Impact of Tactile Stimulation on Anthropometric Measurements of Premature Infants in Assiut City

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Abstract

Prematurity is a major health problem because it is a leading cause of infant mortality. The incidence of prematurity in the year 2010 was 42.8 % of the total admission to neonatal intensive care unit (NICU) at Assiut University Hospital**.** Tactile stimulation is one of the sensory stimulation, it is important for early physical and mental growth of neonates. This study aims to assess impact of tactile stimulation on anthropometric measurements of premature infants in Assiut City. **Subjects and Method:** Quasi-experimental research design was utilized in this study. 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. The study subjects included a convenient sample of 50 premature infants. One tool was utilized to fulfill the aim of this study; anthropometric measurements Sheet. **Results** showed that the premature infants of the study had better anthropometric measurements**,** especially in weight gain**.** Although, no statistical significant differences were found between the study and the control groups regarding growth measurements, the percentages and means weight of premature infants who received tactile stimulation were higher than those who didn't receive such stimulation. It was **concluded** from the findings of the current study that premature infants who received tactile stimulation had better growth than those who did not receive it and had only the hospital usual care. **Recommendations:** Health care professionals should use the appropriate types of neonatal stimulation, e.g., tactile, visual, auditory or/and mixed stimulation to promote neonate's growth. Health care institutions, such as, Neonatal Intensive Care Unit (NICU), should include the tactile stimulation as a usual care interventions for stable premature infants.

Keywords: Tactile stimulation, anthropometric measurements & premature infants.

Introduction

Prematurity is a major health problem because it is a leading cause of infant mortality **(Fakher et al., 2005).** The incidence of prematurity in the year 2010 was 42.8 % of the total admission to neonatal intensive care unit (NICU) at Assiut University Hospital **(Unpublished Statistical Record, Assuit university Children Hospital, 2010).** Premature infants experience a range of morbidity related to the immaturity of their organ systems and to concurrent disease states. There is concern that an unfavorable environment in the neonatal intensive care unit (NICU) may compound this morbidity **(Symington & Pinelli, 2006).**

The premature infants face many challenges during their first months of life. They are supposed to be in a well protected womb and instead they are introduced to a hostile environment while their bodies are not ready for. The life in nursery intensive care unit is based on an environment of sensory bombardment, light, invasive procedures and constant noise which upsets infants' sleep-awake cycles. In addition, 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).** They receive an inappropriate pattern of stimulation as nonreciprocal, painful and multiple stimuli **(Als, et al., 2004 and Gardner, et al, 2011).** Therefore, modification of the environment could minimize the iatrogenic effects, developmental care interventions; reduce neurodevelopment delay, poor weight gain, length of hospital stay, length of mechanical ventilation, physiological stress and other clinically relevant adverse outcomes. Once such modification of the environment would be to provide positive, developmentally appropriate

tactile stimulation **(Symington & Pinelli, 2006).**

Touch (as tactile stimulation) is important for early physical and mental growth of neonates. Touch has been found to influence perceptual and cognitive functions positively. It promotes the growth of myelin and the insulating material around nerves that makes nerve impulses travel faster. It stimulates growth-promoting hormones and increases the enzymes that make the cells of the vital organs more responsive to the growth-promoting effects of these hormones **(Raush, 1998 and Gray & Sponseler, 2000).**

Tactile stimulation produces a positive effect in both preterm and full-term neonates. It may lead to increased weight gain by increasing insulin and insulin growth factor-1 (IGF-1) inasmuch as insulin promotes the conversion of glucose to both short-term (glucogen) and long-term storage (lipids). The IGF-1 plays an important role in promoting growth by stimulating cell growth and multiplication and inhibiting apoptosis **(Field, et al., 2008).** Similarly, tactile stimulation can increased vagal activity which is associated with the release of food absorption hormones (e.g. gastrin). This could contribute to more efficient food absorption (**Hernandez-Reif, et al., 2005 and Field, et al., 2005).**

As premature infants are often isolated in incubators they are deprived of positive stimulation. **Sheehan (2011)** suggests that tactile stimulation is both safe and beneficial for premature infants and that it is the duty of the pediatric nurse to implement the technique of tactile stimulation for these infants as part of comprehensive nursing care**.**

