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# Impact of Tactile Stimulation on Neurobehavioral Development of Premature Infants in Assiut City

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**Abstract**
Objective: To assess impact of tactile stimulation on neurobehavioral development of premature infants in Assiut City. Design: Quasi-experimental research design. Setting: The study was conducted in the Neonatal Intensive Care Unit at Assiut University Children Hospital, Assiut General Hospital, Health Insurance Hospital (El-Mabarah Hospital) and El-Eyman for Gynecology and Obstetric Hospital. Subjects: The study subjects included a convenient sample of 50 premature infants divided into study or control groups and they were matched with gestational age and birth weight. Tool: Brazelton Neonatal Behavioral Assessment Scale is used to assess neurobehavioral development of infants from birth to two months of age. Method: Premature infants divided into two groups; (a) study group who receiving tactile stimulation (b) control group who receiving routine hospital care only. Neurobehavioral development using Brazelton's Neonatal Behavior Assessment Scale (NBAS) was assessed at initial contact and after 5 days of intervention and on discharge. Results: showed that the premature infants of the study had better neurobehavioral development than those in the control group with statistical significant differences were found between the study and the control groups Conclusion: It was concluded from the findings of the current study that premature infants who received tactile stimulation had better neurobehavioral development than those who didn't receive it and had only the hospital routine care.
**Keywords**: Tactile stimulation, neurobehavioral development, premature infant.

## 1. Introduction

It has been argued that premature infants in Neonatal Intensive Care Unit (NICU) are subject to a highly continuous stressful environment, high-intensity noise, bright light and a lack of the tactile stimulation that they would otherwise experience in the womb or in general mothering care (Vickers, et al., 2004). Tactile stimulation is considered a safe practice and there are no significant harmful effects if performed appropriately. It stimulates the production of certain 'feel good' hormones including endorphins and oxytocin. Endorphins released with tactile stimulation are natural source of pain relief for the body (Kulkarni, et al., 2010).

Tactile stimulation improves neurodevelopment of premature infants. Early stimulation given to neonates will change the growth of the brain cells, improve adaptive behavior, and finally cause the achievement of the optimal development of their age (Aliabadi & Askary, 2013). Growth hormone IGF-1 is an important medium in brain activity and plays a leading role in brain function. It can pass through the blood-brain-barrier and promote brain development (Nishijima, et al., 2010, Hamza, et al., 2011, Lee, et al., 2011 and Wen, et al., 2012). The regular application of stimulation, starting as early as 24-48 hours, has a great positive impact on the development of the brain and its function. This sensory stimulation helps premature infants adapt quicker to the new environment and allows them to catch up with full-term infants (Mendes & Procianoy, 2008, Guzzetta, et al., 2009, McGrath, 2009, Massaro, et al., 2009 and Ho, et al., 2010).

Premature infants are often isolated in incubators and deprived of much of the mechanosensory stimulation they would otherwise receive (Rose, et al., 2005 and Rai & Rankin, 2007). Therefore, the nurse has an important role in stimulating these premature infants. The duty of the pediatric nurse is to implement the techniques of tactile stimulation as a part of the comprehensive nursing care plan of the neonates. A pediatric nurse also should have extensive knowledge on proper tactile stimulation techniques to use for premature infants and infants with special needs. The pediatric nurse will provide a customized tactile stimulation to each premature infant, based on his unique needs (Sheehan, 2011).

## 2. Aim of the Study

This study aims to assess the impact of tactile stimulation on neurobehavioral development of premature infants in Assiut City.

## 3. Research Hypothesis

Premature infants who receive tactile stimulation have better neurobehavioral development than those who don't receive it and on routine hospital care.

**4.1Subjects and Method**

This was a quasi-experimental research design performed from November 2011 to July 2012. The study was carried out at the Neonatal Intensive Care Unit at Assiut University Children Hospital, Assiut General Hospital, Health Insurance Hospital (El-Mabarah Hospital) and El-Eyman for Gynecology and Obstetric Hospital.

The study subjects included in this study were 50 premature infants with the following criteria: both sex, born at 30-36 weeks of gestation and birth weight of 1000 gm to ≥ 2500 gm within the first 48 hours, Apgar score >7 at 1 and 5 minutes with no resuscitation required at birth. The premature infants who are medically stable, with medical conditions primarily related to immaturity, such as, mild respiratory distress syndrome, elevated bilirubin and mild hypoglycemia and hypocalcaemia were not excluded from the subjects. The study excluded premature infants with genetic anomalies, congenital heart malformations and/or central nervous system dysfunction or gross congenital malformation, HIV infection, syphilis and hepatitis B, intracranial infection or septicemia, intrauterine growth retardation (IUGR), hypothyroidism and/or inborn errors of metabolism and any evidence of intraventicular hemorrhage.

The subjects were divided into two matched groups (25 neonates received tactile stimulation beside the hospital routine care as a study group and the other 25 as control group where they received the hospital routine care only).

