Original Article

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The Effect of Multisensory Stimulation on Weight Gain of Preterm Infants

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ABSTRACT

BACKGROUND AND OBJECTIVE: Low birthweight is one the common problems of infants and one of the main health indicators of a society. Weight is one the major determinants of physical and mental development in infants, particularly preterm infants. The aim of this study is to investigate the effect of multisensory stimulation on weight gain of preterm infants.

METHODS: In this double-blind clinical trial, 80 preterm infants born at 32-36 weeks gestational age, were randomly divided into two groups (control and multisensory stimulation). The intervention group received multisensory stimulation program consisting of 12-minute daily sessions, 5 times a week until the day of discharge and the control group received only the usual care. Infants were weighed every day until the day of discharge (IRCT registration code: 2016073114454N2).

FINDINGS: No significant difference was observed between the two groups of preterm infants in terms of gestational age, birthweight and sex. The difference between mean weight gain on the first day and the day of discharge was 131.6±10.1 g in the intervention group and 58.9±10.2 g in the control group. The difference between the two groups was significant ($p<0.001$).

CONCLUSION: The Results of the study revealed that using multisensory stimulation for weight gain of preterm infants is a cost-effective and effective method.

KEY WORDS: *Stimulation, Weight gain, Preterm infant.*

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Introduction

As defined by World Health Organization, infants born before the 37th week after the last menstruation are preterm infants (1). Premature birth is among the major causes of infant mortality in developed countries and its prevalence is estimated to be 5-7% in these countries and is currently regarded as an important general health issue.

Global estimates of preterm birth in 2005 show that these births include 9.7% of all births, which is an overall 12.9 million per year, while around 11 million of them occur in Asia and Africa (2). According to the studied conducted in Iran, the prevalence of preterm birth ranges from 5.5% in Shiraz to 8.21% in Arak (3). One the common problems in infants is low birthweight, which is one of the main health indicators of a society. Weight is one the major determining factors for physical and mental development in infants, particularly preterm infants (4, 5). Infants are a subgroup of vulnerable groups of the soci

ety and the less their birthweight is, the more vulnerable they are. Therefore, birthweight is one of the most important causes of infant mortality (6, 7). Due to low weight and poor health, these infants are hospitalized in Intensive Care Unit (ICU) for a long period. Maintaining physiological stability and weight are the most important criteria for their discharge (6, 7). Since weight gain is one the important indices in the development of infants, assessment of development criteria and designing and conducting this process requires certain interventions (8).

Hence, preterm birth is the most common cause of infant mortality and is a risk factor for evolutionary and developmental disability, which may lead to long term complications in infant's developmental and musculoskeletal system (9).

Since the main steps of growth and development occur during pregnancy, especially during the last months and weeks, and since these infants were born earlier, they didn't have the chance for the development of vital systems (10). In addition, the Neonatal Intensive Care Unit (NICU) is completely different from intrauterine environment and this may be a risk factor for the development of these vulnerable infants (11, 12).

Multisensory stimulation is a relatively new intervention closely related to principles of sensory stimulation therapy (13). Since 1960, researchers have suggested various multisensory stimulations for preterm infants hospitalized in NICU to simulate the intrauterine environment during the first weeks of life to maintain and accelerate the process of development in preterm infants (14).

Different stimulation programs include a combination of auditory stimulation, sensory-motor and visual stimulation and several advantages have been reported for both groups of health preterm infants and infants with different complications of prematurity (8).

Some studies related to preterm infants demonstrated that sensory stimulation, singular or multisensory, is accompanied by positive results in developmental and physiological domains including: weight gain, reduced stress levels, reduced heart rate and positive changes in behavior (15). Results also demonstrated that various techniques of multisensory stimulations is helpful for modification of some undesirable neurological effects of preterm birth and negative complications of long term hospitalization (16,17).

