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Effects of Gentle Human Touch and Field Massage on Urine Cortisol Level in Premature Infants: A Randomized, Controlled Clinical Trial

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ABSTRACT

Introduction: Hospitalization in neonatal intensive care unit may leads to many stresses for premature infants. Since premature infants cannot properly process stressors, identifying interventions that reduce the stress level for them is seems necessary. The aim of present study was to compare the effects of Field massage and Gentle Human Touch (GHT) techniques on the urine level of cortisol, as an indicator of stress in preterm infants.

Methods: This randomized, controlled clinical trial was carried out in Al-Zahra hospital, Tabriz. A total of 84 premature infants were randomly assigned into three groups. First groups were touched by their mothers three times a day (15 minutes in each session) for 5 days by GHT technique. The second group was received 15 minutes Field massage with sunflower oil three times a day by their mothers for 5 days. The third group received routine care. In all groups, 24-hours urine samples were collected in the first and sixth day after the intervention and analyzed for cortisol level. Data were analyzed by SPSS software.

Results: There were significant differences between mean of changes in cortisol level between GHT and control groups and Field massage and control groups (0.026).

Conclusion: Although the massage with Field technique resulted in a significant reduction in blood cortisol level, but the GHT technique have also a similar effect. So, both methods are recommended for decreasing of stress in preterm infants.

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Introduction

Premature birth is defined as birth before 37 completed weeks of gestation.¹ Approximately, the global rate of preterm birth was around 11.1% that is equivalent with 14.9 million births annually.² Vazirinejad et al., reported that the rate of low birth weight (birth weights less than 2500 grams) was 9.6% in a referral hospital in Iran.³

Due to recent advances in prenatal and neonatal care the survival rate of premature infant has been significantly increased.⁴ It should be noted that this increased survival is

not associated with decrease in complications such as low birth weight and survived infants are more susceptible for problems such as severe disability, mental retardation, cerebral palsy, and vision and hearing problems.⁵ So, the purpose of providing care for premature infants has changed from survival and prevention of major disabilities to normal brain development.⁶

Despite the vital importance of the neonatal intensive care unit (NICU) in survival of preterm infants, being hospitalized in these wards would cause stress for these infants, which ultimately leads to disruption of their

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development.⁷ These stressful experiences are including sleep deprivation, high levels of light and noise, loss of human interaction and pain.⁸ Moreover, stressful experiences in infants are associated with the release of stress hormones such as cortisol and adrenaline and may lead to dangerous side effects such as fear, irritability, sleep disturbances, alterations in the response of immune system, and impaired emotional relationship.⁹

When infant attempts to adjust with stressful situations, hypothalamic - pituitary-adrenal axis is activated and changes in plasma levels of cortisol and beta-endorphins reaches to its maximum level.¹⁰ Long-term complications of high concentrations of cortisol were including insulin resistance, hyperlipidemia, immunodeficiency and destructive changes in hippocampus.¹¹ Since premature infants cannot properly adjust with environmental stressors, interventions is needed to improve their autonomic nervous system performance.¹² Applying the supportive care can be used as an approach to enhance the development of infants and mitigate the complications caused by prematurity.¹³ This approach is composed of a wide range of interventions including additional stimulus control (such as visual, hearing, and equilibrium and tactile stimulus), cluster care, family-centered care, behavioral or supportive techniques (such as Kangaroo mother care, positioning, non-nutritive sucking), and positive stimuli such as music and gentle touch. The purpose of these techniques is to improve the quality of life of premature infants.¹⁴

In the past, it was recommended that the unnecessary touch of preterm infants may have many negative impacts on their hemodynamic status and should be avoided.¹⁵ But, recent evidence suggests that the lack of sensory stimuli in premature infants may act as a stressor and may cause developmental and neurological delays.¹⁶ Many studies have been carried out on the effects of massage therapy on preterm infants and have shown many positive consequences such as: weight gain, decreased duration of hospitalization,

the increase in the incidence of late infection, and activation of behavioral and brain development.¹⁷ Stress in preterm infants can be measured by assessing the hormonal and behavioral indicators, so the effects of interventions for stress reduction have been examined on the levels of stress hormones level.¹ Since premature infants cannot properly process stressors, identification of interventions that reduce the stress level for them is seems necessary.