Brazelton Neonatal Behavioral Assessment Scale developed by Brazelton & Nugent (1997) was used to assess the premature infants' neurobehavioral development. It is a multidimensional, multi-item scale. The basic score sheet included 28 behavioral items and 18 reflex items. The clusters were as follows:

1. Reflexes
2. Motor system which included general tone, motor maturity, pull to sit, defensive response and activity level.
3. Autonomic stability, which included tremulousness, startles, liability of skin color and smiles.
4. Habituation, which included response decrement to light, rattle and bell and foot stimulation.
5. Social interactive organization, which included animal visual, animate visual and auditory, inanimate visual, inanimate visual and auditory, inanimate auditory, animate auditory and alertness.
6. Range of states, which included peak of excitement, rapidity of build up, irritability and liability of states.
7. State regulation, which included cuddliness, consolability, self-quieting and hand to mouth.

The behavioral items of BNBAS were scored 0n 9 points (9 points represent the optimal status function or high level of functioning, 5 represents central level of functioning and 1 represents very low level of functioning). Reflex items were scored on 4 points (ranging from 0 to 3, where 3 points represents hyperactive response, 2 points represents normal response, 1 represents hypoactive response and 0 point represents reflex not able to be elicited despite several attempts).

**4.2Method of Data Collection**

An official permission was obtained from the chairmen of NICU where the study was carried out after explaining the aim of the study. The premature infants' neurobehavioral development was assessed for both groups at the initial contact. For the study group, the tactile stimulation was done by the researcher after 24 hours of preterm infants' delivery. The tactile stimulation was done where each premature infant received 5 minutes tactile stimulation twice per day (one in the morning and one in the afternoon shift) for 5 days. The tactile stimulation was performed for each preterm infant in the study group in the following sequence: The premature infant was placed in prone position, then he was rubbed in circular motion by warmed palm of hand for 5 minutes period (1 minute for each region) from the neonate's head and face to the neck, from the neck across the shoulder, from the shoulder to the hand of both arms, from the upper back to the waist, from the thigh to the foot of both legs (Reda, 2007).

The neurobehavioral development was reassessed after 5 days from the tactile stimulation and on discharge for every premature infant in the study and control groups. Any premature infant died or not assessed on his discharge was excluded from the study.

**4.3Data Analysis**

Data were collected, tabulated and analyzed. Data entry was done using Microsoft Excel 2003 computer software package, while statistical analysis was done using SPSS version 16.0 statistical software packages. Data was presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Quantitative continuous data were compared using t-test in case of comparisons between two groups. Whenever the expected values in one or more of the cells in a 2x2 tables was less than 5, statistical significance was considered at P-value <0.05.

**5.Results**

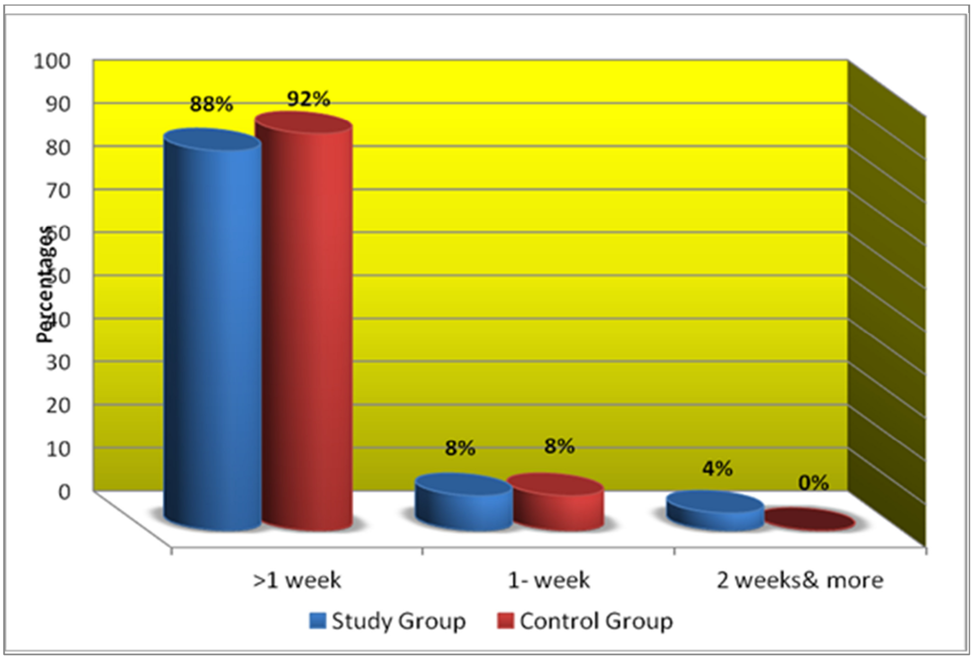


Figure (1): Characteristics of Premature Infants of Study and Control Groups Regarding Age\week
Characteristics of premature infants of the study and control groups regarding age\week illustrated in figure (1). It is clear from the table that the age of the majority of the premature infants in both the study and control groups was less than one week of age (88% and 92% respectively) with mean age of 2.5+ 2.92 weeks for the study group and 2 + 2.15 weeks for the control group.

