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Research Article

Development Coordination Disorder: Prevalence and Risk Factors in a Sample of Mexican Children

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Abstract

Development Coordination Disorder (DCD), is characterized by motor coordination problems unrelated to intellectual, congenital, or acquired delays. Here we present the prevalence rate of DCD through Movement Assessment Battery for Children 2 (MABC-2), as a reference test and to identify associated risk factors in a sample of Mexican children. A total of 344 children, aged between 6 and 12 years, were examined with the DCDQ-07 questionnaire to identify the probable DCD carriers. The MABC-2 battery was applied to all children identified that way. All the children studied were from an elementary school (children with typical development). A questionnaire was also applied, asking for the variables associated to risk factors. Eleven (3.2%), children were identified as DCD children. Male gender was more affected.

INTRODUCTION

Developmental coordination disorder (DCD), is a motor skill disorder which appears in school-age children (6 to 12 years), with an estimated prevalence close to 5% (3-5%) [1,2]. It is a public health problem, since it has important repercussions on the different development spectra: motor, cognitive, psychosocial and emotional. DCD is a motor control problem with consequences in the functionality to carry out daily activities such as dressing, tying shoelaces or using utensils to eat; in the classroom, students perform activities more slowly including sports, especially those that require the use of balls and team games, which at the same time leads to limited social participation [3].

Although motor development difficulties may begin at an early age of life, coordination disorder is usually not diagnosed before 5 years [4,5].The first symptoms reported in the population with DCD are problems in balance and posture control [6].

There exist tests like the Developmental Coordination Disorder Parent Questionnaire (DCDQ), the revised version (DCDQ-R), and the teacher questionnaire MABC-2 checklist (MABC-2-C), all focus on the individual's activity level (e.g. self-care, ball skills), they do contain items that refer and relate to underlying body functions [7,8].

According to the American Pediatric Association, 5 to 6% of all school-age children have motor coordination problems that are important enough to interfere with the performance of social and academic activities. Although DCD is relatively common, health and education professionals do not recognize it well, since these coordination difficulties are often considered "minor" and, therefore, do not require specialized attention such as that provided to children with more severe disabilities [3,9].

Regarding gender, differences between boys and girls are not clear, although boys seem to be more likely to be diagnosed with a prevalence of 2: 1 [4,5,10-12].

Many specialists believe that this pathology is related to prenatal complications, such as hypoxia, perinatal malnutrition, and low birth weight, but there is no solid evidence to support this claim. The identification of perinatal risk factors can help generate hypotheses regarding the etiology and help identify children at higher risk [12].The identification of children at risk of developing motor difficulties at a younger age can help initiate the intervention and minimize secondary complications [4,13,14].

Some researchers suggest that DCD is due to organic central nervous system pathology, such as neurochemical abnormalities and lesions of the parietal lobe, which affect the child's ability to move effectively [14-16].

Prematurity combined with premature rupture of membranes and retinopathy of prematurity, show a significant association

with the DCD diagnostic in 8 year old children. However, despite the high prevalence of premature newborns, there is no consistent pattern of perinatal and neonatal factors to explain DCD in this population [4,17,18].

There is a belief that these children will grow without problems, despite their coordination difficulties, however, there is convincing evidence that DCD persists until adolescence and is associated with a variety of negative consequences, including significant behavioral and emotional problems, such as low self-esteem, poor perception of competition and depression [19]. The parents' main complaint is that these children experience widespread home and school activity restrictions, which can translate into an increased risk of being overweight and obese [19-22].

Objectives

The objectives of this study were to estimate the prevalence rate of DCD, through the DCDQ07 questionnaire, suspected it with the MABC-2 and confirmed it with clinical evaluation, as well as to identify associated risk factors in a sample of Mexican school children.

Instruments

The Developmental Coordination Questionnaire 2007 (DCDQ-07) (sensitivity 85%, specifity 71%) [23], is a tool for parents to evaluate their children's degree of coordination in activities of daily living (ADL). The questionnaire contains 15 items in three subcategories: control during movement, fine motor/hand writing, and general coordination. The DCDQ-07 has shown a high intra- and inter-reliability score in children aged 5–15 years [24]. We used the spanish version [23].

MABC-2. The Movement Assessment Battery for Children, Second Edition (sensitivity 90%, specifity 69%) [23], was used for this study. This battery includes three categories of motor tasks: manual dexterity, aiming and catching, and balance. Trained evaluators assessed the motor coordination skills of participants following the guidelines in the MABC-2 manual. Each evaluation was conducted as a one-on-one interaction with each student and took approximately 30–40 minutes to complete [8,24]. There are 3 possible results that depend on the punctuation: 70 o more (percentile above 15), correspond to children with typical development, between 63 and 69 (percentil 5 to 15), children at risk to develop neuromotor deficit and the last result, below 62 points (below percentile 5) correspond to children with fine and gross motor deficit [25].