At the moment, there are contradictory evidences regarding the effect of multisensory stimulations from neuromuscular aspects and in some studies, using incomplete multisensory stimulations did not have significant effects on premature development (18) and in some studies, short term effects of multisensory stimulations (auditory, tactile, vestibular and visual stimulation) on neuromuscular development and weight gain was scarcely reported (19).

Considering these issues and the fact that infants only react through behavioral channel, using the specialty and clinical skills of nurses to take care of infants and understand their behaviors seems necessary.

So far, various developmental models have been suggested to nurses for the care of infants. The professional status of NICU nurses should not be limited to clinical practices such as arterial blood sampling or intubation and we need a deep perspective in regard with developmental intervention with a difference view (20).

Therefore, multisensory stimulation is one of the solutions for successful weight gain in preterm infants. Therefore, achieving this type of care in the NICU will have a positive effect in enhancing growth and development in preterm infants. Considering the importance and urgency of the above-mentioned topics, this study aims to investigate the effect of multisensory stimulation on weight gain of preterm infants.

Methods

This double-blind clinical trial was conducted using preterm infants hospitalized in NICU of Motahari Hospital in Jahrom in 2016 (IRCT registration code: 2016073114454N2).

Infants born at 32-36 weeks gestational age, infants with written consent of their mother, infants without the need for mechanical ventilation, infants fed orally by gavage, hemodynamic stability (pink color, body temperature between 36 and 37℃, arterial oxygen saturation above 84%) and infants without congenital anomalies were included in the study.

In case of considerable change in hemodynamic stability, central nervous system damage, genetic or metabolic diseases, severe asphyxia, respiratory diseases requiring ventilation and high levels of bilirubin that needs to be treated with phototherapy infants were excluded from study.

The sample size of 80 preterm infants was calculated using a pilot study and mean comparison formula with 95% confidence level and 90% test power. First, 80 infants were selected using accessible random sampling and were randomly divided into two groups of control and multisensory stimulation.

The intervention method in this study included a multisensory stimulation program including: auditory stimulation, tactile stimulation, visual stimulation and vestibular stimulation by mother for 12 minutes (11). Tactile stimulation was done by massaging infant's organs for 3 minutes, auditory stimulation was done by playing lullaby songs inside incubator for 3 minutes, visual stimulation was done by hanging black and white cards inside incubator for 3 minutes and vestibular stimulation was done by vertical and horizontal shaking of infant for 3 minutes (11). Stimulations for calm and alert infants were done 30 minutes before eating, 12 minutes each time, and 5 times a week until the day of discharge from NICU to Post NICU along with routine care (11).

The control group only received the routine care. Preterm infants often need time for development. During their stay in hospital, infant learn to eat and sleep and are weighed regularly. Preterm infants usually stay in hospital until they reach suitable gestational age and they are usually discharged when they reach 1500 g (5).

A researcher practically teaches mothers the correct method of intervention and the researcher monitors the process of intervention done by mother to make sure it is done correctly and there is no sign of stress during intervention. During interventions, the infant was examined each 10 seconds regarding signs of stress and in case of observing one of the signs of stress, the intervention was stopped for 15 minutes and was started again after that.

If any sign of stress was repeated for three times, the intervention was stopped in that interval. Infant's weight was measured at 8 every morning until the day of discharge using a calibrated scale with assessed validity and reliability.

The data were analyzed using SPSS 16. Independent t-test was used to determine the effect of intervention in the two groups and $p<0.05$ was considered significant.

Results

The two groups were homogenous regarding demographic variables, type of delivery and gender and there was no significant relationship between the two groups in terms of these variables. Moreover, based on statistical tests, there was not a significant difference between the two groups in terms of variables of height, weight, head circumference, gestational age at birth and first- and fifth-minute Apgar (Table 1). The period of hospitalization in NICU for intervention group and control group were 15.1±2.2 and 14.5±1.8 days, respectively, which was not statistically significant.

