Motor development of preterm and term infants - using the Alberta Infant Motor Scale*

Desenvolvimento motor de crianças prematuras e a termo - uso da Alberta Infant Motor Scale

Desarrollo motor de niños prematuros y a término - uso de la Alberta Infant Motor Scale

Polyana Candeia Maia[1], Larissa Paiva Silva[1], Márcia Maria Coelho Oliveira[2],
Maria Vera Lúcia Moreira Leitão Cardoso[3]

ABSTRACT

Objectives: To compare the motor development of infants born preterm and term at four and six months of age, applying the Alberta Infant Motor Scale AIMS-Brazilian version. **Methods:** Longitudinal, comparative study, conducted in Fortaleza, Ceara, between November/2009 and May/2010. A convenience sample was used, consisting of 24 preterm and 24 term infants. **Results:** In children aged four months, there was a statistically significant difference in the standing position (p = 0.014) and in six months in all positions (prone, supine, sitting, standing) and total scores. In terms of the percentile, at four and six months respectively, 37.5% of preterm infants showed excellent performance and 54.2%, normal performance. **Conclusion:** Statistical analysis of gross motor performance between groups of children studied showed differences in the development and evolution of the percentiles of AIMS.
Keywords: Child; Child development; Motor activity; Term birth; Infant, premature

RESUMO

Objetivos: Comparar o desenvolvimento motor de crianças nascidas pré-termo e a termo aos quatro e seis meses de idade, aplicando a *Alberta Infant Motor Scale*-AIMS na versão brasileira. **Métodos:** Estudo longitudinal, comparativo, realizado em Fortaleza-Ceará, entre novembro/2009 e maio/2010. amostragem por conveniência, foi constituída por 24 crianças pré-termo e 24 a termo. **Resultados:** Nas crianças de quatro meses, verificou-se diferença estatisticamente significante na posição em pé (p=0,014) e, nas de seis meses, em todas as posições (prono, supina, sentada, em pé) e escores totais. Quanto ao percentil, aos quatro e seis meses, respectivamente, 37,5% das crianças pré-termo mostraram desempenho excelente e 54,2%, normais. **Conclusão:** A análise estatística do desempenho motor grosso entre os grupos de crianças estudadas mostrou diferenças no desenvolvimento e evolução dos percentis da AIMS.
Descritores: Criança; Desenvolvimento infantil; Atividade motora; Nascimento a termo; Prematuro

RESUMEN

Objetivos: Comparar el desarrollo motor de niños nacidos pretérmino y a término a los cuatro y seis meses de edad, aplicando la *Alberta Infant Motor Scale*-AIMS en la versión brasileña. **Métodos:** Estudio longitudinal, comparativo, realizado en Fortaleza-Ceará, entre noviembre/2009 y mayo/2010. La muestra por conveniencia, estuvo constituída por 24 niños pretérmino y 24 a término. **Resultados:** En los niños de cuatro meses, se verificó una diferencia estadísticamente significativa en la posición podálica (p=0,014) y, en las de seis meses, en todas las posiciones (prona, supina, sentada, podálica) y scores totales. En cuanto al percentil, a los cuatro y seis meses, respectivamente, el 37,5% de los niños pretérmino mostraron desempeño excelente y el 54,2%, normales. **Conclusión:** El análisis estadístico del desempeño motor grueso entre los grupos de niños estudiados mostró diferencias en el desarrollo y evolución de los percentiles de la AIMS.
Descriptores: Niños; Desarrollo infantil; Actividad motora; Nacimiento a término; Prematuro

* *Study carried out in two public institutions in the city of Fortaleza (CE), Brazil.*

[1] *Post-graduate student (MSc) of the Post-graduation in Nursing Program, Federal University of Ceará - UFC - Fortaleza (CE), Brazil.*

[2] *Post-graduate student (PhD) of the Post-graduation in Nursing Program, Federal University of Ceará - UFC - Fortaleza (CE), Brazil.*

[3] *Post-doctoral student of the University of Victoria/Canada. Researcher 1D CNPq. Associate Professor of the Department of Nursing , Federal University of Ceará - UFC - Fortaleza (CE), Brazil.*

Corresponding author: **Polyana Candeia Maia**
Av.: João Pessoa, 5061 - Apto 301 - Bloco 3 - Damas - Fortaleza - CE - Brazil
Cep: 60425-813 E-mail: polly_can_maia@hotmail.com

INTRODUCTION

The prematurely born child, not having reached structural and functional maturity of the organs and tissues due to incomplete intrauterine development, may present deviations in the pattern of motor development, in qualitative terms, when compared to full-term infants[1]. Motor development is characterized by changes in motor skills throughout life, which result from the interaction between genetically determined and environmental biological processes. The first year of life is marked by changes in motor skills acquired in this period, in which the infant increases its motor repertoire, and its movements become adequate to suit its needs, making them more efficient[2].

