

Effect of tactile kinesthetic stimulation on preterm infants' weight and length of hospital stay in Khartoum, Sudan

Ragaa G. Ahmed, PhD, Gaafar I. Suliman, DCH(Lon), PhD, Walyeldin A. Elfakey, MD, Karimeldin M. Salih, MD, Ehab I. El-Amin, PhD, Waled A. Ahmed, PhD, Khalid E. Khalid, PhD.

ABSTRACT

الأهداف: دراسة تأثير التنبيه الحسي الحركي لمدة 7 أيام على وزن ومدة إقامة الأطفال الخدج في المستشفى في ولاية الخرطوم بالسودان.

الطريقة: اعتمدت الدراسة على المنهج شبه التجريبي والذي أُجري في 4 مستشفيات، الخرطوم، السودان وذلك خلال الفترة من يناير إلى يونيو 2013م. شملت الدراسة 160 طفل خديج والذي تم توزيعهم عشوائياً على مجموعتين وهما مجموعة الدراسة ومجموعة الشاهد (80 طفل في كل مجموعة). لقد تلقى الخدج في مجموعة الدراسة هذه الرعاية التمريضية الروتينية، في حين تلقى الخدج في مجموعة الدراسة هذه الرعاية إضافة إلى التنبيه الحسي الحركي وذلك على مدى 3 فترات لمدة 15 دقيقة في كل فترة وعلى مدار 7 أيام متتالية. وقد قمنا بتجميع البيانات اللازمة وذلك باستخدام الاستبيان، واستمارة مرجعية، وميزان وزن (مقياس ترجيح)، وعلى أساسها تمت مقارنة زيادة الوزن ومدة الإقامة في المستشفى بين المجموعتين.

النتائج: أشارت نتائج الدراسة إلى ازدياد وزن الأطفال الخدج في مجموعة الدراسة وذلك بصورة واضحة من الناحية الإحصائية وعلى مدى 7 أيام المتتالية (1071gm versus 1104gm) وذلك عند المقارنة بمجموعة الشاهد (1077gm versus 1084gm) والتي زاد وزن الخدج فيها 6.9 غرامات فقط خلال نفس الفترة (1084.55±90.74). ولقد كان معدل الفرق بين المجموعتين واضحاً من الناحية الإحصائية ($p=0.00$). فيما كانت مدة إقامة الخدج في المستشفى بين الخدج في مجموعة الدراسة أقل بصور واضحة من الناحية الإحصائية مقارنة بمجموعة الشاهد (18.05±9.36 versus 25.47±10.25; $p=0.00$).

الخلاصة: أظهرت نتائج الدراسة بأن لدى التنبيه الحسي الحركي للأطفال الخدج تأثيراً فعالاً على زيادة الوزن والخروج المبكر من المستشفى مما سيزيد من كفاءة الخدمات الصحية المقدمة ويقلل من تكلفتها.

Objectives: To determine the effect of 7 days tactile kinesthetic stimulation (TKS) on preterm infants' weight and hospital stays in Khartoum State, Sudan.

Methods: This is a quasi-experimental study, it was conducted in 4 hospitals between January and June 2013, Khartoum, Sudan, and it involved 160 preterm infants randomly assigned into the case and control groups (80 neonates in each). Preterm infants in the control group

received routine nursing care, while preterm infants in the case group received TKS for 3 periods, 15 minute per day for 7 constitutive days, in addition to routine care. Data was collected using a structured self-designed and validated questionnaire, checklist, and weighting scale. Weight gain and hospital stay were compared between the 2 groups.

Results: Over the constitutive 7 days, the case group gained significantly more weight (1071gm versus 1104gm) compared with the control group (1077gm versus 1084gm) (1084.55±90.74) who gained only 6.9gm within the same 7 days without TKS treatment. The mean difference in weight gain was significant ($p=0.00$). The hospital stay for preterm infants in the case group was significantly shorter (18.05±9.36 versus 25.47±10.25; $p=0.00$).

Conclusion: Tactile kinesthetic stimulation for preterm infants has a beneficial effect on weight gain and earlier discharge from hospital, which are sequentially efficient and cost effective.

*Saudi Med J 2015; Vol. 36 (2): 196-199
doi: 10.15537/smj.2015.2.9415*

From the Department of Nursing (Ahmed R, Ahmed W), the Department of Community Health (El-Amin), the Department of Laboratory Medicine (Khalid), Faculty of Applied Medical Sciences, the Department of Pediatric (Elfakey), Faculty of Medicine, Albaha University, Albaha, the Department of Pediatric (Salih), Faculty of Medicine, King Khalid University, Abha, Kingdom of Saudi Arabia, and the Department of Pediatric and Child Health (Suliman), Gaafar Ibn-auf Children's Hospital, Khartoum, Sudan.

