



Effect of non-nutritive sucking stimulation on incubation duration in low birth weight infants

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Abstract

Background: Low birth weight infants (LBWIs) are at an increased risk 20 times more likely to die than others, those infants are in more dangers to live normally. Nonnutritive Sucking Stimulation is recognized for enhancing successful feeding.

Purpose: this study aimed to determine the effect of using Nonnutritive Sucking Stimulation on the incubation duration for LBWIs.

Subjects and Procedures: Sixty LBWI infants ranged in age from 30 to 36 gestational weeks of both sexes participated in this study. They were selected from the neonatal intensive care unit of Om El Masryeen and Abo el Reesh hospitals. They were assigned randomly into two groups of equal number representing study and control groups. Study Group in which infants received their medical treatment in addition to a selected physical therapy intervention aiming to improve their nutritive abilities during incubation period while infants in the control group subjected to medical treatment only. The physical therapy treatment program was conducted three times per day from date of admission until the infant reached grade 4-point ordinal scale in functional oral intake scale (FOIS).

Results: There was a statistically significant increase in oromotor functional scale measures post treatment in the control and study groups compared with that of pretreatment with a statistically significant difference in post treatment values in favor to the study group ($p > 0.05$).

Conclusions: Nonnutritive Sucking Stimulation is an effective modality that may be added to the treatment program used in low birth weight infants who have weak suckling.

Keywords: low birth weight, non-nutritive-sucking stimulation, preterm infant

Introduction

Low birth weight (LBW) is the commonly used name for any baby born weighing less than 2500 grams, what's is commonly seen in the developing rather than developed countries ^[1]. Low birth weight children can be born before term and have varying degrees of social and medical risk ^[2].

Worldwide, approximately 99% of LBW infants are born in developing countries of Africa, Asia, Central and South America ^[3]. A low birth weight baby's head may appear to be bigger than the rest of the body, and the baby often looks thin with little body fat ^[4].

Preterm infants' hospital discharge is often delayed due to their inability to feed by mouth safely and competently. Infants may encounter oral feeding difficulties due to the immaturity of specific physiologic functions ^[5].

Oral motor function is fine motor function of the oral mechanism. Oral feeding is a complex task; that will develop by oral reflex at 12-16 weeks, sucking and swallowing activities at 28 weeks and the full coordination will be in 30-32 weeks ^[6].

Below 30 weeks of gestational age the coordination between suction, swallowing and breathing is not completed so will need gastric feeding tube ^[7]

Oral feeding in preterm infants is frequently characterized by immature sucking and/or uncoordinated suck, swallow, and breathe sequencing which may lead to delays in successful breast- and bottle-feeding, poor weight gain, and dehydration during early postnatal weeks ^[8].

Oral- motor stimulation (OMS) plays an important role to promote normal oral feeding by helping the activation of the muscles involved in the suction process, improving its efficiency, lead to gain and achieve the normal weight, this may overcome the duration of stay in incubation, decrease the chance for infection so decrease costs, in a safe and inexpensive way ^[9].

Subjects and Procedures

Subjects

This study was conducted after the approval of the Ethical Committee of the faculty of Physical Therapy, Cairo University, Egypt no (P.T.REC/012/003595). A sample of sixty LBWIs with weak suckling of both sexes participated in the present study with their ages ranged from 30 to 36 weeks geostationary age. They were selected from neonatal intensive care unit of Om el Masryeen and Abo el Reesh hospitals. They had a diagnosis of preterm low birth weight infants with delayed sucking which obtained from their medical records and confirmed by Electronic weight scale for weight and grade 1 or 2 according to functional oral intake scale. Participant excluded if he/she showed regression symptoms and need for ventilator or discover any disease in brain during incubation period.

In addition, written consent form from the parents of low birth weight infant's participation from beginning of the study.

Design and Randomization

This study was a randomized controlled trail which was conducted from 3 November 2017 till September 2021. Sixty -one low birth weight infants were screened for participation in the current study. One infant' parents refused to complete in the study. The remaining sixty LBWIs were randomly assigned into two groups; the control group who spend incubation period without any physical therapy intervention and the study group who received a designed physical therapy. The process of randomization was performed by an independent person who was blinded to the purpose or protocol of the study. Every participant was passing through a flow chart which based on Consolidated Standards of Reporting Trials (CONSORT) shown figure (1).