Despite technological advances in neonatology, which have increased the survival of premature newborn babies, such infants are more likely to present problems in their motor development[3]. In addition, during the evaluation of the growth and development of the child, a survey of the needs and concerns of parents should be carried out, so that care favoring appropriate intervention to prevent possible deficits in the development can be planned[4]. Thus, health professionals have an interest in monitoring the changes and alterations in the development of the child, whether premature or not, aiming to intervene, when necessary, always respecting the progress of the abilities of each child. Comparative studies which use evaluation instruments which highlight the differences between the development of children born preterm, as well as those born at term are, therefore, of singular importance[5].

The evaluation of the abilities of the child is a significant part in the diagnosis[6]. Therefore, in order to evaluate the development and to identify possible delays, scales or tests adequate for each age group are used. Among the various instruments to evaluate the motor development of the child, the Alberta Infant Motor Scale (AIMS) has been applied in Brazilian and international studies. It is an observational scale that combines qualitative and dynamic perspectives in the evaluation of the child[2-3,7-9]. It was created in Canada by two physiotherapists, is used to evaluate gross motor development, and can be applied from birth until 18 months of age. In this context, the role of the nurse is highlighted, visualizing the care of the child in the nursing practice, which has much to contribute to strategies for health promotion in the more diverse scenarios. Thus, in this care, systematic monitoring in relation to the clinical progression, interventions, referrals to rehabilitation services and monitoring of infantile growth and development in the long term is essential. This study aimed to compare the motor development of preterm and full-term children, at four and six months of age, using the Brazilian version of the Alberta Infant Motor Scale.

METHODS

This is a longitudinal, quantitative, comparative study. The consecutive convenience sample consisted of 48 children recently discharged from two public institutions of the municipality of Fortaleza-CE. The evaluations were conducted at the Laboratory of Communication (LabCom-Saúde) of the Department of Nursing of the Federal University of Ceará and/or through domicile visits, from November 2009 to May 2010. Two evaluations were performed: the first involved 48 infants at four months of age, comprising 24 full-term (chronological age) and 24 preterm children (corrected age). The second was performed after an interval of two months for each child, i.e. when they were at the age of six months, chronologically for the full-term children and corrected for the preterm ones. It should be noted that the calculation of corrected age is an adjustment of the chronological age, depending on the degree of prematurity, considered fundamental for the correct evaluation of the development in the first years of life. To do so, the amount of weeks less than 40 weeks in gestation are deducted from the chronological age[10]. The children were selected to participate in the study, according to the age criteria, when they would be four months in the first evaluation and six months in the second evaluation, considering the gestational age for the composition for each group (full-term and preterm), without giving importance to the gender. They could not be carriers of congenital malformations, cerebral palsy or intraventricular hemorrhage.

For data collection, the Portuguese version of the AIMS, entitled the Alberta Infant Motor Scale and translated in 2007, was used[11]. The AIMS contains 58 items grouped under four positions: prone (21 items), supine (9 items), sitting (12 items) and standing (16 items), which describe the development of spontaneous movement and of motor skills of the child. Conforming to the methodology of the AIMS, it was not necessary to follow a standard sequence completing all the items of one position, before attempting the observation of another[8]. According to the movements presented in the repertoire of the child, for each item observed or not observed, the scores 1 (one) and 0 (zero), respectively were recorded. Finally, the items observed were added, resulting in four subtotals. At the end of the evaluation the total score was summed and converted into a percentile in a chart available in the score sheet, which identifies the percentile of the overall motor performance of the child, which may range from 5% to 90%, established using the AIMS normative sample in Canada[7]. Five percentile ranges were adopted, which were categorized as follows: 00 to 10 considered

atypical development, 11 to 25 suspect performance, 26 to 75 normal performance, 76 to 90 very good performance, and 91 to 100 excellent performance[2].