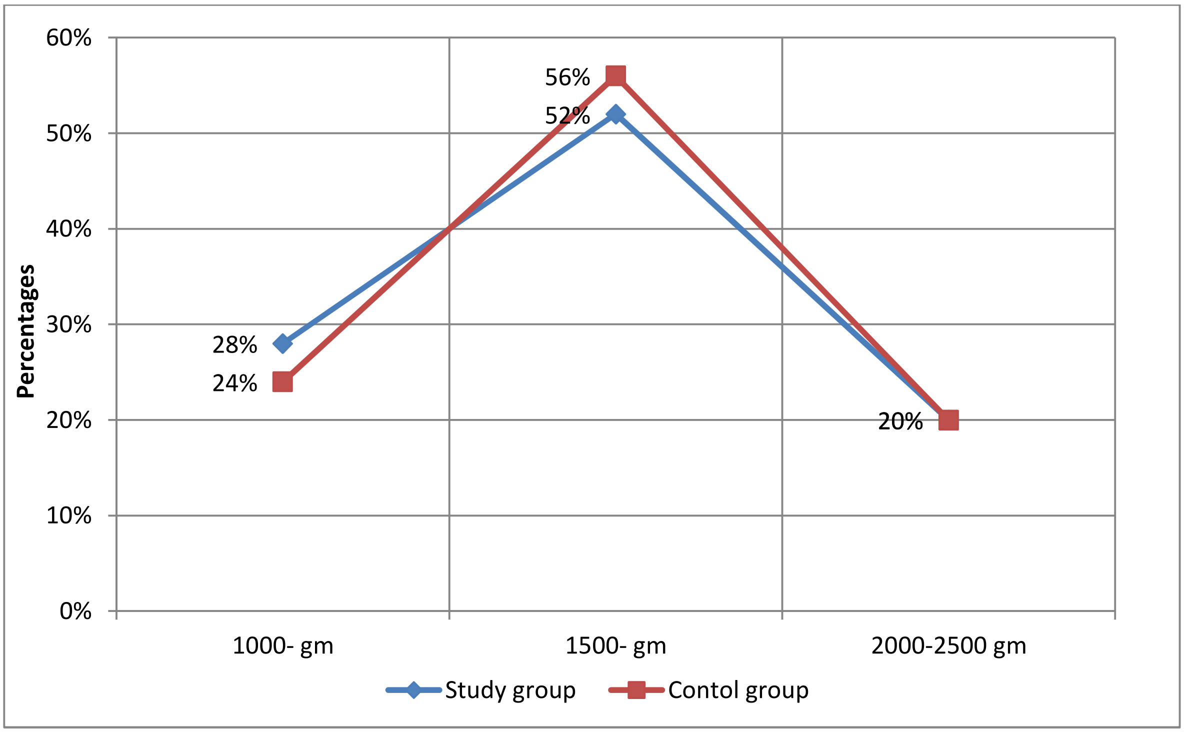


Figure (2): Characteristics of Premature Infants of Study and Control Groups Regarding Birth Weight/gm
Figure (2) indicate characteristics of premature infants of study and control groups regarding birth weight/gm. It was found that the birth weight of more than half of the premature infants of the study and control groups was 1500 to less than 2000 gm (52% for the study group and 56% for the control one). The mean birth weight of the premature infants of the study and control groups was 1702.9 ± 46.7 and 1751.8 ± 377.57 gm respectively.