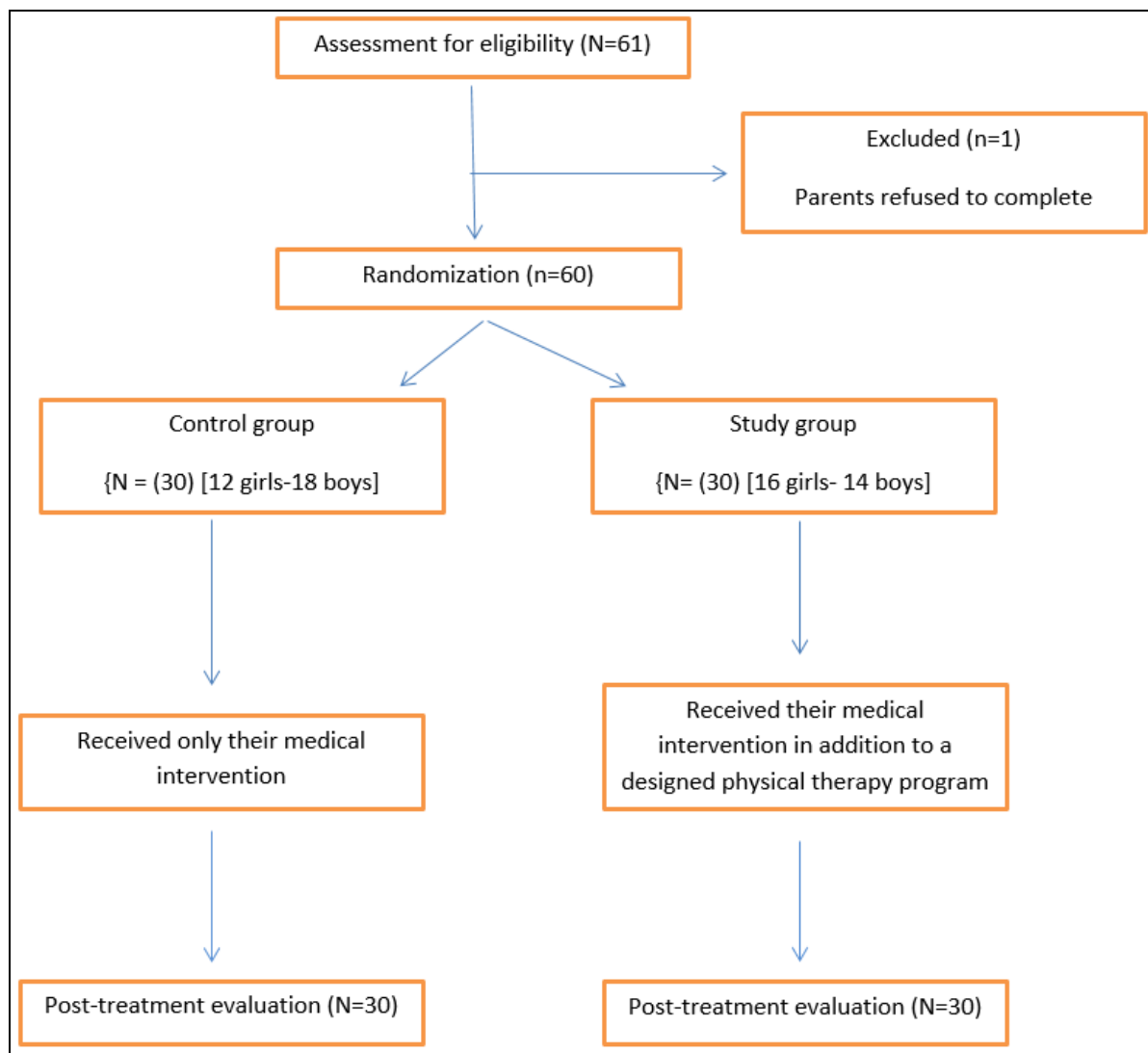


Fig 1: Participants flow chart

Evaluation Procedures

Weight was detected by electronic weight scale before starting the study as raw data.

Every infant underwent assessment of oromotor abilities by using functional oral intake scale FOIS) - That (developed to document the functional level of oral intake of food and liquid, in the current study functional oral intake for single consistency (milk) was chosen.

Treatment procedures

For control group

Infants in this group received only the medical treatment without any physical therapy intervention.