In both full-term and premature infants; IGF-1 is significantly correlated with birth weight, body length and Ponderal index and IGF-1 are notably lower in premature infants. Inasmuch as a positive relationship has been observed between IGF-1 levels and subsequent weight gain, IGF-1 might be one of the factors mediating the greater weight gain observed in massaged preterms and the reverse might also be true, i.e. that weight gain may stimulate insulin and IGF-1 **(Field, et al., 2005)**. Therefore, tactile kinesthetic stimulation had direct effect on weight gaining in preterm infants **(Mohamadzadeh, et al., 2009).**

Aim of the Study

The aim of this study is to determine whether an intervention to increase tactile stimulation promotes growth in a sample of premature infants admitted to the NICU at Assiut City, as compared to neonates receiving the usual care.

Research Hypothesis

Premature infants who receive tactile stimulation have better anthropometric measurements than those who receiving the usual hospital care.

Subjects and Method

Research Design

Quasi-experimental research design was utilized in this study.

Setting

The study was conducted in the Neonatal Intensive Care Unit at Assiut University Children's Hospital, Assiut General Hospital, Health Insurance Hospital (El-Mabarah Hospital) and El-Eyman for Gynecology and Obstetric Hospital.

Subjects

The study subjects included a convenience sample of 50 premature infants with the following criteria:-

Inclusion Criteria

1) Both sex
2) Gestational age between 30 - 36 weeks.
3) Apgar score >7 at 1 and 5 minutes with no resuscitation required at birth.
4) Medically stable condition.
5) Infants with medical conditions primarily related to immaturity, such as, mild respiratory distress syndrome, elevated bilirubin and mild hypoglycemia and hypocalcaemia were not excluded**.**

Exclusion Criteria

1) Genetic anomalies, congenital heart malformations and/or central nervous system dysfunction or gross congenital malformation.
2) HIV infection, syphilis and hepatitis B/intracranial infection or septicemia.
3) Require surgery.
4) Intrauterine growth retardation (IUGR).
5) Hypothyroidism and/or inborn errors of metabolism.
6) 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).

Criteria of Matchability

Each premature infant allocated in the study group was matched with a premature infant with the same birth weight and gestational age for the control group.

Instrument

Growth was measured by obtaining the premature infants' weight, length as well as head, chest and mid-arm circumferences. In addition, data were collected on current age, gestational age, birth weight, gender, and medical history. Demographic and clinical data were collected. Data were collected prior to and following the intervention.

Tactile intervention

For the study group, the tactile stimulation was done by the investigator 24 hours after delivery. Each infant in the treatment group 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 neonate 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)**. Neonates in the control group received the usual care which consisted of; feeding, giving medication, diapering, etc…. .

Method of Data Collection

1. Official permission was obtained from the chairmen of Neonatal Intensive Care Unit in Assiut University Children Hospital, Assiut General Hospital, Health Insurance Hospital (El-Mabarah Hospital) and El-Eyman for Gynecology and Obstetric Hospital.
2. The tool of the study was developed by the researcher and it was tested for its content validity by five experts in the pediatric nursing field where its value was 0.98. Reliability of the tool was calculated by Cronbach's Alpha test and its value was R=97%
3. A written consent from parents of the studied premature infants was obtained. The researcher explained to parents of the premature infants the aim of the study and confidentiality of the data. They were informed of their right to withdraw their neonates from the study at any point of the study and that their participation would not affect the care they receive.
4. A pilot study was carried out on five premature neonates (10% of subjects) to test the clarity and applicability of the tool. Necessary modifications were done. They were excluded from the sample.
5. The premature infants' anthropometric measurements were assessed for both groups at the initial contact and reassessed 5 days after the intervention, as well as upon discharge from the NICU.
6. Any premature infant died or not assessed on his discharge was excluded from the study.
7. Data was collected from November 2011 to July 2012.

Statistical Analysis of Data

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. Qualitative variables were compared using chi-square test. Statistical significance was considered at P-value <0.05.