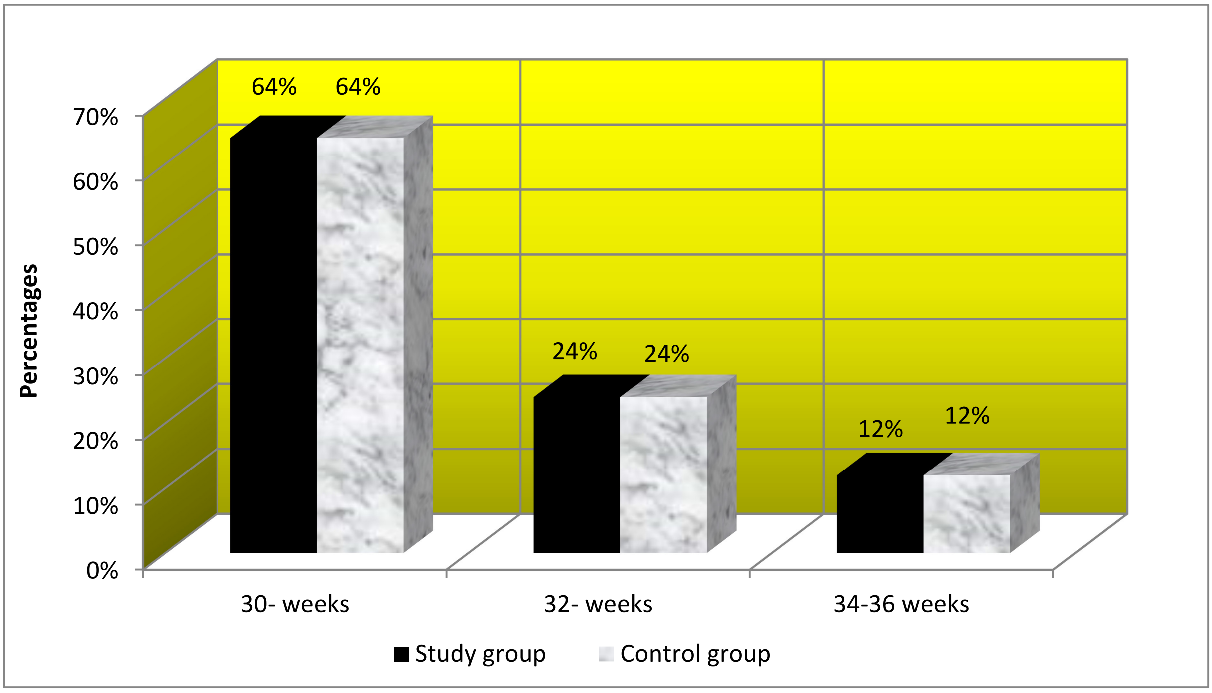


Figure (3): Characteristics of Premature Infants of Study and Control Groups Regarding Gestational Age/Weeks

Figure (3) represent characteristics of premature infants of study and control groups regarding gestational age/ weeks. Regarding premature infants' gestational age, 64% of both the study and control groups were 30 weeks to less than 32 weeks of gestation. Also, the gestational age of 12% of the premature infants of either the study or control groups was 34 - 36 weeks of gestation, with mean 32 ± 1.99 and 32.4 ± 1.98 for the study and control groups of premature infants respectively. It is clear that there were no significant differences between the study and the control groups regarding their characteristics.

Table (1): Impact of Tactile Stimulation on the Means of Premature Infants' Habituation and Social Interactive as Neurobehavioral Development of Study and Control Groups

| Premature Infants' Response | Initial contact | | | 5 Days | | | On Discharge | | |
|---|---|---|---|---|---|---|---|---|---|
| | Study Group $\bar{X}$ n=25 | Control Group $\bar{X}$ n=25 | $t_1$ | Study Group $\bar{X}$ n=25 | Control Group $\bar{X}$ n=25 | $t_2$ | Study Group $\bar{X}$ n=25 | Control Group $\bar{X}$ n=25 | $t_3$ |
| • To light | 1.8 ± 0.9 | 1.6 ± 0.6 | 0.359 | 4.4 ± 1.1 | 3.2 ± 0.8 | 0.001** | 7.5 ± 1.1 | 5.1 ± 0.7 | 0.001** |
| • To rattle | 2 ± 0.7 | 1.8 ± 0.6 | 0.283 | 4.8 ± 0.8 | 3.0±0.8 | 0.001** | 7.7±0.95 | 5.3 ± 0.8 | 0.001** |
| • To bell | 2 ± 0.7 | 1.8 ± 0.7 | 0.287 | 4.8 ± 0.9 | 3.4 ± 0.8 | 0.001** | 7.8 ± 0.9 | 5.3 ± 0.7 | 0.001** |
| • To foot stimulation | 1.6 ± 0.8 | 1.5 ± 0.5 | 0.598 | 4.4 ± 1.1 | 3.0 ± 0.7 | 0.001** | 7.7 ± 1.1 | 5 ± 0.7 | 0.001** |
| • Animate visual | 1.4 ± 0.6 | 1.4 ± 0.6 | 1.000 | 4.3 ± 0.7 | 3.3 ± 0.8 | 0.000** | 7.3 ± 0.8 | 5.1 ± 0.6 | 0.001** |
| • Animate visual & auditory | 2 ± 05 | 1.8 ± 0.6 | 0.206 | 4.8 ± 0.8 | 3.6 ± 0.8 | 0.000** | 7.8 ± 0.9 | 5.4 ± 0.7 | 0.001** |
| • Inanimate visual | 1.3 ± 0.6 | 1.3 ± 0.5 | 1.000 | 4.2 ± 0.7 | 3.2 ± 0.6 | 0.000** | 7.2 ± 0.7 | 5 ± 0.7 | 0.001** |
| • Inanimate visual & auditory | 1.7 ± 0.5 | 1.6 ± 0.5 | 0.482 | 4.6 ± 0.9 | 3.5 ± 0.5 | 0.000** | 7.4 ± 0.8 | 5.2 ± 0.5 | 0.001** |
| • Inanimate auditory | 2 + 0.5 | 1.8 + 0.6 | 0.206 | 4.9 ± 0.9 | 3.8 + 0.6 | 0.000** | 8 + 1 | 5.5 + 0.6 | 0.001** |
| • Animate auditory | 2 + 0.5 | 1.9 + 0.5 | 0.482 | 5.0 + 0.8 | 3.8 + 0.5 | 0.000** | 8.1 + 0.8 | 5.7 + 0.6 | 0.001** |
| • Alertness | 1.9 + 0.6 | 1.7 + 0.6 | 0.244 | 4.8 + 0.9 | 3.6 + 0.6 | 0.000** | 8 + 1 | 5.5 + 0.5 | 0.001** |

**Table (1)** illustrates impact of tactile stimulation on means of premature infants' habituation and social interactive as neurobehavioral development in the study and control groups. It is clear from the table that at initial contact, the premature infants' responses to rattle and bell in both the study and control groups were the highest habituation response, where their means were 2+0.7 for each among the study group and 1.8+0.6 and 1.8+0.7 for the control one respectively. On the other hand, the lowest mean for both the study and control groups was for inanimate visual (1.4±0.6 and 1.3±0.5 respectively).

