

COMPARATIVE STUDY OF VISUAL MOTOR AND GLOBAL MOTOR PERFORMANCE OF SCHOOL-AGED TWINS BORN PRETERM**ESTUDO COMPARATIVO DO DESEMPENHO VISO MOTOR E MOTOR GLOBAL DE GÊMEOS PRÉ-TERMO NA IDADE ESCOLAR****ESTUDIO COMPARATIVO DEL RENDIMIENTO VISUO MOTOR Y MOTOR GENERAL DE GEMELOS PREMATUROS EN EDAD ESCOLAR**

Received: 10/05/2014
Approved: 12/01/2015

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Twin pregnancy may represent probability of developmental delay due to the tendency to delayed intrauterine growth with subsequent preterm birth. This study aims to describe the motor and visual motor performance of twins, with a history of premature birth, in the beginning of schooling. Four pairs of twins were compared with non-twins who were born preterm and children born at term in relation to performance in the Denver II, Visual Motor Integration and Developmental Coordination Disorder Questionnaire-Brazil 2 tests. In the descriptive analysis a pair of twins showed rating lower than expected for their age in Denver II test; in DCDQ-Brazil 2 and VMI instruments significant differences were observed in all pairs of twins. Statistical analysis showed that premature twins exhibit similar performance to premature children of single pregnancy. Premature infants, twins or not, underperformed in motor and visual motor aspects compared to subjects at term. This reinforces the importance of monitoring children born preterm until the early years of schooling.

Descriptors: Twins; Premature birth; Motor skills; Child development.

Gemelaridade pode representar probabilidade de atraso no desenvolvimento devido à tendência ao retardo no crescimento intrauterino com consequente nascimento pré-termo. Este estudo tem como objetivo descrever o desempenho motor e viso motor de gêmeos, com histórico de nascimento prematuro, no início da escolarização. Quatro pares de gêmeos foram comparados com crianças nascidas pré-termo não gêmeas e crianças de nascimento a termo em relação às performances nos testes *Denver II*, *Visual Motor Integration* e *Developmental Coordination Disorder Questionnaire-Brasil 2*. Na análise descritiva um par de gêmeos apresentou classificação inferior ao esperado para a idade no teste Denver II; nos instrumentos DCDQ-Brasil 2 e VMI foi constatada diferença em todos os pares de gêmeos. Análise estatística demonstrou que prematuros gemelares apresentam desempenho semelhante aos prematuros de gestação única. Crianças prematuras, gêmeos ou não, apresentaram um desempenho inferior em aspectos motores e viso motores quando comparadas com sujeitos a termo. Reforça-se importância do acompanhamento de crianças pré-termo até os anos iniciais da escolarização.

Descritores: Gêmeos; Nascimento prematuro; Destreza motora; Desenvolvimento infantil.

El Gemelización puede representar probabilidad de retraso en el desarrollo, debido a la tendencia a un crecimiento intrauterino retardado con el parto prematuro posterior. Este estudio tuvo como objetivo describir el rendimiento motor y viso motor de gemelos con antecedentes de parto prematuro en el inicio de la escolaridad, en la escolarización temprana. Cuatro pares de gemelos en comparación con los niños nacidos prematuros no gemelos y niños desde el nacimiento hasta el término en relación con actuaciones en *Denver Pruebas II*, *Integración Visual Motor* y *Trastorno Generalizado del Desarrollo Coordinación Cuestionario-Brasil 2*. Análisis descriptivo reveló un par de gemelos con calificación más baja de lo esperado para su edad en la prueba de Denver II; en DCDQ-Brasil 2 se observaron 2 instrumentos y VMI se constato diferencias significativas en todos los pares de gemelos. El análisis estadístico mostró que los niños gemelos presentan un rendimiento similar a un solo embarazo prematuro. Los bebés prematuros, gemelos o no, un rendimiento inferior en aspectos motores y motores de visión en comparación con los sujetos a término. Se refuerza la importancia de vigilancia en los niños prematuros hasta los primeros años de escolarización.