METHODS

An observational study was carried out in 344 children with typical development, from an elementary school in Mexico City (It is not a special school), from December 2018 to July 2019. The entire sample of children was examined to rule out intellectual disability, since the school routinely conducted psychological studies before the children began their studies. All children were between 6 to 12 years old, the mean was 8.4 years and SD 1.9. The sample calculated with the prevalence described in other studies result in 384 children, very close to the school sample we could studied.

This study had the approval of INR-LGII Ethics in Investigation Committee, number 068. The parents of the children signed the informed consent and the children also agreed to participate. This study conforms to all STARD guidelines and reports the required information accordingly (see filled STARD ckecklist).

This study was conducted in two stages. **Stage 1:** children were screened using DCDQ-07 test and risk factor questionnaire was applied, both were answered by the parents in the presence of the researcher. The variables evaluated were: urinary tract infections, threatened miscarriage (bleeding or uterine contractions in the first 20 weeks that do not conclude in abortion) [26], risk of preterm labor (regular contractions associated with cervical change before 37 weeks' gestation) [27], vaginal infection, premature rupture of membranes, low birth weight, preterm birth (Babies born alive before 37 weeks of pregnancy are completed) [27].

Stage 2: DCD likely cases were defined using MABC-2 battery. The patients who were in red zone of this test were sent to the Pediatric Rehabilitation Department (INR LGII), for DCD clinical confirmation according with the DSM-5 criteria. This stage was conducted by another researcher [28].

Statistical analysis

Descriptive: Measures of central tendency: mode, average and median. Standard deviation. Range for some measurements.

The unadjusted odds ratio for the different variables was obtained. For the multivariate analysis, logistic regression was used to obtain the adjusted odds ratios. Logistic regression models were obtained by entering the variables with $p < 0.1$ in the bivariate analysis. The $p < 0.05$ was considered significant.

RESULTS

Of the 344 patients, 203 (59%), were boys and 141 (41%), girls. The boys had an average age of 8.0 with SD 1.85, and the girls had 9.0, with SD 2.02. When the patients were categorized according to the DCDQ-07 age groups, 64.7% were in 7-9 years band. Of the total, 17 children resulted with probable DCD with the DCDQ-07 questionnaire; when they were evaluated with MABC-2, 11, 6 male and 5 female (Group 1), were positive for motor difficulties, and after a clinical study they were confirmed to have DCD, two patients, 1 male and 1 female (Group 2), were in risk zone, the rest, 4 students, 2 male and 2 female (Group 3) were children with no motor problems (Table 1 and Figure 1). The general punctuation of the MABC-2 was: mean 64.37, SD 4.11 with limits 58/72.

Prevalence rate of DCD we found, was 3.20% (1.34%-5.06%) with 95% confidence interval. The risk factor that showed association with DCD was the threat of positive premature delivery with $p = 0.0001$ (Table 2).

The collinearity between the variables was not important, there was a low correlation between urinary tract infection and low birth weight and risk of premature delivery, and prematurity with threat of spontaneous abortion, low birth weight with premature rupture of membranes. There was only a high correlation between prematurity and the risk of preterm birth. However, these correlations did not affected the results at all.

Table 1: Demographic, DCDQ-07 and MABC-2 data. Total of patients = 334.			
Girls	141 (41%)	9.0 +/- 2 yrs	6-12 yrs
Boys	203 (59%)	8.0+/- 1.8 yrs	6-12 yrs
DCDQ07			
TDC suspected	17	5 %	
No suspected TDC	327	95.0%	
MABC-2			
Motor deficit (Group 1)	11 (64.7%)	58-62 points	< 5 percentile
Risk (Group 2)	2 (11.7%)	65-66 points	5-15 percentile
Without motor deficit (Group 3)	4 (23.6%)	70-72 points	>15 percentile

