

# Motor oriented stimulation program during the premature children independent walking acquisition.

Programa de estimulação motora orientada no processo de aquisição da marcha independente de crianças prematuras.

Joyce Karla Machado da Silva<sup>(1)</sup>, Tiago Del Antonio<sup>(1)</sup>, Rafaela Martins de Almeida<sup>(2)</sup>, Mayra Paula de Oliveira Lima<sup>(2)</sup>, Daniela Licka Taniguti<sup>(2)</sup>, Vanildo Rodrigues Pereira<sup>(3)</sup>.

Universidade Estadual do Norte do Paraná (UENP), Jacarezinho (PR), Brazil.

## Abstract

**Introduction:** Prematurity may act negatively in the course of some motor skill, such as the independent walking acquisition.

**Objective:** To identify the independent walking acquisition age in premature infants of different gestational ages, distinguish the period of independent walking acquisition among the lower economic classes and compare the independent walking acquisition with data in the literature. **Method:** This research is characterized as a developmental study. The sample is composed by 21 premature infants of both gender. Assessments and individual data collection were carried out monthly and at the end of the study, at the largest child's living environment, and that every month the parents/caregivers previously received orientation and demonstration regarding the procedure for applying the stimulation protocol, presented in an illustrative and demonstrative primer. The instrument used for the monthly assessment was the Alberta Infant Motor Scale (AIMS) and the questionnaire of the Associação Brasileira de Empresas e Pesquisa (ABEP), to get the socioeconomic status of the children's family. The results were analyzed using the Shapiro-Wilk test. Analyzed the age of ability to walk due to the low socioeconomic level through the Kruskal-Wallis test (C1, C2 and D). **Results:** When comparing the independent walking acquisition age and gestational age, the group with less than 33 weeks of gestational age acquired independent walking later than the group with gestational age between 33-37 weeks. However, it was found that the children average age of independent walking in the study was  $14 \pm 2$  months. Comparing independent walking acquisition age and low economic levels (C1, C2 and D), the group with higher socioeconomic status (C1) acquired independent walking two months before the group with the lowest economic level. **Conclusion:** influenced positively the motor performance of premature infants in the acquisition of independent walking.

**Keywords:** Movement, Infant Development, Early Intervention (Education).

## Resumo

**Introdução:** A prematuridade pode atuar negativamente no curso de alguma habilidade motora, tal como a aquisição da marcha independente. **Objetivo:** Visa identificar a idade de aquisição da marcha independente em prematuros de diferentes idades gestacionais, diferenciar o período de aquisição da marcha independente entre as classes econômicas baixas e comparar a idade de aquisição da marcha independente com dados existentes na literatura. **Método:** Trata-se de um estudo de caráter desenvolvimental. Fazem parte da amostra 21 crianças prematuras, de ambos os gêneros. As avaliações e a coleta de dados individuais foram realizadas mensalmente e ao final do estudo, no ambiente de maior convívio da criança, sendo que todo mês os pais/cuidadores recebiam, previamente, orientação e demonstração referente a todo processo de aplicação do protocolo de estimulação, presente em uma cartilha ilustrativa e demonstrativa. O instrumento utilizado para avaliação mensal foi o *Alberta Infant Motor Scale* (AIMS) e o questionário da Associação Brasileira de Empresas e Pesquisa (ABEP) para obter o nível econômico da família das crianças. Os resultados foram analisados por meio do teste de *Shapiro-Wilk*. O teste de Kruskal-Wallis analisou a idade de aquisição da marcha em função do nível econômico baixo (C1, C2 e D). **Resultados:** Na comparação entre a idade de aquisição da marcha independente e idade gestacional, o grupo com idade gestacional menor que 33 semanas adquiriu marcha independente mais tarde que o grupo com idade gestacional entre 33-37 semanas. Verificou-se, no entanto, que a idade média de aquisição da marcha independente nas crianças do estudo foi de  $14 \pm 2$  meses. Ao comparar ainda a idade de aquisição da marcha independente com os níveis econômico baixo (C1, C2 e D), o grupo com melhor nível econômico (C1) adquiriu a marcha independente dois meses antes que o grupo com menor nível econômico. **Conclusão:** A estimulação realizada pelo cuidador influenciou positivamente o desempenho motor das crianças prematuras.