For study group

Infants in this group received in addition to their medical treatment a designed physical therapy treatment program that was conducted for ten minutes three times per day from date of admission until getting grade 4 at FOIS. The session included different forms of non-nutritive oromotor exercises as passive techniques as massage, tapping, stroking, vibration and passive range of motion exercises, these procedures were applied to improve circulation, give sensory input and enhance joint flexibility and stretching exercise which helped in affecting muscle tone by manipulating muscle spindle either to inhibit (slow stretch and prolonged in time) or to elicit (quick in time stretch) as quick stretch.

Statistical analysis

Unpaired t-test was conducted for comparison of the subjects' characteristics between groups. Chi squared test was conducted for comparison of sex distribution between groups. Mann-Whitney U test was conducted for comparison of median values of Oromotor functional scale between groups and Wilcoxon signed ranks test was conducted for comparison of between pre and post treatment in each group. Unpaired t test was conducted for comparison of mean values of incubation duration between groups. The level of significance for all statistical tests was set at $p < 0.05$. All statistical analysis was conducted through the statistical package for social studies (SPSS) version 22 for windows (IBM SPSS, Chicago, IL, USA).

Results

Subject characteristics

The statistical analysis of subject characteristics of the control and study groups showed insignificant difference between groups regarding gestational age, weight and sex distribution ($p > 0.05$). (Table 1)

Table 1: Basic characteristics of participants.

	Control group	Study group	MD	t- value	p-value
	Mean \pm SD	Mean \pm SD			
Gestational age (months)	33.56 \pm 1.59	33.46 \pm 1.63	0.1	0.24	0.81*
Weight (GM)	1916.67 \pm 263.05	1841.66 \pm 201.75	75.01	1.23	0.22*
Sex					
Girls	12 (40%)	16 (53%)		$(\chi^2 = 1.07)$	0.3
Boys	18 (60%)	14 (47%)			

SD: standard deviation MD, mean difference χ^2 , Chi squared P: probability value; * Non-significant

Oromotor functional Scale

There was a significant increase in Oromotor functional scale post treatment in the control and study groups compared with that pre-treatment ($p < 0.001$). There was no significant in Oromotor functional scale between groups post treatment ($p > 0.05$). (Table 2, figure 2).

Table 2: Oromotor functional scale measures pre and post treatment for control and study groups

Oromotor functional scale	Control group	Study group	U- value	p-value
	Median (IQR)	Median (IQR)		
Pre treatment	1 (1.25,1)	1 (1,1)	435	0.75ns
Post treatment	4 (4,4)	4 (4,4)	450	1ns
Z- value	5.07	5.2		
	$p = 0.001^{**}$	$p = 0.001^{**}$		

IQR: inter quartile range U- value, Mann-Whitney test value Z- value: Wilcoxon signed ranks test value; p value, probability value; NS: Non-significant; **, Significant

Incubation Duration

The mean value \pm SD of incubation duration of control group was 7.96 ± 2.25 days and that of study group was 4.03 ± 1.88 days. The mean difference between groups was 3.93 days showed a statistically significant decrease in the incubation duration in favor to the study group ($p < 0.001$) (Table 3).

Table 3: Comparison of incubation duration between the control and study groups:

	Control group	Study group			
	Mean \pm SD	Mean \pm SD	MD	t- value	p value
Incubation duration (days)	7.96 \pm 2.25	4.03 \pm 1.88	3.93	7.33	0.001**

SD: standard deviation MD, mean difference p, probability value; **Significant

Discussion

The current study was conducted to evaluate the effect of using nonnutritive sucking stimulation (NNSS) on incubation duration in preterm infants with low birth weight (LBWIs). In this study all infants were low birth weight, with their weights ranged from 1500 to 2500 grams both, with gestational age ranged from 30 to 36 weeks with no congenital anomalies or malformations.

Choosing NNSS in the current study may be supported by many studies^{10, 11} who reported that NNSS might be a valuable tool for rehabilitation of LBWIs for successive suckling.

Improvement in the study group may be attributed to the application of. Non-nutritive sucking pressure and sucking activity which may increase significantly the suction power during the gavage period in response to the oral stimulation, which may be supported by (Lau and Kusnierczyk, 2001)^[12], who reported that there is appositive correlation between sucking pressure and sucking expression.