The statistical program *Predictive Analytics Software* (PASW) *version* 18 was used for the data analysis, employing descriptive statistics. The nonparametric Mann-Whitney test was used to compare the two groups regarding subtotal scores (score of each position) and total scores (sum of subtotals) of the AIMS. The research project was approved by the Research Ethics Committee of the Assis Chateaubriand Maternity School/MEAC under Protocol No. 085/09. All parents or guardians of the children signed the Terms of Free Prior Informed Consent (TFPIC) authorizing the participation in the study, with the confidentiality of the data collected guaranteed.

RESULTS

Initially, the study sample consisted of 50 children, but there was a loss of two children in the second evaluation, one from the preterm group and the other from the full-term group, giving a total of 48 participants, 24 from each group. The preterm group consisted of 13 female and 11 male infants and the full-term group, 10 females and 14 males. It is noteworthy that cesarean delivery prevailed in the preterm group (87.5%), and in the full-term group, half the children (50%) were born vaginally. Anthropometric measurements at birth and the period of hospitalization of these children are shown in Table 1 with the Mann-Whitney test applied for comparison between the groups.

Table 1 - Characteristics of the infants according to gestational age, anthropometric data and period of hospitalization. Fortaleza, November/2009 to May/2010

Variables	$\chi \pm$ SD	Min.	Max.	p value
GA (weeks)				
Preterm	34.1±1.3	32.0	36.5	0.000
Full-term	39.6±1.1	37.0	41.8	
Weight (g)				
Preterm	1903±575.3	1095	3275	0.000
Full-term	3249±450.3	2230	4085	
Length (cm)				
Preterm	42.7±3.4	35	49	0.000
Full-term	49.1±2.4	43	55	
Days of hospitalization				
Preterm	22.0±18.0	3	60	0.200
Full-term	7.6±4.3	2	14	

With respect to gestational age, the preterm group ranged between 32.0 and 36.5 weeks, mean 34.1±1.3, and in the full-term group there was a variation from 37.0 to 41.8 weeks, mean 39.6±1.1. Concerning birth weight, the preterm group ranged between 1095 and 3275g, mean 1903±575.3 and the full-term group, minimum 2230g and maximum 4085g, mean 3249±450.3. The smallest and greatest length in the preterm group was 35cm and 49cm, respectively, with a mean of 42.7±3.4. In the full-term group this varied between 43cm and 55cm with a mean of 49.1±2.4. Regarding the amount of days of hospitalization, all the children in the preterm group were admitted to the Neonatal Intensive Care Unit (NICU), remaining 3 to 60 days, and ten children in the full-term group were hospitalized for between 2 and 14 days. The nonparametric Mann-Whitney test presented a statistically significant result between the groups when GA, weight and length were compared, with p=0.000. Regarding the performance in the AIMS, significant differences were found, using the nonparametric Mann-Whitney test, in the total scores and individual item scores at both ages, especially those of six months, as shown in Table 2.

Table 2 - Comparison of motor performance between groups of children at four and six months of age, according to the final scores of the AIMS. Fortaleza, November/2009 to May/2010

Variable	Preterm x± SD	Full-term x±SD	p Value
4 Months			
Prone	7.5±2.5	7.8±1.7	0.613
Supine	7.1±1.9	7.1±1.8	0.975
Sitting	2.6±1.0	2.7±0.6	0.849
Standing	2.2±0.5	2.6±0.4	0.014*
Total	19.5±4.9	20.5±3.7	0.590
6 Months			
Prone	10.5±3.2	13.0±2.9	0.016*
Supine	8.1±1.8	8.7±0.7	0.074
Sitting	6.5±3.1	8.7±2.4	0.029*
Standing	3.0±0.7	4.1±1.4	0.001*
Total	28.2±7.7	34.7±6.4	0.002*