**Palavra-chave:** Movimento, Desenvolvimento infantil, Intervenção Precoce (Educação).

Submission date 29 August 2014, Acceptance date 1 December 2014, Publication date 9 December 2014.

1. Physical Therapy professor of Universidade Estadual do Norte do Paraná (UENP), Jacarezinho (PR), Brazil.
2. Physical Therapy graduated at Universidade Estadual do Norte do Paraná (UENP), Jacarezinho (PR), Brazil.
3. Physical Education professor at Universidade Estadual de Maringá (UEM), Maringá (PR), Brazil.

## Corresponding Author

Joyce Karla Machado da Silva - Chácara Boa Esperança, S/N, Centro. Zip Code 86410-000. Ribeirão Claro (PR), Brazil. - Phone: (43) 9981-3363. Email: jksilva@uenp.edu.br

## INTRODUCTION

Preterm birth interrupts intrauterine development generating systemic immaturity in the neonate, which will result in increased difficulty adapting and can provide delays in psychomotor development and consequent deficits in motor, language, cognitive and behavior.<sup>(1)</sup> Therefore, early stimulation becomes sorely needed in preterm infants to prevent and/or minimize the sequelae of prematurity, allowing the child to the maximum development of their capabilities.<sup>(1,2)</sup>

This stimulation should occur preferentially in early childhood stage where there is greater maturation of the nervous system, gain various skills and increasing interaction between the child, the environment and the task.<sup>(2)</sup> When the caregiver is actively inserted into a stimulation program, the action becomes more effective than that performed only by professionals.<sup>(3-6)</sup> However, in Brazil, this type of action is often applied and the caregiver as to the orientation of its stimulation baby is still scarce.<sup>(3)</sup>

This study was guided by a program of motor stimulation oriented to caregivers and was guided in analyzing motor development in the acquisition of independent walking in premature infants of different gestational ages and economic classes. Furthermore, we compared with existing data in the literature of the age of acquisition of independent walking preterm study who underwent intervention since the first quarter of life.

## METHODS

It is an developmental character study, almost experimental in time series that has mixed longitudinal characteristic. Comitê de Ética em Pesquisa com Seres Humanos of Universidade Estadual de Maringá (UEM) - Opinion No. 032/2011 COPEP-UEM.

The intervention program was developed in two stages: first recommended by the manufacture of motor stimulation protocol (characterized by an illustrative booklet) and the second for the evaluation, application protocol and periodic reassessments. The monthly application of the protocol is given as in figure 1. The supervision of the protocol was performed monthly by a professional, by observing the performance of activities by the caregiver, the greater the child's living environment.

The booklet provides guidance and information about the importance of stimulating the baby. As proposed, features 76 activities in four positions (prone, supine, sitting and standing), each activity has been illustrated and described to a greater understanding of his achievement. The exercises are divided every three months until 24 months of corrected age. - Corrected age suit chronological age to the degree of prematurity, making it possible for correct evaluation of the development of preterm infants in the first year of life.<sup>(7)</sup>

As an evaluation tool, using a form which person-

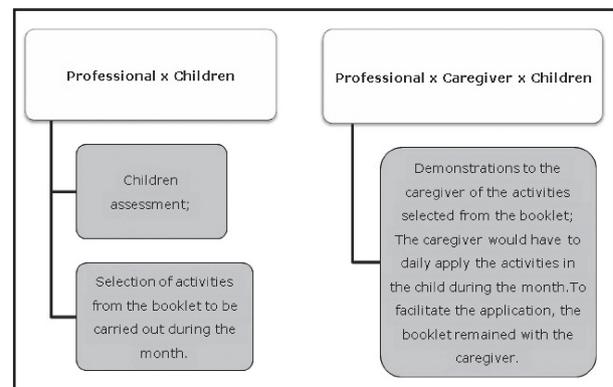
al data of the child, the family and the caregiver would perform stimulations as well as a complete history of pregnancy and preterm were collected was used. Information was also sought on the number of individuals living in the home and the economic level of the family, who came through the ABEP questionnaire (Associação Brasileira de Empresas de Pesquisa).