Jay used the concept of Gentle Human Touch (GHT) to show a soft touch delivered by human agents.¹⁸ In a study by Harrison *et al.*, the effects of GHT on six premature infants at 32-27 weeks of gestation were investigated.

The results showed that during GHT intervention the experimental group had lower levels of cortisol, more weight gain, reduced need for oxygen, as well as decreased motor activity.¹⁹ Results of another study by Acolet *et al.*, showed that the cortisol level of 11 premature infants in 29 weeks of gestation was reduced after massage therapy.¹¹ A few studies have examined the impact of touch interventions on preterm infant's stress and most studies in this field has limitations in methodology, including small sample size, the use of invasive procedures to determine the level of stress and using the observation tool, that all could impact on the results. Therefore, this study aimed to compare the effects of Field massage and Gentle Human Touch (GHT) techniques on the urine level of cortisol in preterm infants, as an indicator of stress.

Materials and methods

This study is a randomized, controlled clinical trial that conducted from September to December 2014. The setting for the study was the Neonatal Intensive Care Unit (NICU) in Al-Zahra hospital affiliated to Tabriz University of Medical sciences, Tabriz, Iran. The samples composed of 84 preterm infants with gestational age between 30 and 36 weeks. Other inclusion criteria for these infants were including: passing 7 to 10 days from birth, no

need for artificial ventilation, having no medical order for intravenous or intramuscular injections, absence of congenital anomalies, mother willingness to cooperate in the study, and no feeding of infant for half an hour before the massage. In this study, infants who were discharged from the hospital until within the sixth day of the study or were critically ill newborn whom received severe invasive procedures within five days of intervention or their mothers did not completely adhere to the study protocol were excluded from the study.

Eligible infants who were available were selected. Then through the 6 block they were randomly allocated into three groups. Random numbers to select these infant was determined using RAS statistical software. Opaque sealed envelopes with sequentially numbered were used for allocation concealment. The sample size was calculated based on the mean and standard deviation of changes in cortisol levels (Yakson group 3.0(0.6), GHT group 3.1(0.6), control group 3.2(0.7) obtained from a previous study.^{20,21}

Considering 95% confidence interval and power test of 0.80, the minimum sample size was estimated to be 21 infants in each group by using G-Power software. By estimation of 30% attrition rate, the final sample of each group was increased to 28 infants.

In this study, a checklist was used to record information regarding mother and neonates characteristics. The content validity of this checklist was approved by 10 academic staff from Tabriz University of Medical Sciences.

The study had the approval from local ethic committees of Tabriz University of Medical Sciences, Iran and registered with code number 201407275168N5 in Iranian Registry of Clinical Trials (IRCT) site. Before data collection, an informed consent was signed by all potential parents and the study protocol was approved by two neonatologists. Then, infants were randomly allocated into three groups by random blocking method (GHT Group, Field massage, and control group). GHT Group infants were touched by their mothers three times a day (15 minutes) for 5

days. In this group, the mothers disinfected their hand with anti-microbial solutions and warm them under the warmers. Then they touched the forehead of their premature infants with their palm for 15 minutes when put the fingertips over the eyebrows. Also, they put their other hand on the lower abdomen to support the infants' back and buttocks. The second group, received 15 minutes Field massage periods for 5 days three times a day by their mothers by using sunflower oil. This technique was consisted of three 5-minute massage phases which in the first and final phases the infant was lying on the abdomen. This massage is done with the smooth parts of the fingers of both hands with a medium pressure. In these two phases, the following areas was massaged respectively: 12 massage movement (every 5 seconds) from the head to the neck on the way of two sides of the face and vice versa; 12 massage movements (every 5 seconds) from the back of the neck to shoulders and vice versa; 12 massage movements (every 5 seconds) from the upper back to lower back and waist and vice versa; 12 massage movements (every 5 seconds) from the thighs down to the ankles and vice versa; and 12 massage movements (every 5 seconds) from the shoulders to wrists and vice versa. In the middle phase, Infants was lying flat on their back and six passive flexion - extension movements (every 10 seconds) were given to the following areas: right arm, left arm, right leg, left leg, and both feet. The third group was the control group whom received routine care including Kangaroo mother care (KMC), massage without any technical received.

