Original Article

Fine Motor Development of Low Birth Weight Infants at the Corrected Age of 8 to 12 months

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Objectives: The aim of this study was to compare fine motor development between low birth weight (LBW) infants and normal birth weight infants (NBW) at the age of 8-12 months by using the Peabody Developmental Motor Scales-2 (PDMS-2).

Method: This was a non-experimental cross sectional study which was conducted on 18 LBW and 14 normal infants. By looking up infant profiles in 'Aliasghar Hospital's NICU, those with the defined inclusion criteria were identified (case group). Normal birth weight infants were randomly selected from the same hospital's Health Center. They were then matched with the case group for their dates of birth. After completing the questionnaire on demographic variables, their gross motor development was assessed with PDMS-2. Finally, the scores of the motor quotient were analyzed with independent T-test.

Results: There was a significant difference between the groups' fine motor quotients (p= 0.007).

Conclusion: This study showed that LBW infants are significantly lower than normal weight infants in acquiring fine motor skills. Meaning, LBW infants are more prone to developmental difficulties.

Key words: LBW infants, Motor development, Peabody Developmental Motor Scales

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Introduction

Despite advances in medical care and neonatal medicine and changes in survival patterns of high-risk infants, the developmental outcomes and follow-up assessments of these infants remain a serious concern (1).

One of the complications found in these high risk infants is the birth of LBW infants (< 2500 grams or <37 weeks for gestational age). According to the World Health Organization's (WHO) statistics, the worldwide rate of LBW is 17% (6% in industrialized countries and 21% in developing countries). The results of two studies in Iran showed that the rate of LBW is 10% in the Islamic Republic of Iran (2) and 8.4 % in Yazd (a central city in Iran) (3).

Recent studies have shown that LBW infants are prone to abnormal neurological signs in tone, coordination and reflexes, due to neonatal complications which lead to development of motor deficits and delays at the age of 6 months or later (4). Generally speaking, the shorter the gestational period or the lower the birth weight the greater the risk for motor deficits in the premature infant (1). It has been reported that approximately 10% of extremely LBW (ELBW) preterm infants (< 1,000 grams) will develop cerebral palsy (CP). A 32% rate of CP has also been observed in infants weighing less than 1,500 grams (1). Furthermore, infants who demonstrate early motor impairments that resolve may also have mild fine motor difficulties that persist and later affect their hand function and school performance (4). Hence, concise assessments and follow up of these children is of utmost importance in enabling early interventions and prevention of subsequent abnormal outcomes.

Unfortunately, although several studies have been conducted to evaluate and examine the developmental outcomes of prematurity in motor and cognitive skills elsewhere, sufficient numbers of studies have not been conducted in this regard in our country. Bearing in mind the significance of developmental difficulties in hand function based on other studies, in this study we decided to prospectively and specifically investigate the

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development of fine motor skills. The aim of this study was to compare Fine Motor Development in LBW and NBW infants at the corrected age of 8-12 months by using the Peabody Developmental Motor Scales.

Method

This research was a descriptive and prospective cohort study which was carried out between January and July 2008 in 'Aliasghar Hospital's Occupational therapy clinic in Tehran, Iran. It was conducted on two groups of infants aged 8-12 months: the LBW group (<2500g), and the NBW group. The sample size was based on the Z formula and a confidence interval of 95% with 80% power to detect a significant difference between the two groups. with a level of 0.05 was calculated to be 14 children included 18 premature infants with the history of low birth weight [11[1] (LBW) and 7[2] (VLBW)] and 14 NBW infants with the history of normal birth weight.

All LBW infants at 8-12 months corrected age (CA) that had been admitted at Aliasghar Hospital's NICU for 14 days or more, and all NBW infants aged 8-12 months –that had been referred to the hospital's Health Center for vaccination were screened for eligibility for inclusion in the study. The inclusion criteria were: 1- being in Aliasghar's NICU for 14 days or more between 20/1/2008 and 20/7/2008, 2- infant birth weight lower than 2500 grams, and 3- singleton infant. The exclusion criteria were: 1- any brain injury, degenerative disease and/or other acquired problems affecting development upon NICU discharge, 2- any congenital abnormalities affecting development, and 3- any sensory problem (deafness, blindness, …). All infants who fulfilled the above criteria were included in the study.

After screening and selecting both groups randomly, informed consent forms were given to their families. Then, all infants underwent a routine clinical examination by a pediatrician and the questions concerning medical history, development and demographic information were completed by the pediatrician. Finally, an occupational therapist conducted PDMS on each infant.

The PDMS-2 is one of the most commonly used assessments for measuring infants and toddlers' motor skills from birth through 5 years. The 'Peabody Development Motor Scales' is one of the most reliable testing instruments used by many professionals as a diagnostic tool to assess gross and fine motor skills in children with special needs. Most motor skills dysfunctions are identified with the PDMS-2. By using the results of the PDMS-2, we can develop a more responsive learning and rehabilitation program for the child with special needs. The test is composed of six subtests that assess related motor abilities that develop early in life: Reflexes, Stationary (body control and equilibrium), Locomotion, Object Manipulation, Grasping, and Visual-Motor Integration. Results from these subtests are used to generate the three composite scores: Gross Motor Quotient, Fine Motor Quotient, and Total Motor Quotient.