After 5days, it was observed that the mean values of the premature infants' habituation and social interactive increased for both the study and control groups. The means of the study group ranged from 5+0.8 for animate auditory to 4.8+0.9 for alertness and response to bell. Compared to 3.8+0.5 for animate visual and auditory or animate auditory and 3.2+0.6 for inanimate visual in the control one. The differences between premature infants' habituation and social interactive in both the study and control groups were highly statistically significant (t=0.000).

The means of the premature infants' response in both the study and control groups increased on discharge than after 5 days. The means in the study group ranged from 8.1+0.8 for animate auditory to 7.2+0.7 for inanimate visual. For the control group, the means ranged from 5.7+0.6 for animate auditory to 5+0.7 for animate visual. There were highly statistical significant differences found between the both groups (t= 0.001).

Table (2): Impact of Tactile Stimulation on the Means of Premature Infants' Motor System, Range of States, State Regulation and Autonomic System as Neurobehavioral Development of Study and Control Groups

| Premature Infants' Response | Initial contact | | | 5 Days | | | On Discharge | | |
|---|---|---|---|---|---|---|---|---|---|
| | Study Group $\overline{X}$ n=25 | Control Group $\overline{X}$ n=25 | $t_1$ | Study Group $\overline{X}$ n=25 | Control Group $\overline{X}$ n=25 | $t_2$ | Study Group $\overline{X}$ n=25 | Control Group $\overline{X}$ n=25 | $t_3$ |
| • General tone | 1.6 + 0.6 | 1.6 + 0.6 | 1.000 | 4.2 + 0.6 | 3.4 + 0.6 | 0.000** | 7 + 0.7 | 5.3 + 0.7 | 0.000** |
| • Motor maturity | 1.6 + 0.5 | 1.6 + 0.5 | 1.000 | 4.3 + 0.7 | 3.4 + 0.6 | 0.000** | 7.2 + 0.9 | 5.3 + 0.6 | 0.000** |
| • Pull to sit | 1.6 + 0.5 | 1.5 + 0.5 | 0.482 | 4.2 + 0.8 | 3.3 + 0.5 | 0.000** | 6.9 + 0.9 | 5 + 0.5 | 0.000** |
| • Defensive | 1.6 + 0.6 | 1.5 + 0.5 | 0.525 | 4.3 + 0.7 | 3.2 + 0.6 | 0.000** | 7.2 + 0.9 | 5 + 0.8 | 0.000** |
| • Activity level | 1.7 + 0.5 | 1.6 + 0.5 | 0.482 | 4.3 + 0.8 | 3.3 + 0.7 | 0.000** | 7.4 + 0.7 | 5.3 + 0.8 | 0.000** |
| • Peak of excitement | 1.5 +0.6 | 1.5 + 0.6 | 1.000 | 4.1 + 0.8 | 3.2 + 0.6 | 0.000** | 6.9 +0.7 | 5 + 0.7 | 0.000** |
| • Rabidity of build up | 1.7 +0.7 | 1.7 + 0.6 | 1.000 | 4.5 + 0.8 | 3.6 + 0.6 | 0.000** | 7.4 +0.9 | 5.5 +0.7 | 0.000** |
| • Irritability | 1.9 +0.6 | 1.8 + 0.6 | 0.558 | 4.6 + 0.8 | 3.7 + 0.7 | 0.000** | 7.6 + 1 | 5.4 +0.5 | 0.000** |
| • Liability of states | 1.8 +0.5 | 1.6 + 0.6 | 0.206 | 4.3 + 0.6 | 3.5 + 0.7 | 0.000** | 7.1 +0.6 | 5.3 +0.6 | 0.000** |
| • Cuddliness | 1.4 ±0.6 | 1.4 ± 0.6 | 1.000 | 4.4 ± 0.6 | 3.4 ± 0.7 | 0.000** | 7.1 ± 0.8 | 5.3 ± 0.7 | 0.000** |
| • Consolability | 1.3 ± 0.5 | 1.3 ± 0.5 | 1.000 | 4.3 ± 0.8 | 3.3 ± 0.5 | 0.000** | 7.2 ± 0.8 | 5.2 ± 0.6 | 0.000** |
| • Self quieting | 1.8 ± 0.6 | 1.6 ± 0.6 | 0.244 | 4.7 ± 0.7 | 3.5 ± 0.8 | 0.000** | 7.5 ± 0.9 | 5.3 ± 0.7 | 0.000** |
| • Hand to mouth | 1.9 ± 0.7 | 1.6 ± 0.6 | 0.110 | 4.9 ± 0.7 | 3.6 ± 0.8 | 0.000** | 7.8 ± 0.9 | 5.3 ± 0.6 | 0.000** |
| • Tremulousness | 1.3 ± 0.6 | 1.3 ± 0.5 | 1.000 | 4 ± 0.6 | 3.2 ± 0.6 | 0.000** | 6.8 ± 0.7 | 5.2 ± 0.5 | 0.000** |
| • Startles | 1.4 ± 0.6 | 1.4 ± 0.6 | 0.244 | 4 ± 0.6 | 3.3 ± 0.5 | 0.000** | 6.8 ± 0.7 | 5.2 ± 0.5 | 0.000** |
| • liability of skin | 1.9 ± 0.5 | 1.7 ± 0.5 | 0.163 | 4.7 ± 0.7 | 3.5 ± 0.8 | 0.000** | 7.5 ± 0.9 | 5.4 ± 0.7 | 0.000** |
| • Smiles | 1.9 ± 0.6 | 1.7 ± 0.6 | 0.244 | 4.4 ± 0.8 | 3.5 ± 0.8 | 0.000** | 6.9 ± 1.3 | 5.3 ± 0.7 | 0.000** |