The ABEP questionnaire quantifies, through a system of points, the number of items in the residence for the purpose of assessing the economic level of the family (0-4 or more) as well as the level of education of household head (illiterate to complete higher education), thus taking the classification into classes A1, A2, B1, B2, C1, C2, D and E.

Even at baseline motor development was analyzed by means of reflexes/reactions and the Albert Infant Motor Scale (AIMS), a reliable scale to diagnose motor delays and the degree.<sup>(8)</sup> It is was also part of the study, a reevaluation and evolving form, which was filled monthly, containing: date, reflexes and reactions present and/or abolished, the AIMS score, exercises oriented primer for the subsequent months and body weight, which was obtained by digital scale brand Welmy®, model 109E.

For applying the stimulation protocol rattles/teethers, "pressure" musical toys, plastic balls, EVA mats (120 X 61 cm), plastic dolls, bears, colorful plush toys, docking, large rolls (we used 25 X 80 cm) and small (15 x 80 cm), large wedges (55 x 20 x 40 cm) and small (45 x 10 x 40 cm) foam support in "shoes" shape and push walker. The material was selected taking into consideration the safety of children in their use, being non-toxic and easy to wash; besides, was prioritized for toys that offer visual (through strong and primary colors) and sound stimulus.

For inclusion in the survey guardians of children would have to sign an Informed Consent (IC) and premature could not present evidence of neurological and/or orthopedic disorders, malformations, syndromes and congenital infections confirmed and sensory disabilities (visual and/or auditory).



**Figure 1.** Form of monthly application of the protocol.

Children were assessed at baseline, reevaluated every 30 days before further stimulation monthly and at the end of the survey. Professionals involved in the study were trained previously to perform initial evaluations of interventions and, consequently, data collection, appropriately and consistently, especially as the observation of the different postures of infants analyzed by AIMS.

Data were analyzed by GraphPad Prism 5.0 program (Inc., San Diego CA, USA). The normal distribution of data was assessed using the Shapiro-Wilk test; parametric statistical tests were used when the data distribution was normal, whereas non-parametric were applied for non-normal data. Regarding the comparison of the age of acquisition of the march of premature infants due to the economic level of the family (C1, C2 and D), made the Kruskal-Wallis test. Statistical significance was determined at  $p < 0.05$ .

**RESULTS**

The sample consisted of 21 preterm infants of both genders, ages corrected birth to about 18 months, the approximate time of the acquisition of independent walking. The children lived in the cities of Norte Pioneiro of Paraná (Andirá, Cambará, Carluke, Jacarézinho, Ribeirão Claro and Santo Antonio da Platina) and all belonged to the lower economic levels, C1 to D according to ABEP (28.6% - C1, 47,6% - C2 and 23.8% - D).

The sample group, 12 premature intervention started from the 1st quarter of life until the acquisition of independent walking (AIMS score 58), while 9 premature infants had at least 6 months of intervention. Totaling 21 children of low economic level and at different gestational ages (<33 weeks gestation and 33-37 gestational weeks).

Given the comparison between the age of acquisition of independent gait with respect to gestational age, the group with less than 33 weeks gestational age acquired independent walking later than the group with gestational age between 33-37 weeks, although the difference was not statistically significant (Table I).

When comparing the age of acquisition of independent walking among the lower economic levels (C1, C2 and D), the group with higher socioeconomic status (C1) acquired independent walking two months before the groups with lower socioeconomic levels (C2 and D) despite the lack of statistical significance (Table II).

It was found also that the average age of independent walking in children who received the intervention from the first three months of life was  $14 \pm 2$  months.