The resutes of the current study may be supported by (Dieter and emory, 1997)^[13], who investigated NNSS in premature infants with different forms of stimulation including vestibular, tactile, kinesthetic, auditory, oral and various multi-modal combination, reported results from goals of study which included (a) promoting state regulation, (b) facilitating the infant's interface with the environment, (c) enhancing general neuro-behavioral development.

Using stretch and tactile stimulation in the current study may facilitate increase the flexibility and elasticity of the skin over zygomaticus and masseter muscles that was reflected on increase width of oral cavity, also increase tone in risorius and orbicularis oris muscle to contract to achieve suck movement of mouth to withdrawal the milk from nibble or bottle to achieve complete benefits from exercises.

The results of the present study showed a decrease in incubation duration that had a positive effect on both infant parents and society by decrease the costs of hospitalization specially in our developing country this can be supported by an American statistics of the preterm infants costs that recorded 8% (384200) of all 4.6 million infant stays nationwide included a diagnosis of preterm LBWIs in 2001. Costs for these preterm LBWIs admissions totaled \$5.8 billion, representing 47% of the costs for all infant and 27% for all pediatric stays. Preterm LBWIs stays averaged \$15100, with a mean length of stay of 12.9 days versus \$600 and 1.9 days for uncomplicated newborns. This aim achieved and confirmed in results of study statistics was mean value \pm SD of incubation duration of control group was 7.96 \pm 2.25 days and that of study group was 4.03 \pm 1.88 days that show mean difference between groups (Russell, *et al* 2007)^[14].

Conclusion

According to the results of this current study, we can be concluded that nonnutritive sucking stimulation can decrease in the incubation period for low birth infants by increasing their abilities to suck.

Conflict of interest

The authors have no conflicts of interest to declare.

References

1. Yasmeen S, Azim E. Status of low birth weight at a tertiary level hospital in Bangladesh for a Selected Period. *South East Asia Journal of Public Health*,2011;1(1):24-27.
2. Hack M, Klein NK, Taylor HG. Long-Term Developmental Outcomes of Low Birth Weight Infants. *The Future of Children*,1995;5(1):176-196.
3. Bhutta ZA, Darmstadt GL, Hasan BS, Haws RA. Community-based interventions for improving perinatal and neonatal health outcomes in developing countries: a review of the evidence. *Pediatrics*,2005;115(Supplement 2):519-617.
4. Devi WA. Low Birth Weight Baby. *Journal for Research*, 2016, 2(04).
5. Lau C. Development of suck and swallow mechanisms in infants. *Annals of Nutrition and Metabolism*,2015;66(Suppl. 5):7-14.
6. Arvedson J, Rogers B, Buck G, Smart P, Msall M. Silent aspiration prominent in children with dysphagia. *International journal of pediatric otorhinolaryngology*,1994;28(2-3):173-181.
7. Lau C. Oral feeding in the preterm infant. *NeoReviews*,2006;7(1):e19-e27.
8. Lau C, Smith EO, Schanler RJ. Coordination of suck-swallow and swallow respiration in preterm infants. *ActaPaediatrica*,2003;92(6):721-727.
9. Isolauri E, Majamaa H, Arvola T, Rantala I, Virtanen E, Arvilommi H. Lactobacillus casei strain GG reverses increased intestinal permeability induced by cow milk in suckling rats. *Gastroenterology*,1993;105(6):1643-1650.

10. Rocha AD, Moreira MEL, Pimenta HP, Ramos JRM, Lucena SL. A randomized study of the efficacy of sensory-motor-oral stimulation and non-nutritive sucking in very low birthweight infant. *Early human development*,2007;83(6):385-388.
11. Lau CHANTAL, Alagugurusamy R, Schanler RJ, Smith EO, Shulman RJ. Characterization of the developmental stages of sucking in preterm infants during bottle feeding. *Actapaediatrica*,2000;89(7):846-852.
12. Lau C, Kusnierczyk I. Quantitative evaluation of infant's nonnutritive and nutritive sucking. *Dysphagia*,2001;16:58-67
13. Dieter JN, Emory EK. Supplemental Stimulation of Premature Infants: A Treatment Model. *Journal of Pediatric Psychology*,1997;22(3):281-295.
14. Russell SH, Hancock MP, McCullough J. Benefits of undergraduate research experiences. *Science*,2007;316(5824):548-549.