Descriptores: Gemelos; Nacimiento prematuro; Destreza motora; Desarrollo infantil.

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INTRODUCTION

Newborn twins are a particular group of high-risk infants for growth and development because of the tendency to delayed intrauterine growth, with low birth weight and preterm birth¹⁻³.

Several studies have shown that since fetal development of twins occur in a smaller space due to the presence of a brother in the womb, this favors the development of pre, peri and post natal adverse outcomes, which are common in this population. As a result there has been a high mortality and morbidity rate, with unfavorable results for the future development, such as possible neurological alterations and deficits in cognitive and sensorial functions^{3,4}.

Twin pregnancy is a common situation in obstetrics and since it has a high number of complications, there should be permanent and greater surveillance by obstetricians⁵. When the twin birth is associated with preterm birth, there must be a risk condition for the neurodevelopment of infants that requires a careful "look" to prevent future morbidities⁶.

Advances in care for newborns at risk during the neonatal period have contributed to the significant increase in the survival rate of these children. However, gestational age (GA) and birth weight remain recognized as important factors for the maturity of various systems. These factors, when outside the normal standards, may result in increased neonatal morbidity^{7,8}.

Considering the decrease in the number of premature children with severe neurological deficits, and increased survival of children with GA of less than 32 weeks, studies have started to worry about less visible problems, but that can lead the premature infant with a poor performance in academic and daily life activities⁹⁻¹².

Many children exhibit late problems, usually in the preschool or school age. As children grow up and face greater challenges, there are some deficits, such as perceptual and motor failures, which influence the writing and other skills necessary for academic achievement⁹.

Visual motor, visual spatial and visual perceptive difficulties have also been reported in preterm infants, usually related to difficulties in neuropsychological tasks, such as copying figures, perceptual correlation, spatial processing, visual memory and fine motor activities^{11,12}. When such difficulties are associated, they may lead to educational difficulties at the time these children begin the regular education^{9,12}.

Study by Pinheiro¹², revealed that premature children (aged from 5 and 7 years old, GA from 27 to 34 weeks, and included in the regular school system) had difficulties in certain aspects of visual motor integration, and in some more global motor aspects, as scored in tests Denver II and DCDQ-Brazil 2, which respectively evaluated the overall development and the possibility of Developmental Coordination Disorder (DCD).

The Developmental Coordination Disorder - DCD is characterized by delayed development of motor skills, or difficulty in coordinating movements, resulting in inability to perform daily activities¹³. Some children have difficulties only in fine motor skills, others in gross motor skills and some others, in both, which makes the heterogeneous DCD. These difficulties may continue until adolescence and adulthood and are not justified by neurological disorder or mental retardation, affecting significantly the daily life, social integration and the development of self-concept¹³⁻¹⁶.

The relationship between the DCD and visual motor integration problems have also been reported in the literature^{9,16,17}.

It is hypothesized that premature twins present lower performance when compared to single pregnancy premature in visual motor and global motor aspects, because since fetal development of twins occurs in a smaller space, it favors the appearance of complications with unfavorable results for the future development.

This study aims to describe the motor and visual motor performance of twins, with a history of preterm birth, in the early schooling.

METHOD

This study derives from extensive research that investigated, through comparative and descriptive-correlational study, changes in visual motor coordination and global motor coordination in children who were born preterm, attending pre-school and early elementary school, compared with children born at term¹⁴.

For the present study, the results were selected from the results of tests with four sets of twins with preterm birth history, aged from 5 to 7 years old, attending the regular school system. The survey was conducted in Rio Claro city in 2011. For statistical tests, these participants were compared with eight children born preterm, and with eight others who were born at term, all without the twinning history. The sample consisted, therefore, of 16 children divided into four groups:

G1 n – Group of twin children born preterm (n);

G2 n' – Group of twin children born preterm (n');

G3 experimental - Group of non-twin children born preterm;

G4 compared - Group of non-twin children born at term.

The study was approved by the Ethics Committee for Research on Human Beings-Federal University of São Carlos (CEP/UFSCar) under the opinion No. 291/2010.