**DISCUSSION**

Children exposed to risk factors such as prematurity, should get special attention from health services through monthly follow-ups, especially in the first year of life, as a single assessment can not bring concrete results as to the diagnosis of motor development.<sup>(1)</sup>

The analysis of motor development and its influences facilitates the development of interventional programs that may prevent installation delays or make appropriate referrals to minimize installation commitments.<sup>(9)</sup> In this sense the present study sought to enable an alternative intervention in the caregiver was responsible for the daily activities and professional by monthly assessments and guidance as to stimuli and referrals. This alternative proved to be possible to address a larger number of children, continuously for a long period of time, which would be impossible if the provider had to perform daily operations. Moreover, evaluations and stimulations in the most convivial environment of the child pointed to a practice in which they managed to avoid the lack of periodicity of parents and their children to programs.

However, Motor development may suffer negative influence of the environment.<sup>(10-12)</sup> The use of unsuitable toys for age and low family socioeconomic status are some of the environmental factors that tend to be harmful. In the current study it was observed in monthly follow-ups to the families' homes, the vast majority of households did not have toys for stimulation, indicating a poor environment stimuli and often no space for locomotor exercises. Based on this, the environmental risk as to the use of toys was supplied providing materials for all children to an age-appropriate stimulation and motor development phase in which it stood.

The nutritional factor has a strong relation with the structure of the brain and consequently with motor development. Poor prenatal nutrition in the first years of life determines a deficit of 15% of the brain cells.<sup>(13)</sup>

**Table I.** Comparison of gestational age with respect to the acquisition of independent walking.

Variables	Gestacional aGE		P
	33 to 37 weeks (n=13)	Under 33 weeks (n=8)	
Corrected age (months) acquisition of independent walking	15 (13-15)	17 (13- 18)	0.11

**Table II.** Comparison between economic levels with regard to the acquisition of independent walking.

Variable	Economic level			P
	C1 (n=6)	C2 (n=9)	D (n=6)	
Age (months) acquisition of independent walking	13 (12-14)	15 (13-17)	15 (13-17)	0.12

Thus, malnutrition is considered a risk factor for the development and unfavourable socioeconomic conditions potentiate its deleterious effects. This study found, however, that 100% of children had to be appropriate for Gestational Age - the analysis of birth weight and gestational age - despite being premature and low economic level. However, was not assessed head circumference during the activities, which does not allow adequately relate nutritional status of children and their cortical development.

A survey of preterm have found no effect of gestational age on the acquisition of motor patterns assessed by AIMS.<sup>(8)</sup> In the present study, has not been verified gestational age and the acquisition of motor patterns, we analyzed only the age of acquisition independent walking towards AIMS. And no significance in the age of acquisition of the march towards smaller and higher gestational age, could suggest that the guidance and stimulation provided by the caregiver might have favored the age of acquisition of independent walking in children with lower gestational age at the same stage of children with greater gestational age.

Saccani<sup>(14)</sup> analyze the association between motor performance and gestational age, found that premature children had higher representation of motor delay criterion and potential delay when compared with term infants. The same occurs in the present study, because when you look at the age of acquisition of independent walking turns attention to the period from the 12th month of the child's life, conforme the AIMS scale, where 50% to 12 reached the march months and 90% at 14 months. However, in our analysis, the acquisition of walking at different gestational ages was 15 to 17 months, which indicates a criterion of delay based on scores from AIMS to children born at term.

Of the 21 children in which they analyzed the age of acquisition of the march, 100% were in the low economic level, 23.8% of the Class D, 47.6% of Class C2 and 28.6% of the class C1, so analysis was not possible between the high and low economic classes. This corroborates the findings of a survey that found that 90% of families of premature infants, inserted in the analysis, belonged to the class C and D.<sup>(15)</sup> and also meets the study of Mancini et al.,<sup>(16)</sup> which explains that much of the premature Brazilian children belong to families with low socioeconomic status. For the profile of mothers of preterm and characterization of live births are influenced by social, economic and health conditions of the locality where they occur pregnancy and birth, and that these same conditions certainly influence the future quality of life.<sup>(17)</sup>