Results

Table (1): Characteristics of Premature Infants of the Study and Control Groups

Characteristics	Study Group		Control Group		X^2	P.value
	No	%	No	%		
Age/week						
>1	22	88	23	92	1.02	0.599
1 –	2	8	2	8		
2 & more	1	4	0	0		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	2.5 ± 2.92		2 ± 2.15			
Gestational age/ weeks						
30 -	16	64	16	64	0.00	1.000
32 -	6	24	6	24		
34 – 36	3	12	3	12		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	32 ± 1.99		32.4 ± 1.98			
Gender						
Male	10	40	14	56	1.28	0.257
Female	15	60	11	44		
Total	**25**	**100**	**25**	**100**		
Birth weight/gm						
1000 –	7	28	6	24	0.11	0.944
1500 –	13	52	14	56		
2000-2500	5	20	5	20		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	1702.9 ±46.7		1751.8 ± 377.57			
Type of delivery						
Normal Vaginal Delivery	11	44	14	56	0.72	0.346
Cesarean Section	14	56	11	44		
Total	**25**	**100**	**25**	**100**		

Table (2): Impact of Tactile Stimulation on Premature Infants' Weight of the Study and Control Groups

Weight/ gm	Study Group		Control Group		X^2	P- value
	No	%	No	%		
At initial contact						
1000-	10	40	7	28		
1500-	11	44	14	56		
2000-	3	12	4	16	2.03	0.565
2500 & more	1	4	0	0		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	1612.1 ± 377.7		1731.4 ± 381.1			
After 5 days						
1000-	5	20	7	28		
1500-	14	56	15	60		
2000-	5	20	3	12	1.87	0.601
2500 & more	1	4	0	0		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	1750.8 ± 396.5		1666.3 ± 358.4			
On discharge						
1000-	4	16	8	32		
1500-	12	48	14	56		
2000-	6	24	3	12	3.41	0.332
2500 & more	3	12	0	0		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	1881.6 ± 429.6		1702.4 ± 366			

Table (3): Impact of Tactile Stimulation on Premature Infants' Length of the Study and Control Groups

Length/cm	Study Group		Control Group		X^2	P- value
	No	%	No	%		
At initial contact						
> 40	7	28	6	24	0.10	0.747
40 & more	18	72	19	76		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	41.2 ± 3.2		41.8 ± 3.4			
After 5 days						
> 40	7	28	6	24	0.10	0.747
40 & more	18	72	19	76		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	41.4 ± 3.3		41.8 ± 3.4			
On discharge						
> 40	5	20	5	20	0.00	1.00
40 & more	20	80	20	80		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	42.1 ± 3.3		42 ± 3.5			

Table (4): Impact of Tactile Stimulation on Premature Infants' Head Circumference of the Study and Control Groups

Head Circumference/cm	Study Group		Control Group		X^2	P- value
	No	%	No	%		
At initial contact						
> 33	21	84	12	48	7.22	0.007**
33 & more	4	16	13	52		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	30.3 ± 2.4		31.9 ± 2.3			
After 5 days						
> 33	21	84	12	48	7.22	0.007**
33 & more	4	16	13	52		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	30.4 ± 2.4		31.9 ± 2.3			
On discharge						
> 33	20	80	12	48	5.56	0.018*
33 & more	5	20	13	52		
Total	25	100	25	100		
Mean ± SD	30.9 ± 2.5		32 ± 2.3			