The tests used were:

- Denver II Developmental Screening Test¹⁸. Instrument of screening and early detection of child development conditions, evaluating four areas/categories: gross-motor, fine-adaptive motor, language and personal social¹⁹.

- The DCDQ - Brazil 220, a questionnaire first developed in Canada to be answered by the parents, and recently revalidated and extended for use with Brazilian children and adolescents from 5 to 15 years old. The total score of DCDQ indicates "Probably DCD" or "Probably not DCD", so it is one of the diagnostic criteria for the Coordination Development Disorder.

- Visual Motor Integration Development Test -VMI²¹, which was created for the purpose of effective and objective evaluation of the integration of visual and motor skills. It evaluates visual motor coordination, visual perception and fine motor skills, especially in children.

From the performance shown by children in the instruments used, a descriptive analysis of their performance was held on each instrument. For data analysis purposes the twins participants were numbered 1-4 (twins n) and 1 'to 4' (twins n'), and the subjects with the same numbering were siblings.

Statistical analysis

In the comparisons of groups, since some individuals are twins, there may be inaccuracies due to possible associations between siblings. One of the techniques used in this study, to avoid undue comparisons, was to consider the twins separately.

For comparisons of scores of DCDQ-Brazil 2 and VMI instruments in their various domains we used the Kruskal-Wallis Test - Analysis of Variance to one factor for ranks. When significance occurred, it was employed technique of contrasts with correction for multiple comparisons in order to identify which groups caused significant difference. Thus, the overall conclusions of the contrasts remained in the same significance level without increasing the error probability of the first kind²². Comparisons were performed in two groups of tests: tests 1 comparing Group 1, Group 3 and Group 4; and tests 2, comparing Group 2, Group 3 and Group 4.

To compare the test results of Denver II, Fisher's exact test was performed²². Tests were conducted comparing Groups 1, 3 and 4; Groups 2, 3 and 4 and finally Groups 3 and 4.

To compare the scores between Twins we used Wilcoxon signed rank test²².

All tests were performed with the probability of error occurrence of first kind (alpha) established at 5%.

RESULTS

Table 1 presents the characteristics of twins according to age at the time of data

collection, gender and economic status, gestational age (GA), birth weight, growth curve, Apgar score value and days of hospitalization in neo natal ICU.

It can be seen in Table 1 that age of participants ranged from 5 years and 1 month old to 6 years and 5 months old; 75% of participants were female and 25% male and economic classes ranged from B1 to C1.

It is observed that although there is a variation in birth weight between the pair, both are always classified in the same group, only pair 1 had classified differently in relation to the growth curves. The value of the Apgar score in the first and fifth minute was different for almost all pairs; and the amount of days spent in the NICU ranged between pairs in 50% of cases.

Chart 1. Characterization of twins participants. Rio Claro, 2011.

Part.	Age (years)	Sex	Econ. Class.	GA (week)	Classif. Premat.	BW (gr)	Weigh t Class	GA x Weigh t	Apgar 1 and 5'	Days Hosp. (NICU)
1	5 years 1 month	M	C1	34	Moderate	2130	LW	AGA	9/10	14 days
1'	5 years 1 month	F	C1	34	Moderate	1590	LW	SGA	9/10	14 days
2	5 years 2 months	F	D	31	Moderate	1555	LW	AGA	7/8	35 days
2'	5 years 2 months	M	D	31	Moderate	1540	LW	AGA	8/9	23 days
3	5 years e 10 months	F	D	31	Moderate	1425	VLW	SGA	8/9	36 days
3'	5 years 10 months	F	D	31	Moderate	1380	VLW	SGA	8/9	30 days
4	6 years 5 months	F	B1	28	Extreme	1255	VLW	AGA	1/9	60 days
4'	6 years 5 months	F	B1	28	Extreme	1093	VLW	AGA	5/7	60 days

M: male; F: female; LW: low birth weight; VLW: very low birth weight; AGA: adequate for gestational age; SGA: small for gestational age; BW: birth weight; Apgar 1 and 5': value in the APGAR test in the first and fifth minute.