Received 19th June 2014. Accepted 19th December 2014.

Address correspondence and reprint request to: Dr. Ragaa G. Ahmed, Department of Nursing, Faculty of Applied Medical Sciences, Albaha University, PO Box 1988, Albaha, Kingdom of Saudi Arabia. E-mail: ragy254@yahoo.com

Disclosure. Authors have no conflict of interests, and the work was not supported or funded by any drug company.

Preterm birth is a worldwide problem responsible for more than 80% of neonatal deaths, and more than 50% of long term morbidity in the surviving infants.¹ Preterm birth rates range from 5-7% of live births in some developed countries, but are estimated to be substantially higher in developing countries; these percentages appear to be on the rise.² In 2008, the overall preterm birth rate in the USA was 12.3%.³ Preterm birth has increased for many reasons, including demographic change, infertility treatment, increases in maternal age, multiple gestation, increasing obesity rate, and dramatic rise in late preterm birth.⁴ Preterm birth rate in the United States declined for the seventh straight year to 11.39%, but the low birth weight rate was essentially unchanged at 8.02%.⁵

In 2011, there were 14 neonatal intensive care units in Khartoum State's Governmental Hospitals; however, a paucity of information exists. The number of preterm infants in these 14 units is approximately 1083 preterm births out of a total number of approximately 5415 births; it is almost 20% (preliminary survey from the Ministry of Health, Sudan).

Tactile kinesthetic stimulation (TKS) increases insulin growth factor-1, therefore, increasing weight gain, and 62% of the variance in change of insulin resulted from changes in vagal activity during TKS.⁶ Many randomized controlled trials documented moderate massage therapy increased weight within 5-10 days, sessions varied from 10-15 minutes, 2-3 times a day, and these studies showed 21-48% greater weight gain, and 3-6 days less hospital stays than the control groups.⁷

Preterm infants' weight increases by many ways, such as vestibular stimulation and oral stimulation related to breast feeding or by sucking reflexes, such as non-nutritive sucking during gavage feeding, (kangaroo care technique) kangaroo mother care, or skin to skin holding, gentle touch, massage intervention, and TKS. In this study, we evaluate the effect of TKS on preterm infants' weight and hospital stays in Khartoum State's hospitals due to the lack of these applications in Sudan.⁸ If preterms start to gain weight immediately after birth, this will shorten the length of hospital stay, hence lowering the financial burden. This study aims to determine the effect of the 7 days of TKS on preterm infants' weight and hospital stays in Khartoum, Sudan.

Methods. This study is a quasi-experimental study. It was conducted during a 6 month period; between January and June 2013 in 4 hospitals in Khartoum, Sudan. Two hospitals were chosen for intervention (Omdurman Maternity Hospital [55 preterm infants],

and Khartoum Teaching Hospital [25 preterm infants]), and the other 2 hospitals as controls (Alsaudi Maternity Hospital [55 preterm infants], and Gaafer Ibn-Auf Children Hospital [25 preterm infants]).

The 160 preterm infants were selected depending on the following criteria: birth weight of 1000-1200gm, gestational age of 30-37 weeks, breast milk being fed by tube, and age 4 days since birth. A number of 9 preterm infants were dropped due to attrition of their mothers from the study and only 151 preterm infants completed the study. Preterm infants were randomly assigned into 2 groups (case or control group) following informed consent from their mothers. The randomization of the 4 hospitals was made by using a simple random sampling (lottery method), the 2 hospitals (Omdurman Maternity Hospital and Khartoum Teaching Hospital) were assigned as the case group, and the other 2 hospitals (Alsaudi Maternity Hospital and Gaafer Ibn-Auf Children Hospital) were assigned as the control group. Preterm infants in the control group received routine care, while preterm infants in the case group received TKS in addition to routine care.

The mothers involved in this study undertook a 3 constitutive day training program. In day one, the researchers read and discussed the module in Arabic with the mothers, and they trained the mothers demonstrating on a doll. On day 2, the trained mothers applied their skills on their own preterm infants, and on day 3 they started the actual measurements of weight for 7 days. During the first 3 days of training, the mothers were closely observed by researchers to ensure accurate intervention.