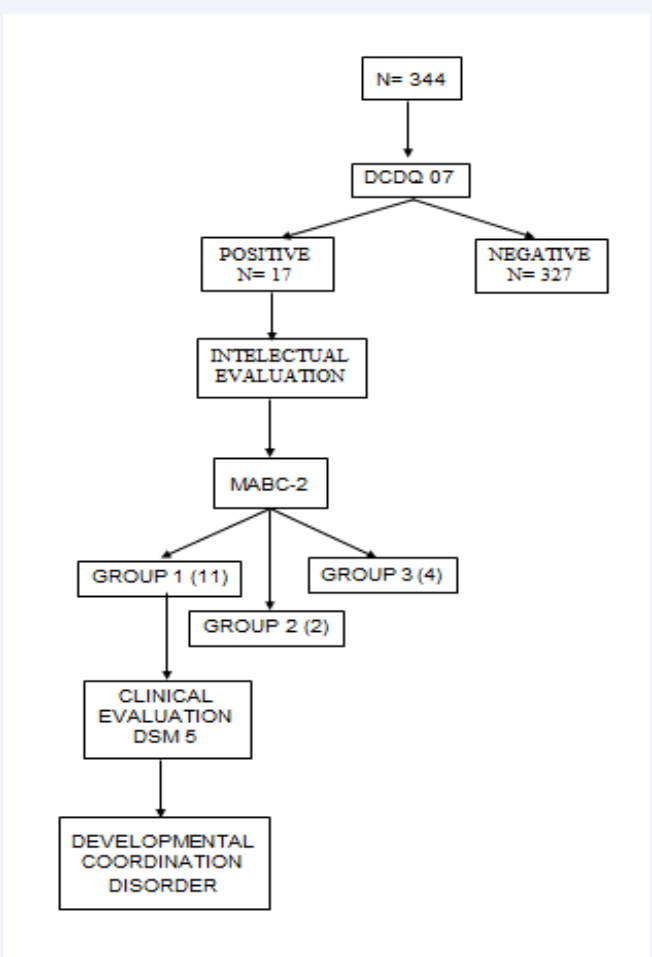

Figure 1 Diagram of the stages and results of the study.

DISCUSSION

The importance of this study lies in the fact that DCD in our population (children with typical development), is similar to those previously described, and that early detection can offer therapeutic programs to reduce, as far as possible, the consequences of neuromotor compromise and improve the participation of affected children in school, sports and daily life activities. This study is to our knowledge, the first one to calculate the prevalence of DCD in Mexican children. The prevalence found in this sample of Mexican children is similar to that reported in several studies [29]. Cherng et al., found a prevalence of 5% and established DCD as one of the most common childhood disorders [2,6,24,29].

We have to consider that the prevalence is high and it could be higher, especially because older children with coordination difficulties choose not to participate in activities with a high degree of motor skill or they do individual activities [1,8,19]. In general, society places a high value on physical activity, due to the psychological, social and financial factors related to it; although in Mexico we have different social and economic situations, the importance we give to physical activity is similar.

There is also a difference between boys and girls because their participation in physical activities is different [2,4,5].

It is also important to mention there is a DCD lack of information in the general population, since parents and teachers consider that the "clumsiness of movement" of the child is normal and with time it will disappear [30,31].

The background of threat of preterm birth (TPB), was the only variable we found associated to DCD. This condition was previously reported by some researchers. None of the other variables were important in our children, although some authors have referred other variables associated to the development of DCD, for example malnutrition, premature rupture of membranes, retinopathy of prematurity and early exposure to steroids. Our sample size could be an explanation why there was no association with the DCD and other variables mentioned [5,12,15-17,32].

It is important to point out that although the DCQ-07 and MABC2 are not considered fine instruments for the detection of DCD, we can say that they are useful for screening in the general population [7].

LIMITATIONS AND STRENGTHS

This study has several limitations. In the first place, it

Table 2: Risk factors studied. We showed bivariate and multivariate analysis.			
Factors	**OR**	**Bivariate analysis p**	**Multivariate analysis p**
UTI	2.3	**0.165**	0.687
Threatened miscarriage	1.7	0.334	
Risk of preterm labor	**15.3**	**0.0001**	**0.0001***
Vaginal Infection	2.3	0.372	
PROM	Cannot be evaluated	0.508	
Low birth weight	Cannot be evaluated	**0.132**	0.157
Preterm birth	1.8	0.390	
UTI = Urinary tract infections; PROM= premature rupture of membranes.			

is necessary to point out its cross-sectional nature and the consequent difficulty in establishing a causal effect but the correct one to know the prevalence of the DCD. Secondly, we must emphasize that our sample comes from a single school; therefore, inferences to all Mexican children cannot be made. However, the inclusion of different ages and gender may be useful for other studies.

Third, it is unknown if there are pre-existing diseases such as learning disabilities or global delays that could affect the prevalence of DCD.

The strengths are that diagnosis of DCD was established in all children with suspected DCD, by applying MABC-2 and with clinical confirmation, which confirms the reliability of the DCDQ-07 screening test. Finally, although the sample size is not as large as other study samples that had estimated the prevalence of DCD, the prevalence found is similar to reported internationally, which may represent an estimate of the prevalence of DCD in Mexican children. It is important to point out, there are few studies in general population, in this case, we studied students for elementary school, which means children with typical development.

CONCLUSIONS

With the results obtained, we conclude that the prevalence of DCD in a sample of Mexican children is similar to that reported in international studies, despite the fact that the sample is small compared to other studies. It is important to emphasize that the population studied is a sample of healthy school-age children.

The lack of information on DCD, especially of parents and teachers, has downplayed this condition. The knowledge of this condition it is important to have an early diagnosis and intervention to have better results in patients' treatments.

Regarding the risk factors it is important to emphasize that the background of preterm labor and prematurity was found in the great majority of the present study of DCD patients, which is similar to that found in international studies, and this could contribute to the explanation of the etiology.

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