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## ORIGINAL

### RELATIONSHIP BETWEEN CHILDREN'S MOTOR DEVELOPMENT AND THE PHYSICAL ACTIVITY LEVEL OF THEIR PARENTS

### RELACIÓN ENTRE DESARROLLO MOTRIZ DE NIÑOS Y NIVEL ACTIVIDAD FÍSICA DE PADRES

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## ABSTRACT

The objective of this study is to determine the relationship between children's motor development and the physical activity level of their parents. A total of 154 subjects, 77 boys and girls and 77 parents, from two school institutions participated. The ages of the children range from 6.6 to 10.5 years with a mean of 8.74 ( $\pm$  1.23). The study is of a correlational, non-experimental, cross-sectional type. The Test of Gross Motor Development (TGMD-2) was used to identify the motor development level and the International Physical Activity Questionnaire (IPAQ) was employed to identify the physical activity level of the parents. For the correlational analysis, Fisher's exact test was applied, checking the statistical significance with a confidence level of 95% ( $p < 0.05$ ). The results indicate that there is no relationship between the physical activity level of the parents and the motor development of their children

**KEY WORDS:** Motor Development, Physical Activity Level, Behaviour Acquisition.

## RESUMEN

El objetivo de este estudio es determinar la relación entre el desarrollo motriz de niños y niñas y el nivel de actividad física de sus padres. Participaron 154 sujetos,

77 niños y niñas y 77 padres, de dos instituciones escolares. Las edades de los niños fluctúan entre los 6,6 a 10,5 años con una media de 8,74 ( $\pm 1,23$ ). El estudio es de tipo correlacional, no experimental, transversal. Para identificar el nivel de desarrollo motriz se utilizó el Test de Desarrollo Motriz Grueso (TGMD-2) y para identificar el nivel de actividad física de los padres el cuestionario Internacional de Actividad Física (IPAQ). Para el análisis correlacional se aplicó la prueba exacta de Fisher, comprobando la significancia estadística con un nivel de confianza del 95% ( $p < 0,05$ ). Los resultados indican que no existe relación entre el nivel de actividad física de los padres y el desarrollo motriz de sus hijos.

**PALABRAS CLAVE:** Desarrollo Motriz, Nivel Actividad Física, Adquisición de conductas.

## 1. INTRODUCTION

One of the most important stages in human motor development (MD) is childhood, therefore, healthy growth and development should be one of the highest priorities for society. Similarly, MD in early childhood has a key influence on an individual's subsequent life cycles (Mendez-Cornejo, Martínez Salazar, Lorca Tapia, Ojeda Santana, & Carrasco Alarcón, 2017; Piña Díaz, Ochoa Martínez, Hall López, & Sáenz-López Buñuel, 2020; Sanz-Arazuri, Valdemoros San Emeterio, Ponce de León Elizondo, & Baena Extremera, 2018). For Luarte et al. (LUARTE, Rivera, & Valderrama, 2012) "motor development is the process by which the individual acquires, organises and uses motor behaviour". The development of motor skills provides a variety of benefits to children.

They are a prerequisite for physical activity, sport participation providing health benefits (Ku, MacDonald, Hatfield, & Gunter, 2020; Navarrete, Castro, Cerda, & Urra, 2021). According to Sameroff 2010 (Sameroff, 2010), behavioural change from childhood to adulthood results from relationships between biopsychosocial aspects, involving the family and the community, indicating that children with similar characteristics may have different outcomes depending on the risks and promotion within the child's social ecology. According to Martins et al. (Martins et al., 2021), it possesses a series of progressive, continuous, dynamic and complex transformations and depends on genetic, psychological and social factors. This motor behaviour changes through an interactive process between the individual's biological limitations and environmental experiences, i.e. upbringing (Clark, 2005; Pimenta, Poeta, Basso, Mariano, & Neto, 2021). According to Flórez (Flórez, 2020), the integration of the individual in society is carried out through different factors affecting them at different stages, the first socialising institution being the family, which plays a crucial role in cognitive, motor and social development. He also points out that the development of children's capacities is related to the family and that it can become a protective factor or a risk factor.

Thus, children's perceptions of their parents' beliefs and behaviours are strongly connected to their own attitudes and participation (Cools, De Martelaer, Samaey, & Andries, 2011; Ferrales, Valderrama, Espejel, Rodriguez, & Ordenes,

2018; Flórez, 2020; Lakes, Neville, Abdullah, & Donnelly, 2020; Ruiz-Ariza, de la Torre Cruz, Suárez-Manzano, & López, 2019; Sanz-Arazuri et al., 2018; Solís, Mirabel, Miguel, & Gallego, 2020; Weiss, 2020).