**Table (2)** represents impact of tactile stimulation on means of premature infants' motor system, range of states, state regulation and autonomic system as neurobehavioral development in study and control groups. At initial contact, it was found that the premature infants' response to hand to mouth was the highest mean (1.9 ± 0.7) and (1.9 ± 0.6) for irritability and smiles in the study group, also, irritability and smiles was the highest mean for the control group (1.8 ± 0.6 and 1.7 ± 0.6) respectively. On the other hand, the lowest mean for both the study and control groups was for consolability (1.3 ±0.5 for each).

After 5 days, the premature infants' response to hand to mouth in both the study and control groups was the highest state regulation and autonomic system response, where its means were 4.9 ± 0.7 and 3.6 ± 0.8 respectively. Tremulousness and Startles were the lowest means of premature infants in the study group (4 ± 0.6 for each) compared to tremulousness response of those in the control group (3.2 ± 0.6). The differences between the study and control groups were highly statistically significant.

On discharge, it was noticed that the mean range increased for both the study and control groups. The premature infants' highest mean on state regulation and autonomic system was 7.8 ± 0.9 in the study group for hand to mouth and 5.4 ± 0.7 of those in the control group for liability of skin response. The lowest mean was 6.8 ±0.7 and 5.2 ± 0.5 for startles for both the study group and control groups. Highly statistical significant differences were found between the premature infants of the study and control groups (t=0.000 for each).

Table (3): Impact of Tactile Stimulation on the Means of Premature Infants' Neurological Reflexes as Neurobehavioral Development of Study and Control Groups