Tactile kinesthetic stimulation was performed for 15 minutes, 3 sessions per day for 7 consecutive days. The procedure was started half an hour after feeding, physiological parameter was observed pre and post technique (temperature, pulse rate, respiratory rate, and oxygen saturation). The procedure of TKS follows Field's protocol for medically stable preterm infants.⁸

They were massaged 3 times per day for 7 days. Fifteen minute stimulation sessions consisted of 3 standardized 5 minutes phase. The preterm infants were stroked during the first and third phase and their limbs were moved passively into flexion and extension during the middle 5 minutes phase. For the stroking phases with moderate pressure the preterm infant was placed in a prone position. The trained mother provided the stroking, placing her warm fingers on the preterm infant body. The stroking occurred for 5, one-minute periods (12 strokes at approximately 5 seconds per stroking motion) over each region as the following sequence: From the top of the head to the neck and back again,

from the neck, across the shoulders and back again, from the upper back to the waist and back again, from the hip to the feet and back to the hip on both legs, and from the shoulder to the hand and back to the shoulder on both arms. Then the preterm infant was placed in supine position for the subsequent flexion/extension of limbs phase, 5, one-minute segments of 6 passive flexion/extension (kinesthetic) movement (like bicycling) were provided, approximately 10 seconds for each arm, then each leg, and finally both legs. For the final phase, the preterm infant was returned to the prone position and given the stroking process again.

This study was approved by the Graduate College and Research Ethics Committee, University of Medical Sciences and Technology, Khartoum, Sudan, (IRB 00008867) and a consent form was completed by the mothers of the preterm infants. The data was analyzed using the Statistical Package for Social Sciences version 17 (SPSS Inc., Chicago, IL, USA). The chi-square test was used to analyze the differences in mothers and preterm infant's characteristics. The independent "t" test was used to analyze the difference in preterm infant's weight and hospital stays, between case and control groups, and a paired sample t-test was used to determine the differences before and after intervention. All values were tabulated as averages (mean) with standard deviation (SD). *P*-values less than 0.05 were considered significant.

Results. As shown in Table 1, 138 mother (preterm infants number=151, and the number of mothers=138). In the intervention group, 68 mothers for 76 preterm infants, and in the control group, 70 mother for 75 preterm infants participated in this study, due to the attrition of 22 mothers from 160, and only 138 completing the study. The number of preterms is higher than the number of mothers because some mothers had twins (8 in the intervention group and 5 in the control group). Their education levels varied between secondary and university levels. Mothers whose children had undertaken TKS showed remarkable low level of education compared with the mothers from the control group ($p=0.00$). As for the preterm infants participants of this study, there is no a difference in the matched variables of gestational age between intervention and control groups. The mean preterm infant age was shown to be significantly high ($p=0.00$) among the intervention group.

The mean weight gain in preterm infants in the case group showed a significant ($p=0.00$) increase in weight (1071gm versus 1104gm) of 33gm following 7 days of

TKS intervention as compared with the control group (1077gm versus 1084gm) who gained only 6.9gm within the same 7 days without TKS treatment. The mean difference was significant ($p=0.00$) (Table 2). Hospital stay for preterm infants in the case group was significantly shorter (18.05 ± 9.36 versus 25.47 ± 10.25 ; $p=0.00$). The 95% confidence interval for the difference of means ranged from -6.21 to -4.07 (Table 2).

Discussion. There are many studies regarding the effects of TKS in preterm infants. Most of these studies have shown an improvement in weight gain.⁹ In this study, results showed no significance difference in preterm infant's weight between case and control group at the beginning of the intervention program. The results of this study were higher than the study on the effect of TKS on weight gain of preterm infants by Mohamadzadeh et al.¹⁰ Their study was on medically stable preterm infants, their gestational age ranged from 28 weeks to 34 weeks, birth weight ranged from 1000gm to 1500gm, breast milk by tube, followed the

Table 1 - Characteristics of mothers and preterm infants in case and control groups in Khartoum Hospitals, Sudan.

Variable	Intervention group n (%)	Control group n (%)	<i>P</i> -value
<i>Mothers education</i>			
Primary	42 (61.8)	12 (17.1)	0.00**†
Intermediate	26 (38.2)	21 (30.0)	
Secondary	0 (00)	23 (32.9)	
University	0 (00)	14 (20.0)	
<i>Number of preterm infants</i>			
Single	60 (78.9)	65 (86.7)	0.50†
Twins	16 (21.1)	10 (13.3)	
<i>Gender of preterm infants</i>			
Male	46 (60.5)	44 (58.7)	0.50†
Female	30 (49.5)	31 (41.3)	
Mean gestational age	32.89±1.94	32.84±1.94	0.87‡
Mean preterm infant age	18.05±9.3	10.69±9.9	0.00**‡

*Highly significant difference between intervention and control group,
†Chi square test, ‡Independent t-test, n - number

Table 2 - The mean difference in preterm infant's weight and hospital stays between the case and control groups in Khartoum Hospitals, Sudan.