Similarly parental encouragement and interactions can influence child motor development (Bennàsser Torrandell & Vidal-Conti, 2021; Chiva-Bartoll & Estevan, 2019; Crumbley, Ledoux, & Johnston, 2020; Dinkel & Snyder, 2020; Huang, Wong, & Salmon, 2013; Ku et al., 2020; Ruiz-Ariza et al., 2019; Tabacchi et al., 2021; Tolano Fierros, 2020; Vázquez-Pérez, Hara, Herrera, & Cervantes, 2020; Yao & Rhodes, 2015) and the opportunities provided by the environment (Chiva-Bartoll & Estevan, 2019; Dinkel & Snyder, 2020; Flórez, 2020), also influence sporting success and performance level (González-García, Pelegrín, & Carballo, 2018). Finally, in the Physical Activity Index of children aged 5-17 years of the Ministry of Sport (Chile), 59% of the population reported having adopted sports habits on their own initiative, followed by friends, parents and other family members (Deporte & Chile, 2019).

## **1.1 OBJECTIVE**

The aim of this study is to determine the relationship between children's motor development and the physical activity level of their parents.

## **2. MATERIAL AND METHOD**

### **2.1 METHOD**

This is a correlational, non-experimental, cross-sectional, quantitative paradigm study.

### **2.2 PARTICIPANTS**

The sample was non-probabilistic and of convenience. A total of 154 subjects participated, 77 schoolchildren (girls= 40; boys= 37) from the first year to the fourth year of primary school and 77 parents and/or legal guardians from two schools in the V Region of Valparaíso (Chile). The ages of the children ranged from 6.6 to 10.5 years with a mean of 8.74 ( $\pm$  1.23).

### **2.3 INSTRUMENTS**

The application of the protocols was conducted in accordance with the ethical principles for research on human beings proposed by the Declaration of Helsinki (World Medical Association) and the procedural suggestions and documentation of the Research Department of the Pontifical Catholic University of Valparaíso through the Scientific and Bioethical Ethics Committee (BIOEPUCV-H158-9-12-2018). Authorisation was requested from the school authorities and then an informed consent form was sent to parents and/or legal guardians, indicating the objectives and scope of the study in order to authorise their child's participation. In order to

identify the motor development level of the students, the Test of Gross Motor Development (TGMD-2) was used. The purpose of this instrument is to determine the motor development of children between the ages of three and 10 years old, categorising motor behaviours into seven categories: very poor, poor, below average, average, above average, advanced and very advanced. Twelve basic motor skills are assessed, grouped into two subtests: locomotion skills and object manipulation or control. Each task is assessed according to criteria of efficiency and performance, where a score of one (1) is recorded if it is performed correctly and zero (0) otherwise. After the application of the test and after adding the two attempts per test, the scores obtained must be analysed with the conversion table according to the age in months of the children, which results in a score called standard score, which describes a gross motor quotient, giving the score according to the range of motor development: very advanced (>130), advanced (121-130), above average (111-112), average (90-110), below average (80-89), poor (70-79) and very poor (< 70).

The International Physical Activity Questionnaire (IPAQ), which has a correlation coefficient of 0.65, was used to identify the physical activity level of the parents. This instrument provides information on estimated energy consumption in 24 hours, provides information on time spent walking, moderate and vigorous intensity activities and sedentary activities, the short version (9 items) was used. It assesses three specific characteristics of activity: intensity (mild, moderate or vigorous), frequency (measured in days per week) and length (time per day). After calculating the physical activity index, whose value corresponds to the product of the intensity (in METs), by the frequency, by the duration of the activity, subjects are classified into three categories, according to certain conditions: Low: no physical activity is registered or it is registered, but does not reach the medium and high categories; Medium: three or more days of vigorous physical activity for at least 20 minutes per day, or five or more days of moderate intensity physical activity or walking for at least 30 minutes, or five or more days of any combination of mild, moderate or vigorous physical activity reaching a total of 600 METs-min/week and High category: three or more days of vigorous physical activity or accumulating 1.

500 METs-min-week or seven or more days of any combination of mild, moderate or vigorous physical activity reaching a total of 3,000 METs-min/week). The METs reference values are: for walking: 3.3 METs; for moderate physical activity: 4 METs and for vigorous physical activity: 8 METs.

## **2.4 DATA ANALYSIS TECHNIQUE**

The IBM SPSS Statistics 25 software (New York, USA) was used to analyse the data. The Kolmogorov-Smirnov test (n 30) was applied to determine the distribution of the data, then the non-parametric Mann Whitney U test (Wilcoxon) was employed to check the heterogeneity of the samples and to test the statistical significance at a 95% confidence level ( $p < 0.05$ ). For the correlational analysis, Fisher's exact test was run to establish the existence of an association between the

qualitative variables and to test for statistical significance at a 95% confidence level ( $p < 0.05$ ).