This study identifies that there was no statistically significant difference between the low income levels of households and the age of acquisition of independent walking, however, there was a gap of two months in the

acquisition of walking between the economic class C1 and D, showing that premature children with higher socioeconomic status (C1) acquired independent walking later than children considered full term but still within the normal range proposed by AIMS. Some authors emphasize the influence of social and environmental factors such as the education level of parents, the best motor performance of children, especially children from families with lower incomes are more likely to motor disorders.<sup>(14,16)</sup>

When analyzing the age of acquisition of walking the children in this study, low socioeconomic level with data from AIMS, it was found that these have acquired the march later. However the creation of AIMS standards, assessments occurred with term infants, and has been performed in the region of Alberta, Canada, where according to the United Nations presents an HDI of 0.908 was scored as a very high rate.<sup>(8)</sup> Already in the present study (Região Norte do Estado do Paraná) HDI has scored 0.747 as an average rate, according to the Instituto Paranaense de Desenvolvimento Econômico e Social. These different characteristics presented can be of biological and environmental interference factors in the difference of the results for age of acquisition of walking.

When checking the average age of acquisition of independent walking all the children who began intervention since the 1st quarter of life was identified that this occurred at 14 months. Compared with existing data in the literature regarding the age of acquisition of gait in children born premature also, met some compatibility. Campos et al.<sup>(18)</sup> found in their study that these infants acquired the march without support around  $14.7 \pm 2.8$  months, and these stimulations were given twice a week. Marin et al.,<sup>(19)</sup> based on different gestational ages at birth weight, the progress report that occurred around  $13.6 \pm 2.8$  months and Bucher et al.<sup>(20)</sup> on a Swiss study, investigated the acquisition of independent walking at around 14.5 months.

Opposite to these results, it turns out the data found in a study of preterm and very low birthweight (<1500 g) and gestational age  $\leq 34$  weeks, which acquired the march around  $12.8 \pm 1.9$  months.<sup>(21)</sup> Probably the age of acquisition of gait has been considered by the author at the time the child alone briefly made some small steps, moving quickly. In the present study, we considered the fully independent and safe walking with weight bearing on legs, arms ranging in medium or low body guard position and neutral or slightly abducted legs (AIMS score 57).

Thus, these infants stimulated since the 1st quarter of life held by the caregiver to walk independently at the same stage of acquisition mentioned in several studies involving premature infants who were also suffering stimulation. This march also took place at the

same stage of acquisition of AIMS scale with term infants, which recommends 90% of subjects born at term to acquire independent walking at around 14 months.

## CONCLUSION

We conclude based on the results that early stimulation performed by the caregiver, in the environment of the greater interaction of the child with stimulating appropriate toys, favored the acquisition of independent walking. Regarding the analysis of the acquisition of independent walking between different low economic lev-

els and different gestational ages, no statistical significance was found, although the results have pointed out some developmental difference. A larger sample size may involve the investigation of a possible association between parents' education with low economic level and the gestational ages of the subjects; if there is such an association may be examined its influence on the whole process of development through acquisition of independent walking. For the present study only small differences, which did not characterize the state of association were found.