*p<0.05

By comparing the items of motor performance between the groups, a significant difference was verified in the standing item at four months (p=0.014) and in the prone (p=0.016) and sitting (p=0.029) items and, above all in the standing item (p=0.001) at six months. The total scores of the same age also indicated difference (p=0.002) between the groups. Figure 1 shows the acquisition of skills in relation to each position, of both groups, at the different ages, according to the mean of the total scores. Figure 1 shows that at four months the full-term infants had a higher mean score in each position, in relation to the children of the preterm group, except in the supine position, in which both groups had the same mean score. In the same figure, the children are shown aged six months, which presents a clear difference in the mean scores in the four positions, with the
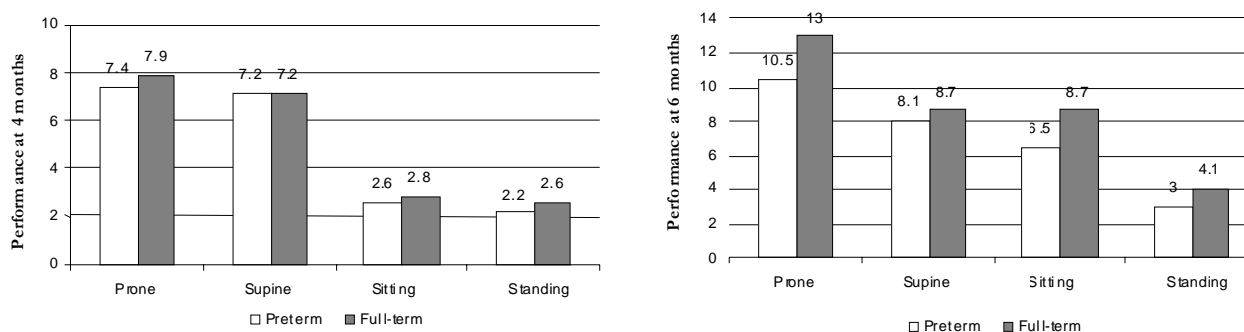
Figure 1 - Comparison of means of the final AIMS scores between the groups of full-term and preterm infants at four and six months of age. Fortaleza-CE, 2010

full-term group prevailing.

In Table 3, the percentiles were organized into categories according to age. In the group of premature infants it was observed that, at both four and six months of age, suspect motor performance was detected. It is noteworthy that 9 (37.5%) of these children were classified with excellent development at four months and 13 (54.2%) with normal development at 6 months. In the group of full-term infants, 10 (41.6%) had excellent motor performance at four months and 11 (45.8%) very good performance at six months. It was observed that there was no child in the full-term group at six months with suspect or atypical development.

Table 3 - Distribution of the groups of children in the five percentile categories of motor performance, according to the AIMS. Fortaleza, November/2009 to May/2010

Percentile categories	Preterm				Full-term			
	4 months		6 months		4 months		6 months	
	No.	%	No.	%	No.	%	No.	%
0 to 10	2	8.3	2	8.3	1	4.2	-	-
11 to 25	2	8.3	2	8.3	-	-	-	-
26 to 75	6	25.0	13	54.2	9	37.5	5	20.9
76 to 90	5	20.9	4	16.7	4	16.7	11	45.8
91 to 100	9	37.5	3	12.5	10	41.6	8	33.3
Total	24	100	24	100	24	100	24	100

DISCUSSION

Because the premature infants in this study were born between 32 and 36.5 weeks, low birth weight and length were present in the majority of these children. Some authors affirm that these low anthropometric data are due to the deprivation of these children of a period of accelerated intrauterine growth, which generally occurs in the third trimester of pregnancy[12]. Studies claim that newborn premature babies with low birth weight are at high risk for developmental problems and present greater vulnerability for not developing the relevant motor skills in the first months of life[13]. It was observed that the two premature infants who presented atypical development (0-10) at the first evaluation were those who were born weighing between 1530 and 1730 grams, with the lowest weight classified with the suspect development (11-25) in the second evaluation. The premature infant born weighing 1290 grams had a regression in the total score, as at four months its development was considered normal, however, at six months was reclassified as atypical. Under these circumstances of change, it is suggested that the baby be included in a development stimulation program; authors state that at the end of the first year of life, the results are significant and the child ends up showing signs of recovery from failures in the development[13].

High neonatal morbidity is also evident as a result of prematurity[14], which implies hospitalization in the NICU. In the present study, 24 (100%) children of the group of prematurely born infants required hospitalization, remaining in the institution between 3 and 60 days. In the full-term group, 10 (41.6%) children remained hospitalized in the NICU of the institution where they were born for a period ranging from 2 to 14 days. The longer hospitalization of the preterm infants under specialist care reflects in low acquisition of motor skills. Studies show that the premature neonates hospitalized for long periods are very sleepy and many are deprived of direct contact with the mother for prolonged periods, which implies a restriction of the spontaneous movement of the child[15].