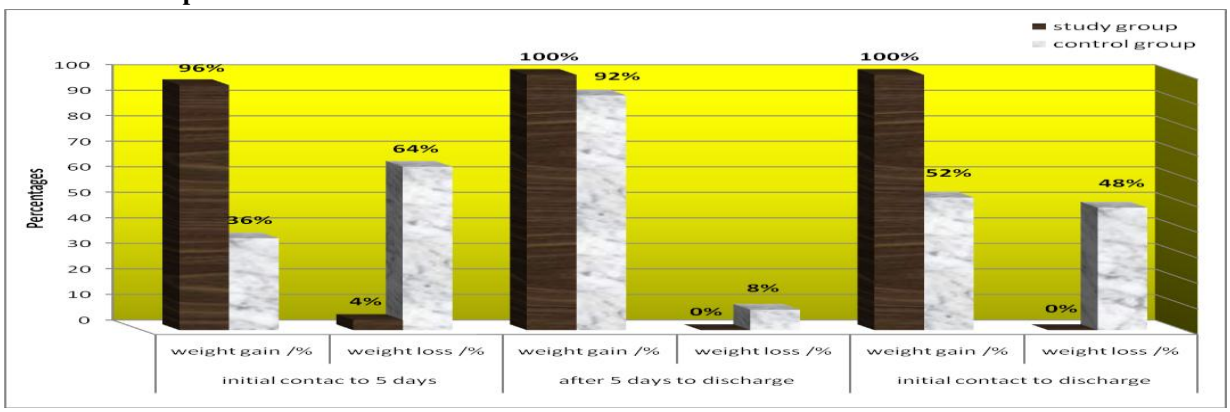
Table (5): Impact of Tactile Stimulation on Premature Infants' Chest Circumference of the Study and Control Groups

Chest Circumference/cm	Study Group		Control Group		X^2	P- value
	No	%	No	%		
At initial contact						
> 30	22	88	19	76	1.22	0.269
30 & more	3	12	6	24		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	27.8 ± 2.6		29.3 ± 2.3			
After 5 days						
> 30	22	88	19	76	1.22	0.269
30 & more	3	12	6	24		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	27.8 ± 2.6		29.3 ± 2.3			
On discharge						
> 30	21	84	19	76	1.23	0.369
30 & more	4	16	6	24		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	28.2 ± 2.6		29.3 ± 2.3			

Table (6): Impact of Tactile Stimulation on Premature Infants' Mid-arm Circumference of the Study and Control Groups

Mid-arm Circumference/cm	Study Group		Control Group		X^2	P- value
	No	%	No	%		
At initial contact						
> 8	17	68	13	52	1.33	0.248
8 & more	8	32	12	48		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	7.1 ± 0.9		7.3 ± 0.9			
After 5 days						
> 8	15	60	13	52	0.32	0.568
8 & more	10	40	12	48		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	7.4 ± 1		7.2 ± 1			
On discharge						
> 8	12	48	13	52	0.08	0.777
8 & more	13	52	12	48		
Total	**25**	**100**	**25**	**100**		
Mean ± SD	7.9 ± 1		7.3 ± 1			

Figure (1): Impact of Tactile Stimulation on Premature Infants' Weight Gain and Loss of the Study and Control Groups



** There is an infant who did not gain or lost weight in the control group after 5 days to discharge.*

Table (7): Impact of Tactile Stimulation on Premature Infants' Percentage Weight Gain of the Study and Control Groups

Percentage Weight Gain	Initial contact to 5 Days					After 5 Days to Discharge					Initial contact to Discharge				
	Study Group		Control Group		P1	Study Group		Control Group		P2	Study Group		Control Group		P 3
	No	%	No	%		No	%	No	%		No	%	No	%	
>5%	10	41.7	9	100	0.027 *	12	48	20	90.9	0.031 *	3	12	13	100	0.01 *
5-%	10	41.7	0	0		9	36	1	4.5		9	36	0	0	
10-%	3	12.5	0	0		2	8	1	4.5		6	24	0	0	
15 -%	1	4.1	0	0		1	4	0	0		3	12	0	0	
20% & more	0	0	0	0		1	4	0	0		4	16	0	0	
Total	**24**	**100**	**9**	**100**		**25**	**100**	**22***	**99.9**		**25**	**100**	**13**	**100**	
Mean	15.4%		3%			22.7%		13.2%		26.4%			4.2%		

Table (1) : illustrates 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. Sixty four percent of both the study and control groups were 30 weeks to less than 32 weeks of gestation. 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). It is clear from the same table that there were no significant differences between the study and the control groups regarding their characteristics.