In all three groups, 24-hours urine samples were collected using urine bag and measured for Cortisol level in the first and sixth day after the intervention. Collected urine immediately transferred to the accredited laboratory in Tabriz and the cortisol level measured by using radio-immunoassay method by LIAISON device and was reported as μg in 24h.¹² The reliability of the LIAISON device with multiple calibrated during the study was approved by a lab technician.

Data analysis was performed using SPSS version 13 software (SPSS Inc., Chicago, IL, USA). Statistical significance was considered as meaningful for P-value less than 0.05. Descriptive statistics including means, standard deviations, frequency and percentage were calculated for all variables. The normality of collected data was evaluated using the Kolmogorov - Smirnov test. An independent

samples t-test was used for statistical comparisons of cortisol level before and after intervention within each group and one-way ANOVA test was used for comparison the cortisol levels between three groups. Confounding variables were controlled by general linear model with repeated measures ANOVA.

All participants signed the consent form of the study (Figure 1).

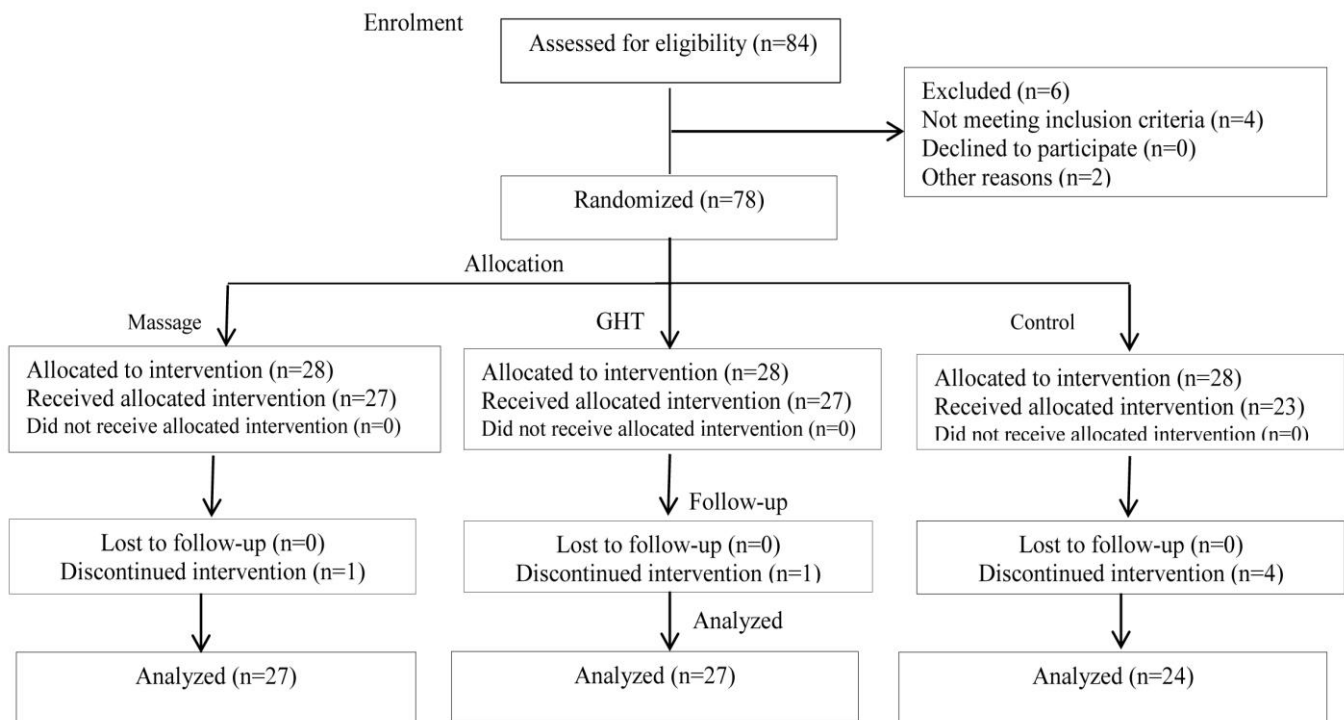


Figure 1. Consort flow diagram

Results

Overall, 84 preterm infants (28 infants in each groups) were participated in this study. One infant in each GHT and Field massage group and 4 infants in control group were excluded from the study because of early discharge or dissatisfaction for taking urine sample in 6th day. So, the result of 78 premature infants was included in the final analysis. The demographic characteristics of preterm infants in three groups are reported in table 1. The results of chi-square and one-way ANOVA tests showed that there were no statistical differences between three groups in regard with these characteristics. Some demographic characteristics of mother of infants were as

followings: age were 28.6 (5.4) years; most of them were educated less than diploma (39.3%); were housewife (86.9%); and had a moderate economic status (75%).

Table 2 shows the comparisons of the mean of stress hormone level within three groups (n= 78) in the first and sixth days of the study.