The mean weight of infants in intervention group increased from 1166.7±162.2 g to 1298.3±172.3 g and the mean weight in control group increased from 1174.3±195.4 g to 1233.2±185.2 g. The intergroup test results demonstrated a significant difference between infants' weight gain in the first and last days in both groups. Based on intergroup comparison, the mean weight of infants on the first day was 1166.7±162.2 g in intervention group and 1174.3±195.4 g in control group. On the final day of assessment, mean weight of infants on the first day was 1298.3±172.3 g in intervention group and 1233.2±185.2 g in control group.

The intergroup test results demonstrated that there is no significant difference between the two groups regarding this variable. However, the difference in mean weight gain between the two steps of assessment was 131.6±10.1 g in intervention group and 58.9±10.2 g in control group and there was a significant difference between the two groups regarding mean weight gain (Table 2).

Table 1. Comparing the mean demographic characteristics in the two groups.

Groups / Variables	Intervention Mean±SD	Control Mean±SD	P-value
Birth weight (g)	1100.2±170.2	1110.1±185.2	0.68
Birth height (cm)	38.10±3.11	39.1±2.9	0.61
Birth age (week)	31.1±1.9	30.4±2.5	0.45
First-minute Apgar	7.1±1.2	6.80±1.9	0.38
Fifth-minute Apgar	7.1±1.8	7.9±2.01	0.62
Days of hospitalization	15.1±2.2	14.5±1.8	0.5

Table 2. Comparing the mean weight gain in the two groups.

Steps / Groups	Entering the study Mean±SD	Discharge Mean±SD	Weight gain difference Mean±SD	P-value
Intervention	1166.7±162.2	1298.3±172.3	131.6±10.1	<0.001
Control	1174±195.4	1233.2±185.2	58.9±10.2	<0.001
P-value	0.84	0.22	<0.001	

Discussion

Results of this study indicated that mean weight gain between the two steps of assessment was 131.6±10.1 g in intervention group and 58.9±10.2 g in control group and there was a significant difference between the two groups regarding mean weight gain. In addition, the results of this study are in line with the study of Field et al. They reported that despite the same level of calorie reception in both groups, the treatment group gained more weight compared with control group and there was a significant difference between the two groups (20).

A study by Rocha et al. demonstrated that sensory-motor-oral stimulation program has beneficial effects on the period of hospitalization. The results of their study also demonstrated that these stimulations did not have significant effects on weight gain in the first week (21). However, according to a study by Fucile et al., preterm infants receiving sensory, motor and oral stimulations alone or in combination with sensory, motor and touch interventions gained more weight compared with control group. In a recent study, despite similarity in the level of calories received by both groups, the weight gain in multisensory stimulation group was significantly higher than control group (22).More weight gain in intervention group is due to stimulation of oral receptors.

This theory led to the hypothesis that stimulation of more receptors in body provides the context for better weight gain in infants (20). Kim et al. demonstrated that multisensory stimulation accelerates physical growth of term infants (23). Study of Modi et al. demonstrated that there is a positive relationship between neurodevelopment and infant massage (24). The results of this study are in line with the present study. Taneja et al. demonstrated that multisensory intervention influences social, physical and mental development (25). Multisensory stimulation may stimulate vagus nerve by stimulating peripheral nerves, which releases gastric and intestinal hormones such as gastrin and cholecystokinin and facilitates digestion and absorption of food and increases weight gain (20). Multisensory stimulation may help prevent infant diseases and reduce the need to visit a doctor repeatedly. Moreover, studies show that multisensory stimulation is related to faster recovery and decreased length of hospitalization (26). The main mechanism for these results is yet to be discovered. However, the hypothalamic-pituitary-adrenal axis seems to respond to stress (27). Long separation between mother and infant and lack of sensory stimulations affect the immune system function indirectly by hypothalamic-pituitary-adrenal axis (28).

Moreover, studies have shown that sensory stimulations in the form of massage decreases urinary stress hormone in term infants (20). Results of the study showed that the significant difference in weight gaining in the two groups is a result of monitoring and controlling all effective variables and the intervention of multisensory stimulations. Multisensory stimulation is a safe method for weight gain in infants and mothers can make this an effective and low-cost method.

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