Table (2) : indicates that an increase in weight was noted at 5 days of life and upon discharge for the infants in both the treatment and the control groups.. It is revealed from the table that the mean weight of the premature infants of the study group was 1612.1 ± 377.7 gm at initial contact and increased to 1750.8 ± 396.5 after 5 days and 1881.6 ± 429.6 gm on discharge. On the other hand, the mean weight of the premature infants of the control group at initial contact was 1731.4 ± 381.1 gm and decreased to 1666.3 ± 358.4 gm after 5 days and increased to 1702.4 ± 366 gm on discharge still less than their mean at initial contact. There were no statistically significant differences found between the study and control groups at the initial contact, after 5 days or on discharge.

Table (3) : represents the effect of tactile stimulation on premature infants' length. It was found that at initial contact and after 5 days, the length of 28% of the premature infants in the study group was less than 40 cm compared to 24% for those in the control group. Also, the length of 72% of the premature infants of the study group and 76% of the premature infants of the control group was 40 cm and more. On discharge, 20% of the premature infants of both the study and control groups were less than 40cm. Also, the length of 80% of the premature infants in either the study or control groups was 40cm and more.

It is revealed from the same table that the mean length of the premature infants of the study group was 41.2 ± 3.2 cm at initial contact and increased to 41.4 ± 3.3 cm after 5 days and 42.1 ± 3.3 cm on discharge. On the other hand, the mean length of the premature infants of the control group at initial contact was 41.8 ± 3.4 cm and still 41.8 ± 3.4 cm after 5 days and increased to 42± 3.5 cm on discharge. No statistically significant differences were found between the study and control groups at the initial contact, after 5 days or on discharge regarding their length.

Effect of tactile stimulation on premature infants' head circumference of the study and control groups is illustrated in **Table (4) :** The mean head circumference of the premature infants of the study group was 30.3 ± 2.4 cm at initial contact and after 5 days and increased to 30.9 **±** 2.5cm on discharge. On the other hand, the mean head circumference of the premature infants of the control group at initial contact and after 5 days was 31.9 ± 2.3cm and increased to 32 ± 2.3cm on discharge. Statistically significant differences were found between the study and control groups regarding the premature infants' head circumference at the initial contact and after 5 days (P = 0.007 for each) or on discharge (P = 0.018).

Table (5) : presents the effect of tactile stimulation on premature infants' chest circumference of the study and control groups. It is revealed from the table that the majority of premature infants' Chest circumference was less than 30 cm of both study and control groups (88% and 76% respectively) at initial contact. After 5 days, 12% and 24% of the premature infants had chest circumference 30 cm and more respectively, while on discharge, 84% of the premature Infants in the study group had chest circumference less than 30 cm compared to 76% of those in the control group. Also, on discharge, 16% and 24% of the premature infants in the study and control groups had chest circumference 30 cm and more respectively.

It is revealed from the same table that the mean chest circumference of the premature infants of the study group was 27.8 ± 2.6 cm at either initial contact or after 5 days and increased to 28.2 ± 2.6 cm on discharge. On the other hand, the mean chest circumference of the premature infants of the control group was 29.3 + 2.3 cm at the initial contact, after 5 days and on discharge. No statistically significant differences were found between the study and control groups at the initial contact, after 5 days or even on discharge regarding their chest circumference.

Table (6) : indicates the effect of tactile stimulation on premature infants' mid-arm circumference of the study and control groups. It was noticed that the mean mid-arm circumference of the premature infants of the study group was 7.1+ 0.9 cm at initial contact and increased to 7.4 +1 cm after 5 days and 7.9 + 1cm on discharge. While, the mean mid-arm circumference of the premature infants of the control group at initial contact was 7.3+ 0.9 cm and

decreased to 7.2 +1 cm after 5 days then increased to 7.3 + 1cm on discharge but still less than their mean at initial contact. No statistically significant differences were found between the study and control groups at the initial contact, after 5 days or on discharge regarding their mid-arm circumferences.

Figure (1) : indicates that all the premature infants in the study group had weight gain during the period from after 5 days to discharge and from initial contact to discharge (100% for each). While, 92% and 52% of the premature infants in the control gained weight respectively from initial contact to 5 days and from 5 days to discharge. On the other hand, none of the premature infants in the study group had weight loss during the period from 5 days to discharge and from initial contact to discharge compared to 8% and 48% of those in the control group respectively.