According to the results stress hormone levels were lower in Field massage group in the sixth day 1.05 (0.45) of the first day 1.12 (0.66).

Despite reducing levels of stress hormones in the sixth day compared to first day in the sixth day of the first day in the field massage group statistical difference was not found between before and after intervention ($P>0.05$). According to the percent of changes and

variance analysis, cortisol level showed a significant difference between three groups ($P=0.045$). In addition, post hoc test showed these differences were between GHT and control groups ($P=0.032$) and between Field

massage and control groups ($P=0.026$). The mean and standard deviation of percentage changes in cortisol levels between three groups was reported in Table 3.

Table 1. Comparison of baseline characteristics of preterm infants in three groups (n = 84)

Characteristics	GHT group Mean(SD) ^b	Field massage group Mean(SD)	Control group Mean(SD)	Statistical indicator
Sex^a				$X^2=2.04$, $df=2$, $P=0.468^{\text{E}}$
Mal	18 (64.8)	13 (46.4)	17 (60.7)	
Female	10 (35.7)	15 (53.6)	11 (39.3)	
Type of delivery^a				$X^2=0.31$, $df=2$, $P=0.949^{\text{E}}$
Caesarian	21 (75)	22 (78.6)	20 (71.4)	
Vaginal	7 (25)	6 (21.4)	8 (28.6)	
Apgar score in				
Minute 1	7.7 (1.3)	7.4 (1.4)	7.7 (1.4)	$F=0.39$, $df=83$, $P=0.678^{\text{Y}}$
Minute 5	8.9 (1.0)	8.7 (1.2)	9.0 (1.1)	$df=83$, $P=0.634^{\text{Y}}$
Birth weight (grams)	1619 (606)	1494 (331)	1372 (494)	$df=83$, $P=0.176^{\text{Y}}$
Postnatal age (days)	23.5 (17.1)	22.9 (18.2)	25.4 (15.8)	$F=0.16$, $df=83$, $P=0.851^{\text{Y}}$
Gestational age (weeks)	31.1 (2.7)	31.1 (2.4)	30.3 (2.1)	$F=1.05$, $df=83$, $P=0.354^{\text{Y}}$

^aN (%), ^EP-Value for chi-square test, ^YP-value for one way – ANOVA test, ^bSD: standard deviation

Table2. Comparisons of the mean of stress hormone level within three groups (n= 78) in the first and sixth days of the study

Variable	GHT group (n=27) Mean (SD) ^a	Field massage group (n=27) Mean (SD)	Control group (n=23) Mean (SD)
Stress hormone ($\mu\text{g}/24\text{h}$) (pretest)	1.20 (0.45)	1.12 (0.66)	0.94 (0.70)
Stress hormone ($\mu\text{g}/24\text{h}$) (posttest)	1.25 (0.49)	1.04 (0.45)	1.27 (0.48)
Statistical indicators	$t=-0.45$, $df=26$, $P=0.65^{\text{E}}$	$t=0.53$, $df=26$, $P=0.58^{\text{E}}$	$t=-2.17$, $df=23$, $P=0.04^{\text{E}*}$