| Premature Infants' Response | Initial contact | | | 5 Days | | | On Discharge | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Study Group** $\overline{X}$ | **Control Group** $\overline{X}$ | **$t_1$** | **Study Group** $\overline{X}$ | **Control Group** $\overline{X}$ | **$t_2$** | **Study Group** $\overline{X}$ | **Control Group** $\overline{X}$ | **$t_3$** |
| | **n=25** | **n=25** | | **n=25** | **n=25** | | **n=25** | **n=25** | |
| • Planter | 1.4 ±0.6 | 1.4 ±0.5 | 1.000 | 2 ± 0.2 | 1.9 ± 0.3 | 0.171 | 2 ± 0 | 2 ± 0 | ---- |
| • Babinski | 1.4 ±0.6 | 1.3 ±0.5 | 0.525 | 2 ± 0.2 | 1.8 ± 0.4 | 0.03* | 2 ± 0.2 | 2 ± 0 | 1.000 |
| • Ankle colnus | 1.1 ±0.7 | 1 ±0.6 | 0.590 | 2 ± 0.2 | 1.6 ± 0.5 | 0.000** | 2 ± 0.2 | 2 ± 0 | 1.000 |
| • Rooting | 0.8 ±0.6 | 0.9 ±0.6 | 0.558 | 1.9 ± 0.3 | 1.6 ± 0.5 | 0.013* | 2 ± 0 | 2 ± 0 | ---- |
| • Sucking | 0.6 ± 0.5 | 0.8 ±0.5 | 0.582 | 1.8 ± 0.4 | 1.4 ± 0.5 | 0.003 ** | 2 ± 0 | 2 ± 0 | ---- |
| • Glabella | 1.3 ±0.5 | 1.2 ±0.4 | 0.438 | 2 ± 0 | 1.8 ± 0.4 | 0.015* | 2 ± 0 | 2 ± 0 | ---- |
| • Passive resist legs | 0.6 ±0.5 | 0.6 ±0.5 | 1.000 | 1.8 ± 0.4 | 1.2 ± 0.4 | 0.000** | 2.4±0.5 | 2 ± 0.2 | 0.000** |
| • Passive resist arms | 0.6 ±0.5 | 0.6 ±0.5 | 1.000 | 1.8 ± 0.4 | 1.2 ± 0.4 | 0.000** | 2.4±0.5 | 2 ± 0.2 | 0.000** |
| • Palmar | 0.7 ±0.5 | 0.6 ±0.5 | 0.482 | 1.9 ± 0.3 | 1.2 ± 0.4 | 0.000** | 2.1±0.3 | 2 ± 0.2 | 0.171 |
| • Placing | 0.8 + 0.4 | 0.6 + 0.5 | 0.124 | 1.9 + 0.3 | 1.2 + 0.4 | 0.000** | 2 + 0 | 1.9 + 0.3 | 0.102 |
| • Standing | 0.8 + 0.4 | 0.6 + 0.5 | 0.124 | 1.9 + 0.3 | 1.2 + 0.4 | 0.000** | 2 + 0 | 2 + 0.2 | 1.000 |
| • Walking | 0.7 + 0.5 | 0.7 + 0.5 | 1.000 | 1.9 + 0.3 | 1.2 + 0.4 | 0.000** | 2 + 0 | 1.9 + 0.3 | 0.102 |
| • Crawling | 0.7 + 0.5 | 0.7 + 0.5 | 1.000 | 1.9 + 0.3 | 1.2 + 0.4 | 0.000** | 2 + 0 | 1.9 + 0.3 | 0.102 |
| • Incurvation | 1 + 0.2 | 0.7 + 0.5 | 0.07 | 2 + 0 | 1.3 + 0.5 | 0.000** | 2 + 0 | 2 + 0.2 | 1.000 |
| • Tonic deviation head & eyes | 1.1 + 0.3 | 1 + 0.2 | 0.171 | 2 + 0 | 1.6 + 0.5 | 0.000** | 2 + 0 | 2 + 0.2 | 1.000 |
| • Nystagmus | 1.1 + 0.4 | 1 + 0.2 | 0.269 | 2 + 0.2 | 1.6 + 0.5 | 0.000** | 2 + 0 | 1.9 + 0.3 | 0.102 |
| • Tonic neck | 1.1 + 0.3 | 1.1 + 0.3 | 1.000 | 2 + 0.2 | 1.6 + 0.5 | 0.000** | 2 + 0 | 1.9 + 0.3 | 0.102 |
| • Moro | 1 + 0.4 | 1 + 0 | 1.000 | 2 + 0.2 | 1.6 + 0.5 | 0.000** | 2 + 0 | 2+0 | 1.000 |

**Table (3)** indicates impact of tactile stimulation on means of premature infants' neurological reflexes as neurobehavioral development in the study and control groups. Statistical significant differences was found between the two groups regarding premature infants' neurological reflexes as neurobehavioral development in the study and control groups after five days in all neurological reflexes except planter reflex. It noticed also there were statistical significant differences found between the two groups regarding premature infants' neurological reflexes as neurobehavioral development in the study and control groups **on discharge regarding** passive resist legs and arms.

No statistical significant differences was found between the two groups regarding premature infants' neurological reflexes as neurobehavioral development in the study and control groups at initial contact and on discharge.

## 6.Discussion

The present study found that the premature infants who received tactile stimulation showed better performance on the Brazelton Scale after 5 days and on discharge, specifically in the areas of habituation behavior than the premature infants who didn't receive such stimulation. Habituation behavior represents the premature infants' abilities to decrease their responses to disturbing or repeated stimuli namely light, rattle, bell and tactile stimulation to the foot, to maintain their sleeping state. This study finding was supported by Wahyutami, et al (2010), Diego, et al (2007) and Field, et al (2005).

The finding of the current study indicated that habituation is the ability to block out or ignore external stimuli after the neonate has become accustomed to the activity. During the first 24 hours after birth, premature infants who received tactile stimulation increase their ability to habituate to environmental stimuli through light, rattle, bell and foot stimulation and sleep than those who received just the routine care. Habituation provides a useful indicator of premature infants' neurobehavioral intactness. This finding was supported by Radwan (2014), Wahyutami, et al (2010), Vickers, et al (2004), Mathai et al (2001) and Field et al (1986).

The finding of the current study may be explained in the light of the fact that tactile stimulation helps decrease the stress premature infants experienced in NICU because the stimulation of the pressure receptors during tactile stimulation triggers a parasympathetic response. This decreases the cortisol (major indicator of stress) levels and the premature infants have the ability to sleep well and acquainted with the noises in the NICU and can habituate as decrement to light, rattle, bell and tactile stimulation of the foot. This finding is supported by Field, et al (2008). Also Field et al (2005) found that preterm infants who received tactile stimulation were less fussy, cried less and showed fewer stress behavior.

Results of the present study indicated that premature infants who received tactile stimulation scored better on Brazelton behavior assessment scale after 5 days and on discharge in terms of social interactive than those who didn't receive such stimulation. Social interactive behaviors include inanimate visual, inanimate auditory, animate visual, animate auditory, animate visual and auditory, inanimate visual & auditory and alertness. The premature infants who received the tactile stimulation had better ability to follow and keep their interest to red ball in animate and inanimate visual and to rattle in animate auditory. They also had better coordination between eye movement and neck to process all information from surrounding when they saw the red ball, heard a rattle in social interactive score and became more alert than the premature infants who didn't receive tactile stimulation. These findings were congruent with Radwan (2014), Wahyutami, et al (2010), Kulkarni, et al (2010), Arora, et al (2005), Mullany, et al (2005), Field, et al (2004), Mathai, et al (2001) and Kuhn et al (1991) .