Variables	Before TKS (Mean ± SD)	After TKS (Mean ± SD)	<i>P</i> -values
<i>Preterm infant's weight</i>			
Control	1077.67±89.87	1084.55±90.74*	0.00**†‡
Intervention	1071.60±80.5	1104.83±83.5*	
<i>Preterm infant hospital stays</i>			
Control		25.47±10.25	0.00**‡
Intervention		18.05±9.36	

*highly significant difference between intervention and control group,
† $p<0.01$, a - paired sample t-test, ‡independent t-test, TKS - tactile kinesthetic stimulation, SD - standard deviation

Field protocol for 10 days, but over 3 consecutive hours. The t-test on the mean weight gain showed that infants that were massaged increased weight by 11.6gm per day, $p=0.00$ in Mohamadzadeh et al's¹⁰ study. Compared with this study, the increase in weight in Mohamadzadeh et al's¹⁰ study is higher (11.6gm versus 4.7gm), this difference is due to a 10 day period rather than a 7 day period, and massage for 3 consecutive hours may be more effective than every 8 hours.¹⁰

Our results regarding the length of hospital stays of the preterm infants showed significant differences between the case and control groups ($p=0.00$). In preterm infants', hospital stay in the case group discharged 7 days earlier than the control group. The mean length of hospital stay in this study was similar (7 days versus 7 days) to a study performed by Mendes and Procianoy¹¹ who measured the effect of maternal massage on preterm infants, reducing hospital stays, and the occurrence of sepsis. Their massage was 6 hourly, 15 minutes per session, and the study design was a randomized controlled trial. Their results revealed that preterm infants who received maternal massage left the hospital 7 days earlier than similar newborns who did not receive massage. There is a similarity in the results despite the difference in the massage applied by mothers, and they followed the Field protocol in both studies, but there was similarity in hospital stays between the 2 studies.¹¹

The strength of this study is in the initiation of a KTS program among Sudanese preterms despite the limited resources. Our study revealed a significant improvement in preterms weight and shortened hospital stay with modification of the KTS technique. Study limitations were, short time for data collection, and the results for measuring the effects could have been more realistic if measured over a longer time. The study was conducted in one state of Sudan; such studies could yield more useful results if conducted on a larger sample size all over the country, which is our suggested future strategy.

In conclusion, TKS has a beneficial effect on weight gain and earlier discharge from hospitals, which is sequentially efficient and cost effective. Further studies

are needed to evaluate the effect of TKS in infants with birth weight less than 1000gm, and to apply this research in other areas of Sudan in order to gather more informative data.

Acknowledgment. *Authors are grateful to all participating hospital staff, and we appreciate the efforts of all our colleagues, and the preterm infants' mothers.*

References

1. Yuan W, Duffner AM, Chen L, Hunt LP, Sellers SM, Bernal AL. Analysis of preterm deliveries below 35 weeks' gestation in a tertiary referral hospital in the UK. A case-control survey. *BMC Res Notes* 2010; 3: 119.
2. Beck S, Wojdyla D, Say L, Betran AP, Merialdi M, Requejo JH, et al. The worldwide incidence of preterm birth: a systematic review of maternal mortality and morbidity. *Bull World Health Organ* 2010; 88: 31-38.
3. Norwitz ER, Caughey AB. Progesterone supplementation and the prevention of preterm birth. *Rev Obstet Gynecol* 2011; 4: 60-72.
4. Loftin RW, Habli M, Snyder CC, Cormier CM, Lewis DF, Defranco EA. Late preterm birth. *Rev Obstet Gynecol* 2010; 3: 10-19.
5. Martin JA, Hamilton BE, Osterman MJK, Curtin SC, Mathews TJ. Birth: Final Data for 2013. *National Vital Statistics Reports* 2015; 64: 1-68. Available from: http://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_01.pdf
6. Field T, Diego M, Hernandez-Reif M. Potential underlying mechanisms for greater weight gain in massaged preterm infants. *Infant Behav Dev* 2011; 34: 383-389.
7. Field T, Diego M, Hernandez-Reif M. Preterm infant massage therapy research: a review. *Infant Behav Dev* 2010; 33: 115-124.
8. Field TM, Schanberg SM, Scafidi F, Bauer CR, Vega-Lahr N, Garcia R, et al. Tactile/kinesthetic stimulation effects on preterm neonates. *Pediatrics* 1986; 77: 654-658.
9. Massaro AN, Hammad TA, Jazzo B, Aly H. Massage with kinesthetic stimulation improves weight gain in preterm infants. *J Perinatol* 2009; 29: 352-357.
10. Mohamadzadeh A, Karbandi S, Habibollah E, Mahdi B. Effect of tactile-kinesthetic stimulation on weight gaining of preterm infants. *Medical Journal of the Islamic Republic of Iran* 2009; 23: 148-153.
11. Mendes EW, Procianoy RS. Massage therapy reduces hospital stay and occurrence of late-onset sepsis in very preterm neonates. *J Perinatol* 2008; 28: 815-820.