^aSD: Standard Deviation, ^EP-Value for independent samples t-test, ^{*}Statistical significant

Table3. Percentage of changes in stress hormone level in preterm infants in the three groups (n= 78)

Groups	Stress hormone (percentage change) Mean (SD) ^Y	Statistical indicators (between-group)
GHT group	585 (175)	$F=3.23$, $P=0.045^{\text{E}*}$
Field massage group	455 (154)	
Control group	138 (716)	
GHT and control group	-541 (248)	$P=0.032^{\text{a}}$
Field massage and control group	-562 (248)	$P=0.026^{\text{a}}$

^EP-value for one-way ANOVA; ^aP-value for independent samples t-test; ^YSD: (standard deviation), ^{*}Statistical significant

Discussion

The main aim of this study was to compare the effects of GHT as a gentle touch and Field massage as a moderate touch on the urine level of cortisol in preterm infants. There are many stressors for premature infants in NICU and it

is important for a nurse to identify interventions that would reduce the impact of stress in these infants. Results of this study indicated that, in comparison with control group, GHT and Field massage groups showed decrease in urine levels of cortisol.

Although there are concerns about the effects of sensory stimulation of premature infants, but several studies have confirmed the positive effects of GHT for premature infants. This finding is in line with the findings of Bahman Bijari *et al.*, who investigated the effects of GHT and Yakson touch on behavioral reactions of preterm infants. The behavioral reactions of infants were assessed before and 5 days after the intervention by using Anderson Behavioral State Scale. In the interventional groups (GHT and Yakson groups) the score of sleep state was increased and the score of wake and fussy states were decreased. These results reflect the positive effects of both methods in sedation of preterm infants.⁵

Although premature infants may appear very weak, but a grade of pressure is needed for effective massage therapy.²² Field *et al.*,²³ conducted a study to examine the effects of moderate versus light pressure massage therapy on weight gain in preterm infants with average gestational age of 30 weeks. In their study preterm infants were received 15 massages sessions with tactile and kinesthetic stimulations three times per day for 5 days.

Results showed that infants in moderate pressure massage group gained significantly more weight per day. This group also showed significantly change on stress behaviors such as: 1- decrease in deep sleep, agitation, and heart rate; 2- increase in active sleep and gross moment. Finally, results showed that massage with moderate pressure therapy with tactile and kinesthetic stimulations was more effective than light pressure massage.

Our study also supports this finding which showed that the level of stress hormone in Field massage group was significantly lower than other two groups. Kuhn *et al.*, examined the effects of massage on sympathetic system and adrenal cortex and reported that massage may increase the catecholamine and cortisol secretions. Increase in secretion of catecholamine is associated with increased stress and raise concerns about the impact of massage on stress level in preterm infants.²⁴ Hernandez-Reif *et al.*,⁴ suggested that massage

reduces the stress of preterm infants and secretion of catecholamine which helps the desirable development and awakes.

Most of previous studies have many methodological limitations such as using invasive method for determining the stress level²⁴ and using observational methods of measurement.²³ These limitations may impact on the validity and generalizability of findings of previous studies. In this regard, in the present study a non-invasive and reliable method of measurement, urine level of cortisol, was used to determine the stress level of preterm infant.

Finally, according to the findings of this study, it is suggested that Field massage therapy should be considered a complementary approach for preterm infants.

Implementation of this procedure requires the attention of health policy makers and health care providers regarding the benefits of this procedure.

This study has some limitations. The main limitation was the difficulty in collecting 24-hour urine with urine bag. In addition, lick of urine especially in female infants is likely to influence the findings. Due to problems in measurements of urinary cortisol, another study with measurement of salivary cortisol is suggested to determine the stress level of infants.

Conclusion

The results of present study showed that both GHT and Field massage therapy techniques reduces the stress hormone levels of preterm infants. The results of this study, in line with previous studies, confirmed the importance and safety of massage for preterm infants. Using these procedures can result in reducing stress hormone levels and reduces their negative effects on preterm infants.

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Ethical issues

None to be declared.

Conflict of interest

The authors declare no conflict of interest in this study.

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