The response of premature infants to stimuli which called social interaction or orientation they become more alert when they sense a new stimulus in their environment. The social interactive in the present study may reflect neonates' response to auditory and visual stimuli, which were demonstrated by their movement or head and eyes focus on the stimuli. In addition, the neonates may prefer the human face and bright shiny objects. As the face or object comes into their line of vision, neonates respond by staring at the object intend, where they use this sensory capacity to become familiar with people and objects in their surroundings (Vandenberg, 2007 and Ricci, 2009).

The results of the current study illustrated that motor behavior of premature infants receiving tactile stimulation was significantly higher than the control group after 5 days and on discharge. Premature infants who received the tactile stimulation were more mature in motor subsystems (general tone, motor maturity, pull-to-sit, defensive, and activity level) than those who didn't receive such stimulation. The finding of the present study may be explained in the light of the fact that tactile stimulation improves muscle tone coordination in premature infants. In addition, tactile stimulation stimulates and increases circulation, improves muscle tone coordination and sleep pattern. This finding was supported by Radwan (2014), Aliabadi & Askary (2013), Kachoosangy & Aliabadi (2011), Ferreira & Bergamasco (2010) and Vaire-Douret, et al (2009), also Wheeden, et al (1993) demonstrated in their study that their preterm neonates' motor behaviours were more mature on the Brazelton examination at the end of the 10-day study period. Also, Ho, et al (2010) in a randomized controlled study examined the impact of tactile stimulation on premature infants with deficits in motor activities, found that tactile stimulation might be a viable intervention to promote motor outcomes in a subgroup of premature infants with poor motor performance.

Results of the present study revealed that the range of states behavior in premature infants receiving tactile stimulation was significantly higher than the control group after 5 days and on discharge. Range of states shows peak of excitement, rapidity of build-up, irritability and liability of states. The findings of the present study could be explained by the fact that tactile stimulation leads to decrease stress hormones and lower anxiety level. Hence, premature infants could adapt better in many stressful situations. It was found that the premature infants of the control group spent more time in the quiet alert state, while the premature infants of the study group were active and spent more time in a state of alertness. This was consistent with Radwan (2014), Aliabadi & Askary (2013), Wahyutami, et al (2010), White-Traut, et al (2009), Vickers, et al (2008) and Ohgi, et al (2004) .

State regulation consisted of: Cuddliness, consolability, self-quieting and hand-to mouth, while autonomic system evaluate tremulousness, startles, lability of skin color and smiles of the neonates. The results of the present study revealed that state regulation and autonomic system behavior of the premature infants who received tactile stimulation were significantly higher than those who didn't receive such stimulation after 5 days and on discharge. These findings could be explained in the light of the greater alertness and motor activity of the premature infants who received the tactile stimulation that contributed to their more organized behavior on the subsequent Brazelton assessment. Also, the premature infants who received tactile stimulation could organize their autonomic system and regulate their state responding to stimulation. These findings were consistent with Radwan (2014), Ferreira & Bergamasco (2010), Wahyutami, et al (2010), Kulkarni, et al (2010),Vickers, et al (2004) and Kelmanson & Adulas (2006).

Results of the current study demonstrated that nearly all the premature infants who received tactile stimulation had better scores regarding neurological reflexes on Brazelton scale than the premature infants who didn't received such stimulation after 5 days. While, no difference was found on discharge between the two groups (study and control groups). These results might be related to the improvement of neurological reflexes of premature infants which are considered criteria for their discharge even for premature infants of study or control groups; where premature infants should be discharged with good or fair reflexes. This finding was congruent with the studies of Wahyutami, et al (2010), Kulkarni, et al (2010), Mathai, et al (2001), Field, et al (1986).

## 7.Conclusion

It was concluded from the findings of the current study that premature infants who received tactile stimulation had better neurobehavioral development than those who didn’t receive it and had only the hospital routine care and the differences were statistically significant.

## 8.Recommendations

***Based on the previous findings and conclusion drawn from the current study, the following recommendations are suggested:***

1. Health care professionals should use the appropriate types of neonatal stimulation, e.g., tactile stimulation to promote growth and neurobehavioral development.
2. Health care institutions such as Neonatal Intensive Care Unit (NICU), should include in their policies neonatal stimulation especially tactile stimulation as a routine care interventions for stable premature infants.
3. Educational programs should be provided to health care professional, especially pediatric nurses in NICU to increase their skills in applying tactile stimulation to premature infants who are medically stable.

***For Further Study:***

1. Study effect of tactile stimulation on premature infants on a larger sample size and over a longer period.
2. Study effect of different types of neonatal stimulations on different age groups.
3. Investigate the effect of different duration of tactile stimulation on neonates and young children's growth and development.

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