After collecting prenatal variables and fine motor scores, the motor quotients were determined and data were analyzed and compared using the SPSS 17 software. Mean motor quotient scores were compared using independent T-tests. Differences were considered significant at P values smaller than 0.05. This study was approved by the Ethical Board of Tehran University of Medical Sciences (TUMS).

Results

The study population consisted of 18 children with a history of LBW (10 boys & 8 girls) and 14 children with a history of NBW (9 boys & 5 girls). Mean birth weight for LBW and NBW was 1670g and 3130g, respectively. In this study there were no ELBW infants (micro-preemies). Mean gestational age for LBW was 34 weeks and for VLBW was 32.5 weeks.

Comparison of the two groups [NBW and total LBW (LBW, VLBW)] based on mean fine motor quotients is shown in table (1). The results showed that mean fine developmental motor quotients (DMQ) were significantly different in both groups.

Table 1. Mean gestational age and comparison of the two groups

Groups	N	Mean fine DMQ	Std. Deviation fine DMQ	Mean std. error	T- test sig (2- tailed)
NBW infants	14	103.00	6.22	3.35	
Total LBW infants	18	91.27	14.22	1.66	0.007
LBW infants	7	85.71	18.90	7.14	0.0052
VLBW infants	11	94.81	9.68	2.91	0.0017

1- A birth weight between 1500 and 2500 grams is considered a LBW.
2- The birth weight between 1000 and 1500 grams is considered a VLBW.

Discussion

In a study by Grantham et al in1998, mental and psychomotor development of term LBW and NBW infants was assessed with the Bayley Scale at 6 and 12 months of age. LBW infants had significantly lower scores in mental and psychomotor development indices at 6 months of age. At 12 months of age the differences between these scores had increased (5). In the Goyen and Lui'sstudy, 58 infants born in less than 29 weeks and/or with 1000 g and without disabilities detected at 12 months. Their gross and fine motor skills were evaluated at 18 months, 3 and 5 years by Peabody Developmental Motor Scales. The information of the home environment as a stimulus for development was provided by HOME scale. Results showed that a large proportion (54% at 18 months, 47% at 3 years and 64% at 5 years) of children continuously had fine motor deficits from 18 months to 5 years. The number of infants who had gross motor deficits significantly increased over this period (14%, 33% and 81%, $p < 0.001$), particularly for the 'Micropreemies' (born < 750 g). Multivariate analyses showed that the quality of the home environment had a positive influence on development of gross motor skills. A large proportion of high-risk infants ongoingly had fine motor deficits that reflect an underlying problem with those skills. In addition, the development of gross and fine motor skills appears to be under a different influence by the home environment (6).

Zhang et al. in 2007 studied preterm infants discharged from NICU at the age of one year and reported critical and abnormal neurological developments respectively seen in 29.0% and 12.4% of them. Moreover, prematurity, low level of education in parents, multiple pregnancies, severe intracranial hemorrhage and apnea were the mentioned risk factors of developmental delay (7).

In a Spanish study in 2008, developmental outcomes of 116 ELBW infants during the first three years of life were assessed. Cerebral palsy was present in 50%, while psychomotor and speech development was normal in most of these children (8).

In a study by Datar in 2009 mental and motor development of VLBW and MLBW[1] babies during the first two years of life was compared with those of normal birth weight ones. LBW had a small adverse effect on mental and motor development in the first two years of life (9).

In this study, although we evaluated only fine motor skills in infants aged 8 – 12 months , the results showed fine motor deficits at those ages which indicates earlier occurrence of fine motor difficulties in these infants. Moreover, according to the PDMS–2 manual, scores between 90 and110 are assumed as moderate deficits. The mean fine motor DMQ score of the present study was located in this range, meaning the motor difficulties of the infants in this study were less than others in similar studies.

In a follow up study in Iran in 2011, fifty LBW preterm neonates admitted to Shahid Sadoughi Hospital's NICU in 2008 were evaluated for developmental statuses at 6 and 12 months of age using the Ages & Stages Questionnaires (ASQ). LBW and preterm infants admitted to the NICU showed degrees of developmental delay at the ages of 6 and 12 months, especially in the gross motor and personal-social developmental domains of the ASQ (10). This study too showed that there was delay in fine motor development of premature infants.

Another study was performed in Zanjan (Iran) in 2011 on 130 six-year-old children. Sixty five children with a history of LBW and 65 with NBW were selected randomly to be assessed for IQ. The Wechsler Intelligence Scale for Children-Revised (WISC-R) and physical growth indices, including weight and height were applied. Verbal, non-verbal and total IQ were all significantly different between LBW and NBW groups. Mean total IQ was 93.66±8.27 and 99.32±11.05, respectively. Weight and height showed significant differences between the case and control groups too (11).

In our study there were limitations such as low parental cooperation and refusal to attend the hospital for tests. The children's fatigue and need to rest frequently, and the small sample size interfered with our study.

Conclusion

In conformity with other studies, the result of this study too indicate the importance of paying special attention to developmental follow up of high risk and LBW infants. Earlier detection and early developmental intervention for these infants is recommended. Finally, it is suggested that more diagnostic evaluations be conducted on LBW infants for all aspects of development. We hope that this study will encourage further studies in the field of developmental assessment and early rehabilitation of high-risk infants and subsequently improve and prevent motor and developmental disabilities is these children.

1- MLBW: Moderately Low Birth Weight

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