## REFERENCES

1. Rugolo LMSS. Crescimento e desenvolvimento a longo prazo do prematuro extremo. *J Pediatr.* 2005;81(1):101-110.
2. Almeida CS, Paines AV, Almeida CB. Intervenção motora precoce ambulatorial para neonatos prematuros no controle postural. *Rev Ciênc Saúde.* 2008;1(2):64-70.
3. Formiga CKMR, Pedrazzani ES, Silva FPS, Lima CD. Eficácia de um programa de intervenção precoce com bebês pré-termo. *Paidéia.* 2004;14(29):301-311.
4. Navajas AF, Caniato F. Estimulação precoce/essencial: a interação família e bebê pré-termo (prematuro). *Cad. de Pós-Graduação em Distúrbios do Desenv.* 2003;3(1):59-62.
5. Oliveira SMS, Almeida CS, Valentini NC. Programa de fisioterapia aplicado no desenvolvimento motor de bebês saudáveis em ambiente familiar. *REVDEF.* 2012;23(1):25-35.
6. Andrade SA, Santos DN, Bastos AC, Pedromônico MRM, Almeida-filho N, Barreto ML. Ambiente familiar e desenvolvimento cognitivo infantil: uma abordagem epidemiológica. *Rev Saúde Públ.* 2005;39(4):606-611.
7. Willrich A, Azevedo CCF, Fernandes JO. Desenvolvimento motor na infância: Influência dos fatores de risco e programas de intervenção. *Rev Neurocienc.* 2009;17(1):51-6.
8. Manacero S, Nunes ML. Avaliação do desempenho motor de prematuros nos primeiros meses de vida na Escala Motora Infantil de Alberta (AIMS). *J. Pediatr.* 2008;84(1):53-59.
9. Seki TN, Balieiro MMFG. Cuidados voltados ao desenvolvimento do prematuro: pesquisa bibliográfica. *Rev Soc Bras Enferm Ped.* 2009;9(2):67-75.
10. Mancini MC, Megale L, Brandão MB, Melo AP, Sampaio RF. Efeito moderador do risco social na relação entre risco biológico e desempenho funcional infantil. *Rev Bras Saúde Matern Infant.* 2004;4(1):25-34.
11. Neto AS, Mascarenhas LPG, Nunes GF, Lepre C, Campos W. Relação entre fatores ambientais e habilidades motoras básicas em crianças de 6 e 7 anos. *Rev Mackenzie Educ Fís Esporte.* 2004; 3 (3): 135-140.
12. Ribeiro NO. O ambiente terapêutico como agente otimizador na neuroplasticidade em reabilitação de pacientes neurológicos. [SI], 2005.
13. Guardiola A, Egewarth C, Rotta NT. Avaliação do desenvolvimento neuropsicomotor em escolares de primeira série e sua relação com o estado nutricional. *J. Pediatr.* 2001;77(3):189-96.
14. Valentini N.C, Saccani R. Escala Motora Infantil de Alberta: validação para uma população gaúcha. *Rev. paul. pediatr.* 2011; 29(2).
15. Formiga CK, Cezar ME, Linhares MB. Avaliação longitudinal do desenvolvimento motor e da habilidade de sentar em crianças nascidas prematuras. *Fisioterapia e Pesquisa.* 2010;17(2):102-7.
16. Mancini MC, Megale L, Brandão MB, Melo AP, Sampaio RF. Efeito moderador do risco social na relação entre risco biológico e desempenho funcional infantil. *Revista Brasileira Saúde de Materna Infantil.* 2004;4(1):25-34.
17. Ramos HAC, Cuman RKN. Fatores de risco para prematuridade: pesquisa documental. *Esc Anna Nery Rev Enferm.* 2009;13(2):297-304.
18. Campos AM, Oliveira TG, Urzêda RN, Formiga CKMR. Desenvolvimento motor e pessoal-social de crianças nascidas pré-termo participantes de um programa de intervenção precoce. *Revista Digital, Buenos Aires.* 2010;14(140).
19. Marín GAM, Pallas ACR, De La Cruz BJ, Carbonero CS, Maestro LM, Pumarega MM et al. Age of sitting unsupported and independent walking in very low birth weight preterm infants with normal motor development at 2 years. *Acta Paediatr.* 2009;98:1815-1821.

20. Bucher HU, Killer C, Ochsner Y, Vaihinger S, Fauchere JC. Growth, developmental milestones and health problems in the first 2 years in very preterm infants compared with term infants: a population based study. *Eur J Pediatr.* 2002;161:151-6.
21. Volpi SC, Rugolo LM, Peraçoli JC, Corrente JE. Aquisição de habilidades motoras até a marcha independente em prematuros de muito baixo peso. *J Pediatr.* 2010;86(2):143-148.