Table (7) : illustrates that statistical significant differences was found between the two groups regarding premature infants' weight gain/Percentage. It was revealed from the same table that the mean weight gain of the premature infants of the study group was 15.4% at initial contact to 5 days and increased to 22.7% after 5 days to discharge and increased to 26.4% from initial contact to discharge. On the other hand, the mean weight of the premature infants of the control group at initial contact was 3% and increased to 13.2% after 5 days and decreased to 4.2%on discharge. The differences in gain weight of the premature infants of study and control groups were statistically significant from initial contact to 5 days and from 5 days to discharge. Where P= 0.027 and 0.031 and 0.01 respectively.

Discussion

The results of the present study revealed that the premature infants gained weight either in the study or the control groups. This result can be explained in the light of the fact that neonates usually increase in their weight by ¾kg /month, 150 to 210 gm/week **(Madkour, 2008)** as a result of their feeding where they received milk formula even for neonates who received I.V infusion beside milk formula. However, infants receiving the tactile stimulation intervention has a statistically signifant improvement in the percent of weight gain achieved.

Tactile stimulation is relatively simple and inexpensive intervention that can increase the weight in premature infants. The finding of the current study indicated that although the premature infants in both groups, i.e., the study or the control groups increased in the weight, the premature infants who received the tactile stimulation gained more weight than those who did not receive such stimulation after 5 days or on discharge. This result was documented by the higher mean weight gain of the study group than the control one (table 2). This finding was congruent with **Radwan, (2014)** who found in her study about effect of tactile kinesthetic stimulation on growth and behavior of preterm neonates that the premature neonates who received tactile-kinesthetic stimulation gained more weight than those who did not receive it. Also, the finding of the current study was supported by **Aly & Murtaza (2013), Karbasi, et al., (2013), Badiee, et al., (2012), Golchin, et al., (2010), Keshavarz, et al., (2009), Livingston et al., (2009) and Turchaninov & Bouimer, (2010).**

The increase of weight gain of the premature infants who received the tactile stimulation (study group) more than those received the hospital routine may be related to increased vegal activity which in turn may lead to increased gastric mobility as a result of the release of digestive hormones and thereby leads to weight gain. This explanation is supported by **Field et al., (2011), Lahat, et al., (2007), Field, et al., (2006), Hernandez-Reif, et al., (2005) and Diego, et al., (2005)**. In addition, **Field et al., (2008)** stated that tactile stimulation may lead to increased insulin and insulin growth factor-1(IGF-1) which promotes growth by stimulating cell growth and multiplication leading to weight gain. In addition, the increase in weight gain of the preterm infants who received the tactile stimulation may be a result of reduced stress that preterm infants experience it in NICU because the stimulation of pressure receptors during tactile stimulation triggers a parasympathetic response, which increases vagal activity **(Ahmed, et al., 2007)**.

The finding of the current study revealed that the increase in the length, head, chest and mid-arm circumferences was not statistically significant among the preterm infants either who received or did not receive the tactile stimulation throughout the study period. In addition, there were no differences in these anthropometric measures between the preterm infants who received tactile stimulation and those who did not receive such stimulation. These results can be explained by the fact that the increase in the length, head and chest circumferences needs time and the study was carried out over a short period of time. Also, these findings may be due to the small sample size. These findings in (table 3, 4, 5) were supported by **Kachoosangy & Aliabadi (2011), Skankaranayanan, et al., (2005), Mathai, et al., (2001).** On the contrary, **Radwan (2014)** found that

the premature neonates who received the stimulation had increase in length, head and mid-arm circumference than those who did not receive it.

Conclusions

It can be concluded from the findings of the current study that premature infants who received tactile stimulation had improvement in the percentage of weight gain and the head circumference, but not in overall length, chest and mid-arm measurements. No negative effects were found on growth between the treatment and control group, suggesting that overall, the intervention was supportive to the growth of premature neonates.

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, visual, auditory or/and mixed the appropriate types of neonatal stimulation, e.g., tactile, visual, auditory or/and mixed stimulation to promote neonates' growth.
2. Health care institutions such as Neonatal Intensive Care Unit (NICU), should include the tactile stimulation as a usual 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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