In Table 1 we can see the performance of pairs in all the instruments applied in the study.

In Denver II instrument, only the subjects 2 and 2' were classified as lower than expected for age, characterized as questionable and abnormal, respectively, according to the classification of the instrument.

In DCDQ-Brazil 2 instrument, it was found score difference in all pairs. Although none of the participants has been characterized as "probably DCD," it was observed lower score in children 2 and 3', as there was greater variation in scores of these pairs (11 points between children 2 and 2', 9 points between children 3 and 3'), and an

increase of 3 points between the pairs of siblings 1 and 4.

In the VMI instrument, we observed again a score difference in all pairs except the pair 4 on the visual motor part, and the pair 2 on the percentage of visual perceptive part. The children of pair 2 obtained worst score in all parts of the instrument. Regarding the population average, we can observe a low performance of all subjects ranging from 0 to 63%.

Statistical tests were based on the comparison between groups: twin n, twin n', non-twin experimental and compared.

Table 1. Score in DENVER II, DCDQ-Brazil2 and VMI instruments. Rio Claro, 2011.

Participants	Denver II	DCDQ	VMI		
			VM	VP	FM
1	#	66	90	99	91
1'	#	69	97	104	107
2	*	64	59	45	93
2'	**	53	70	49	88
3	#	67	91	82	106
3'	#	58	86	97	97
4	#	73	79	78	105
4'	#	70	79	73	65

** Abnormal; * Questionable; # Normal; VM: Visual Motor; VP: Visual Perceptive; FM: fine motor

Table 2 shows the mean values obtained for each instrument according groups and data from the Kruskal-Wallis statistical test for equality of scores. It is

observed a significant difference in scores on visual motor and fine motor parts of the VMI instrument when comparing both groups (twins n and twins n').

Table 2. Mean values and Kruskal-Wallis test for equality of scores. Rio Claro, 2011.

INSTRUMENTS	EXPERIMENTAL GROUP		COMPARED GROUP	Kruskal-Wallis Tests (P)	
	Twins N	Non Twins n'		Test 1(a)	Test 2(b)
DCDQ	64.8	65.3	63.9	0.455	0.448
VMI – Visual Motor	82.5	80.3	88.5	0.002*	0.002*
VMI – Visual Perceptive	77.0	79.8	86.1	0.149	0.340
VMI – Fine Motor	97.5	90.5	96.3	0.042*	0.031*

* Significant differences between the groups (a) Test 1: Comparison Twin n x Non-Twins x Compared Group (b) Test 2: Comparison Twin n' x Non-Twins x Compared group.

To identify which groups caused a significant difference, we applied the contrast technique to the significant tests (Mann-Whitney) with corrections in the significance level for multiple comparisons, as shown in Table 3.

To compare the results of Denver II test, it was applied Fisher's exact test. A significant difference between the performance of the twin group n, non-twin experimental group and compared group (0.023) was observed and between the non-

twin experimental group and compared group (0.041).

The comparison between the twin n' group, non-twin experimental group and compared group showed a statistical result of 0.054. It can be observed an apparent trend, but it was not observed probably due to the small sample size of the study.

Results presented by Wilcoxon signed rank test, carried out for the comparison of scores between twins showed no significant difference, indicating that the performance between the twin siblings are similar.

Table 3. Contrasts - twin n/n'. Rio Claro,2011.

INSTRUMENTS	CONTRASTS	P
VMI - Visual Motor	Twin n = Experimental non-Twin	0.237
	Twin n < Compared Group	0.002
	Experimental non-Twin < Compared Group	0.002
VMI - Fine Motor	Twin n = Experimental non-Twin	0.428
	Twin n = Compared Group	0.069
	Experimental non-Twin < Compared Group	0.009
INSTRUMENTS	CONTRASTS	P
VMI - Visual Motor	Twin n' = Experimental non-Twin	0.324
	Twin n' < Compared Group	0.005
	Experimental non-Twin < Compared Group	0.002
VMI - Fine Motor	Twin n' = Experimental non-Twin	0.430
	Twin n' < Compared Group	0.034
	Experimental non-Twin < Compared Group	0.009

DISCUSSION

The results of this study support the evidence that children with prematurity history have lower scores on visual motor and global motor performance, regardless of single or double pregnancy.