Based on the AIMS data of the children evaluated, differences were encountered in overall motor performance between the full-term and preterm children, at ages four and six months, in all aspects of the scale, both in the total scores and individual item scores which portray the supine, prone, sitting and standing positions (Table 2). In the total score and in the percentile, at four months of age, there was no great disparity in the four positions. However, at the age of six months, the full-term group presented higher scores in the four positions of the AIMS than the children of the preterm group (Figure 1). This result is similar to other studies which show a specific trajectory for the

motor development of premature infants[16-18]. A study conducted with 561 children between 0 and 18 months in the city of Porto Alegre shows that there is a greater range of behavioral variation in the 3rd (Standard deviation - SD=9.07) and 4th (SD=7.60) trimesters, with the lower variations occurring in the 6th (SD = 1.57) and 1st (SD = 3.30) trimesters(9).

Children born preterm are at greater risk of presenting perceptual, motor and cognitive delays, associated or not with behavioral problems and the development stimulation programs are also emphasized, aiming for the prevention of perceptual-motor disorders which are more common among these children[19]. In the first evaluation, in each performance subscale for the preterm group, it was found that, in the prone position the mean score was 7.5, in the supine 7.1, in the sitting 2.6 and in the standing position 2.2. Regarding the full-term infants, the items prone, supine, sitting and standing, had means of 7.8; 7.1; 2.7; and 2.6 respectively. Despite the low scores in two subscales, the results of the evaluation of the infants showed that both groups presented satisfactory outcomes, especially in the prone and sitting items. More specifically, it is concluded that the children born at full-term acquired a greater number of skills in the same period than the preterm group, which can be seen from the results of the second evaluation, when the preterm infants presented means of 10.5 in the prone position, 8.1 in the supine, 6.5 in the sitting and 3 in the standing position. In full-term infants, the means were 13; 8.7; 8.7; and 4.1 in the same positions described. In relation to the total scores, it can be observed that both groups progressed with the advance in age, especially the full-term group, where there was a greater increase in score. The growth and development follow a chronological order and a sequence in the motor development, especially in the postural control and anti-gravity movements[7].

Distributing the children in the five percentile categories (Table 3) showed that 9 (37.5%) preterm infants and 10 (41.6%) full-term ones were situated between 91 and 100 percent in the first evaluation. In the preterm group, there were two (8.3%) children with atypical development and 2 more (8.3%), with suspect development. One (4.2%) full-term child had a score in the atypical development range. In the second evaluation, the preterm group maintained the ranking in both categories mentioned above and in the full-term group, no child scored in the atypical or suspect categories. The majority of the children changed percentile over time, totaling 66.7% and 58.4% of preterm and full-term respectively. It can be observed that in the preterm group, 12 (50%) children moved into a category below that of the classification at four months, however, 10 (41.6%) full-term infants remained in the same category

and 8 (33.4%) changed to the one above that of the previous evaluation. No common characteristic was found in the children who showed instability in the percentiles.

The increase in the total scores of all the children shows that there is interdependence in the postures evaluated by the AIMS. Compensation for delays in other positions resulted in increased scores, since the percentile is calculated from the sum of the four sub-items[9]. According to this study, there was compensation between the sitting and standing positions, which were lower than the prone and supine positions. In a study that analyzed the behavior of children using the AIMS, the authors concluded that the scale provides evidence of reliability for evaluating the development of children and for testing their abilities in different positions[20]. The evaluation performed with preterm infants at six months of age is similar to all subscales of the AIMS[2], thus increasing the reliability of our study.

CONCLUSION

It was concluded that the children studied presented a progressive sequence of the appearance of motor skills in the four positions of the AIMS, however, some were considered to have inferior development than that expected by the AIMS normative data, suggesting that the age, postural control and evaluation instrument have influence in the evaluation of the motor development of the child. Health professionals working in child development should be aware of the possible variations in the motor performance, being able to detect possible delays and make referrals to motor development stimulation programs. It is necessary to understand the dynamics of infant development, promoting the practice of strategies that help the child perform their own rhythm at the appropriate times, conforming to their own potential.

It is noteworthy that the contribution of the results achieved for the area of Pediatric Nursing is relevant, as the monitoring of infant development is an area in which the nurse acts, both in primary healthcare and in the hospital. However, the study presents limitations that must be overcome in other studies such as: an increase in the sample size, including children of diverse age groups, as the AIMS is scale that can be used from birth to 18 months of age, and the inclusion of children from other regions of Brazil.

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