### 3. RESULTS

Table 1 shows the characterisation of the subjects and the differences between variables according to age, motor age, motor development level of locomotion and manipulation, general motor development level and physical activity level of father, mother or legal guardian (indicating standard deviation and percentage of n), grouping the motor development levels of locomotion, manipulation and general in three categories: low (very poor, poor and below average), average and above average (above average, advanced and very advanced). Students show a higher manipulative motor age, which is higher in girls. The physical activity level of the parents is found to be low and moderate with 81.9%, with mothers standing out with a level of vigorous physical activity of 22.5%.

**Table 1.** Characteristics of the sample according to motor development and physical activity level (NAF) by sex and total

	<b>FEMALE (N=40)</b>	<b>MALE (N=37)</b>	<b>TOTAL (N=77)</b>
<b>Age (mean <math>\pm</math> SD)</b>	103.42 $\pm$ 14.89	106.51 $\pm$ 14.65	104.91 $\pm$ 14.76
<b>Motor age of locomotion (mean <math>\pm</math> SD)</b>	74.00 $\pm$ 21.36	72.73 $\pm$ 21.27	73.39 $\pm$ 21.18
<b>Motor age of manipulation (mean <math>\pm</math> SD)</b>	80.55 $\pm$ 25.29	77.59 $\pm$ 20.03	79.13 $\pm$ 22.81
<b>Motor development level of locomotion</b>			
<b>Very poor, poor and below average (%)</b>	19(47.5)	21(56.7)	20(52.0)
<b>Average (%)</b>	18(45.0)	14(37.8)	32(41.6)
<b>Above average, advanced and very advanced (%)</b>	3(7.5)	2(5.4)	5(6.5)
<b>Motor development level of manipulation</b>			
<b>Very poor, poor and below average (%)</b>	20(50.0)	20(54.0)	40(52.0)
<b>Average (%)</b>	19(47.5)	17(45.9)	36(46.8)
<b>Above average, advanced and very advanced (%)</b>	1(2.5)	0(0.0)	1(1.3)
<b>General motor development level</b>			
<b>Very poor, poor and below average (%)</b>	28(70.0)	28(75.6)	56(72.8)
<b>Average (%)</b>	11(27.5)	7(18.9)	18(23.4)
<b>Above average, advanced and very advanced (%)</b>	1(2.5)	2(5.4)	4(3.9)
<b>Physical activity level (NAF) of parent/legal guardian</b>			
<b>Mild n (%)</b>	17(42.5)	14(37.8)	31(40.3)
<b>Moderate n (%)</b>	14(35.0)	18(48.6)	32(41.6)
<b>Vigorous n (%)</b>	9(22.5)	5(13.5)	14(18.2)

SD: standard deviation.

Table 2 shows that 93.8% of the students whose parents have a moderate-level physical activity are below average in their motor development level of locomotion. 64.3% of the students whose parents' level of physical activity is vigorous are below average. 16.1% of the students who have parents with low physical activity level have a motor age above their age.

No significant differences were found between the physical activity level of parents and/or legal guardians with the motor development level of locomotion ( $p = 0.0864$ ) and motor age of locomotion ( $p = 0.490$ ) of their child and/or student ( $p < 0.005$ ).

**Table 2.** Physical activity level (NAF) of parents and/or legal guardians, according to their child's locomotion development level.

	NAF- Mild (n=31) n(%)	NAF-Moderate (n=32) n(%)	NAF-Vigorous (n=14) n(%)	$p^1$
<b>Motor development level of locomotion</b>				0.864
<b>Very poor (%)</b>	2(6.5)	5(15.6)	1(7.1)	
<b>Poor (%)</b>	4(12.9)	4(12.5)	2(14.3)	
<b>Below average (%)</b>	9(29.0)	7(21.9)	6(42.9)	
<b>Average (%)</b>	14(45.2)	14(43.8)	4(28.6)	
<b>Above average (%)</b>	1(3.2)	2(6.3)	1(7.1)	
<b>Advanced (%)</b>	1(3.2)	0(0.0)	0(0.0)	
<b>Very advanced (%)</b>	0(0.0)	0(0.0)	0(0.0)	

<sup>1</sup>: Fisher's exact test.

Table 3 shows that 100% of the students who have parents with moderate to vigorous-level physical activity have a motor development level of manipulation below the average. 28.6% of the students who have parents with vigorous-level physical activity have a motor age above their age. There were also no significant differences between the physical activity level of parents and/or legal guardians with the motor development level of manipulation ( $p= 0.202$ ) and the motor age of manipulation ( $p= 0.169$ ) with  $p < 0.005$ .

**Table 3.** Physical activity level (NAF) of parents and/or legal guardians, according to their child's manipulation development level.