Studies report that twins, because of the tendency to delayed intrauterine growth with consequent low birth weight, are more likely to delay in development ^{2,3}.

It was observed in this study that the premature birth was the most influential factor in visual motor performance and in overall developmental aspects as shown respectively by Kruskal-Wallis tests for equality of scores and the contrast for statistical tests, showing the results for the VMI test; and Fisher's exact test that showed significant differences between groups in the Denver II test. By means of these tests it was observed that the group that causes significant difference is the compared group, that is, the group of children without a history of preterm birth. One can then infer that premature children, whether they are twins or not, have a lower performance in visual motor aspects when compared to subjects born at term.

Study⁴ showed that, in general, there is no statistically significant difference when comparing the first and the second twin. These data corroborate the findings of this study, because by relating birth weight and performance in the tests, whereas the subject n' is the sibling with lower weight, it was not possible to observe a relationship between weight and better or worse performance in

tests, varying in each pair examined. However, it should be noted a predominance of injuries in newborns born last (second twin) and that they presented as a clinical characteristic low birth weight, Apgar scores below seven in the fifth minute, and also developed hematological and nutritional complications⁴.

In turn, when comparing the performance of twins with children born at term, there was a significant difference in the performance thereof, and it may be also related to birth weight of these children. Study review⁸ on the development of premature infants showed that the risk factors associated with preterm birth influence the development until older ages, and adolescents born with weight <2,500 g are smaller, with differences of 5-6 cm in height and 8-9 kg in weight. In relation to adults born with very low birth weight, compared with those born at normal weight, the study points out that the first group showed higher frequency of sensorial impairment (10% x <1%), lower average of IQ (87 x 92) and lower educational level (74% x 83% with complete high school level)⁸.

It can be seen, in this study, that the pairs of twins studied showed a lower score level compared to the population mean (as standardized by the instrument) with regard to the visual motor integration. These results corroborate those from other research that points to the importance of monitoring the

development of preterm newborn until school age⁹.

Although the relationship between DCD and visual motor integration problems are often reported in literature ^{19,20}, in the present study this was not observed between twins, visual motor performance and DCD, and the difference between groups in scores on DCDQ Brazil-2 was not significant at any time.

Thus, it is reaffirmed the need for constant vigilance in cases of twin pregnancy, especially when associated with preterm birth, for the possibility of appearance of the later problems can lead to perceptual and motor failures, which will influence the writing and other skills needed to academic achievement^{5,6,10,14}.

It is considered important to note that the functional sequelae of preterm and twin birth may appear long-term during the development process, hence the need for better monitoring of these children in the health and education contexts, with programs focused on identification and stimulation of development as well as the encouragement to research involving better understanding of the characteristics of the development of children born preterm⁹.

The limitations of this study included the fact that the data are restricted to a survey with limited sample of participants. Based on the sample, it was not possible to prove that newborn twins have unfavorable results for future development with possible neurological disorders and deficits in cognitive and sensorial functions as reported in the literature, since only one pair was identified by the Denver II test with questionable or abnormal development³⁻⁵.

CONCLUSION

In general it was observed that the pairs of twins analyzed have similar performance in all instruments applied.

The twin premature group showed similar performance to the single pregnancy premature group, demonstrating in this study that twinning itself was not an influencing factor on the visual motor and

global motor performance, but prematurity was.

In this sense, it is reinforced the importance of monitoring preterm children up to the early years of schooling, as subtle visual motor problems interfere with reading and writing processes, and if detected and treated, it may minimize adverse effects on the daily activities of children and subsequent moments of the child's life.

It is recommended that future studies work with a larger sample, to deepen the results in order to prove the relationship between preterm twin infants and the possibility of changes related to visual motor and global motor aspects.

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CONTRIBUTIONS

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