداة الأولى: الخصائص والبيانات السريرية لسجل الخدج ، الأداة الثانية: المعلومات الفسيولوجية لحديثي الولاده وسجل النمو البدني. الأداة الثالثة: تقييم مقياس السلوك للخدج (APIB). النتائج: أظهرت نتيجة الدراسة الحالية أن الخدج في مجموعة الدراسة لديهم متوسط وزن 1662.8 ± 300.0 جرام مقارنة بمجموعة الضابطه حيث متوسط الوزن 1502.8 ± 260.0 في اليوم 21 مع وجود فروق ذات دلالة إحصائية. فيما يتعلق بالدرجة الإجمالية للاستجابات السلوكية ، أوضحت النتيجة أن 100٪ من الخدج في مجموعة الدراسة أظهروا استجابات سلوكية طبيعية مقارنة بـ 3.3٪ فقط من الخدج في المجموعات الضابطة في اليوم 21. علاوة على ذلك ، كان لدى مجموعة الدراسة 94.0 ± 3.4 متوسط تشبع بالأكسجين بينما كان لدى مجموعة الدراسة 94.0 ± 3.4. كان لدى المجموعة الضابطة متوسط 91.2 ± 1.0 من تشبع الأكسجين. الاستنتاج: لخصت الدراسة إلى أن تطبيق الرعاية المبكرة للخدج في وحدة العناية المركزة لحديثي الولادة يعزز اكتساب الوزن ، ويحسن الاستجابات اللاإرادية ، ويحسن التنظيم السلوكي. التوصيات: ينبغي تضمين تطبيق الرعاية المبكرة للخدج في سياسة وحدات العناية المركزة لحديثي الوللاده و يجب إدراجه كجزء من الرعاية الروتينية للخدج.

الكلمات المرشدة: الرعايه التطويريه المبكره، الاستجابات السلوكيه،النمو البدنى،المواليد الخدج