	NAF-Mild (n=31) n(%)	NAF-Moderate (n=32) n(%)	NAF-Vigorous (n=14) n(%)	$p^1$
<b>MOTOR DEVELOPMENT LEVEL OF MANIPULATION</b>				0.202
<b>VERY POOR (%)</b>	3(9.7)	7(21.9)	1(7.1)	
<b>POOR (%)</b>	1(3.2)	3(9.4)	4(28.6)	
<b>BELOW AVERAGE (%)</b>	11(35.5)	8(25.0)	2(14.3)	
<b>AVERAGE (%)</b>	15(48.4)	14(43.8)	7(50.0)	
<b>ABOVE AVERAGE (%)</b>	1(3.2)	0(0.0)	0(0.0)	
<b>ADVANCED (%)</b>	0(0.0)	0(0.0)	0(0.0)	
<b>VERY ADVANCED (%)</b>	0(0.0)	0(0.0)	0(0.0)	

<sup>1</sup>: FISHER'S EXACT TEST.



Table 4 shows that 100% of the students whose parents have a low level of physical activity have a general motor development level from average to below average. There were also no significant differences between the physical activity level of parents. Mothers and/or legal guardians according to the level of general motor development ( $p= 0.359$ ) with  $p < 0.005$ .

**Table 4.** Physical activity level (NAF) of parents and/or legal guardians, according to the general development level of their child.

	NAF-Mild (n=31) n(%)	NAF-Moderate (n=32) n(%)	NAF- Vigorous (n=14) n(%)	p <sup>1</sup>
<b>GENERAL MOTOR DEVELOPMENT LEVEL</b>				0.359
<b>VERY POOR (%)</b>	2(6.5)	7(21.9)	2(14.3)	
<b>POOR (%)</b>	13(41.9)	8(25.0)	6(42.9)	
<b>BELOW AVERAGE (%)</b>	7(22.6)	7(21.9)	4(28.6)	
<b>AVERAGE (%)</b>	9(29.0)	8(25.0)	1(7.1)	
<b>ABOVE AVERAGE (%)</b>	0(0.0)	1(3.1)	1(7.1)	
<b>ADVANCED (%)</b>	0(0.0)	0(0.0)	0(0.0)	
<b>VERY ADVANCED (%)</b>	0(0.0)	1(3.1)	0(0.0)	

<sup>1</sup>: Fisher's exact test.

#### 4. DISCUSSION

The results of this study suggest that there is no significant correlation between the physical activity level of fathers, mothers and/or legal guardians and the motor development of their children. A similar situation occurs in the research by Tabacchi et al. (Tabacchi et al., 2021). They studied a total of 79 mothers and their children between 3 and 6 years old, using questionnaires to collect information about their physical activity and sedentary lifestyle, among others, asking the number of days per week in which they performed at least one hour of PA and the daily hours standing in front of a video or pc. In children, the gross motor quotient test was applied based on the QGMD test. No correlation was found between these variables (beta 0.26,  $p > 0.05$ , PA and beta 0.21,  $p > 0.1$  for sedentary behaviour). Similarly, the literature suggests that the role of parents is important in promoting motor skills and competencies. Olivares et al. (Olivares, Cossio-Bolaños, Gomez-Campos, Almonacid-Fierro, & Garcia-Rubio, 2015), analysed the influence of parents and physical education teachers on the extracurricular physical activity of teenagers in Chile. Data were obtained from the Chilean System for Measuring the Quality of Education (SIMCE) in Physical Education, in a representative sample of 23,180 students (11,927 girls and 11,253 boys), with mean ages between 13.7 and 13.8 years. The results show that the influence of parents is more relevant than that of physical education teachers in promoting physical activity in teenagers, regardless of age, gender or physical condition. The percentage of adolescents who were totally sedentary was higher for those whose parents were not physically active (28.4%). They also show that the likelihood that they will engage in some form of physical activity increases by 85% when their parents are physically active. Likewise, Nietmistö et al. (Niemistö, Finni, Cantell, Korhonen, & Sääkslahti, 2020), who

assessed 945 children in Finland, related motor development from the TGMD-3 and the KTK test to family factors based on questionnaires and others. Findings showed that parental involvement was associated with better motor competence scores on the individual outcomes. Finally, Niemistö et al. (Niemistö et al., 2020), point out that studies have shown that family and environmental factors are not as strongly correlated with motor behaviour, but also indicate the importance of parents in providing opportunities to be physically active and to develop motor skills.

## 5. CONCLUSIONS

There is no significant correlation between motor development and physical activity level of the parents. On the other hand, the motor development levels reached by the children are below average or average, very few children reached above average, advanced or very advanced levels, and the physical activity levels of the parents are mild or moderate. Bearing in mind all of the above factors, it is necessary to point out the importance of increasing children's motor development levels and increasing moderate or vigorous exercise by parents and/or legal guardians. Further study in this area is recommended as the existing evidence does not yet clarify this relationship in a cross-sectional manner.

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