ORIGINAL ARTICLE

Developmental coordination disorder in early childhood - A preliminary epidemiological study in greek schools

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ABSTRACT

Backround: The need for early and accurate identification of developmental coordination disorders (DCD) has been stressed by many researchers. The purpose of the present study is an initial investigation of the prevalence of DCD within the Greek school environment in early childhood.

Methods: Participants were 354 early childhood students (204 boys and 160 girls) of 14 early childhood public centers and schools of two urban areas of Northern and Central Greece. The Movement Assessment Battery for Children(MABC) was used for assessment.

Results: Based on the norms of the battery, six children of the total sample (1.6%) exhibited performance that corresponded to the lowest 5% of the continuum suggesting definite coordination disorder. Furthermore, 39 children of the same group (10.8%) were characterized "at risk" since their motor performance corresponded between the 6th and 15th percentiles of the continuum. Finally, more boys than girls "fell" under the cut off points of 15th and 5th percentiles.

Conclusions: Within its limitations, the present study suggests that the prevalence of DCD in Greek children during early childhood appears to be much lower compared to similar international studies. Having a starting point, we feel that there is a good reason for further investigation with psychological assessment tests and pediatric developmental screening in the cases needed, so as to define the factors contributing to our results.

Key words: *prevalence, developmental coordination disorder, childhood, Greece, schools.*

INTRODUCTION

Developmental Coordination Disorder (DCD) is described by the Diagnostic and Statistical Manual-IV[1] as a movement disorder characterized by a marked impairment in the development of motor coordination abilities that significantly interferes with performance of daily activities and/or academic performance. The difficulties observed are not consistent with the child's intellectual abilities and are not caused by a pervasive developmental disorder or general medical conditions that could explain the coordination deficits.[1] Furthermore, it is stated that manifestations of the disorder regarding young children may include clumsiness and delays in achieving developmental milestones such as walking, crawling, sitting, tying shoelaces, buttoning shirts, zipping pants.

Data from relative studies indicate that, without intervention, developmental coordination problems not only persist[2,3,4] but can severely affect other aspects of daily living such as behavior[4,5] learning and academic achievement[6], self esteem and other emotional characteristics[7], participation in physical activities[8,9], as well as physical fitness.[10] Furthermore, it appears that problems in motor coordination may have an impact on more practical issues of every day life such as crossing a road[11] , personal appearance or organizational matters.[12]

Therefore, there is an agreement regarding the urgent need for early and accurate identification of developmental coordination disorders[13,14,15,16] as there is scientific evidence that early and specific intervention has positive outcomes.[17,18] According to the international bibliography the prevalence of DCD ranges between 5% and 7% of the total school population.[1,15,16,19] However, since medical and educational systems often fail to recognize early this condition the affected children usually reach school age undiagnosed and are only recognized when the aforementioned secondary academic, behavioral and emotional problems emerge to some degree.[14]

Another issue that upgrades the importance of early identification and assessment is comorbidity. During the last few years the notion that DCD may not be a discrete disorder[20] but often co-exists with other types of learning disabilities seems to gain support.[21,22,23] Research data reveal that motor difficulties are much more common in children with learning disabilities[24], speech and language disorders[14], attention deficit hyperactivity disorders[19], or perceptuo-motor disorders[25] than it was initially believed. Therefore, identifying DCD may be an important step for locating the aforementioned comorbid conditions.

Limited existing data have indicated that DCD is present within the Greek school population.[17,26] However, accurate prevalence figures have not yet established. The purpose of

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the present study is an initial investigation of the prevalence of DCD among Greek during early childhood.

MATERIALS AND METHODS

PARTICIPANTS

The study tracked 364 early childhood students (204 boys and 160 girls, Mean age = 58.36 months, S.D. = 7.94) of two urban areas of Northern and Central Greece. Table 1 depicts the descriptive data of the participants. Information was requested regarding existing medical records in order to avoid the possibility of health problems that could intervene with motor performance.

Table 1. Numerical and descriptive data of participants

Group	N (boys/girls)	M age (months)	SD age (months)	Minimum age (months)	Maximum age (months)
Boys	204	58.44	7.52	41	74
Girls	160	58.26	8.47	41	76
Total	364	58.36	7.94	41	76

MEASUREMENTS

Movement Assessment Battery for Children (MABC).[15] The specific test is a battery especially designed to assess movement difficulties that determine, in a large degree, the child's social integration, mainly in school.[15] MABC is a norm referenced test which covers three major motor domains: (a) manual dexterity, (b) ball skills, and (c) static and dynamic balance. There are 32 tasks organized in four sets (eight tasks per set). Each set corresponds to one of the four age groups, which the test is designed for: Age group 1 (ages 4-6), age group 2 (ages 7-8), age group 3 (ages 9-10), and age group 4 (ages 11-12). Task characteristics are the same for each age group. The specific tasks for age group 1 used in the present study, were: posting coins, threading beads and bicycle trail (manual dexterity); catching bean bag and rolling ball into goal (ball skills); one-leg balance (static balance); jumping over cord and walking heels raised (dynamic balance).

The child's performance on each task (seconds, steps, catches, etc.) corresponds to a respective motor score from "0" (complete success) to "5" (fail-severe movement difficulty). The scores of all eight tasks are added at the end and their sum constitutes the child's motor score. Thus, a total motor score varies from "0" (for a child with no movement difficulties) to "40" (for a child with severe movement difficulties). This score denotes the child's motor ability compared to his/her age level (note that lower scores denote better performance). According to the norms that are included in the test the differentiation criteria are the lowest 15th and 5th percentiles. If a child has a motor score that corresponds between the 15th and 6th percentiles, he or she exhibits moderate difficulties. If his or her motor score corresponds below the 5th percentile then the child has severe motor problems. Reliability and validity of the MABC are good and are described in details in the test's Manual.[16] The specific test, is being used widely in the international relative literature[13,16] and has been implemented in many countries worldwide, such as Sweden[27], China[28], Belgium[29], Japan[30], U.K[31], Thailand[32], the Netherlands[33], as well as in Greece.[17,26]

PROCEDURES

Motor assessment took place in especially prepared rooms in the schools. Each student was assessed individually.The tasks were applied in the order that is given in the Manual in order to retain its characteristics intact. Prior to the initial assessment the examiner had visited the schools several times and consequently he was not an unfamiliar face to the children. Moreover, he dedicated at least 15 minutes prior to each individual assessment, talking to the child explaining what they were going to do. This procedure helped children to release the tension and fear of the unexpected.

RESULTS

Figure 1 shows the distribution for the total sample (n = 364) based on the children's performance and according to the Norms offered by MABC Manual.[15] Six children of the total sample (1.6%) exhibited performance that corresponded to the lowest 5% of the continuum suggesting definite coordination disorder. Furthermore, 39 children of the same group (10.8%) were characterized "at risk" since their motor performance corresponded between the 6th and 15th percentiles of the continuum. The respective distribution regarding sex are depicted on Figure 2, showing that more boys than girls "fell" under the cut off points of 15th and 5th percentiles.

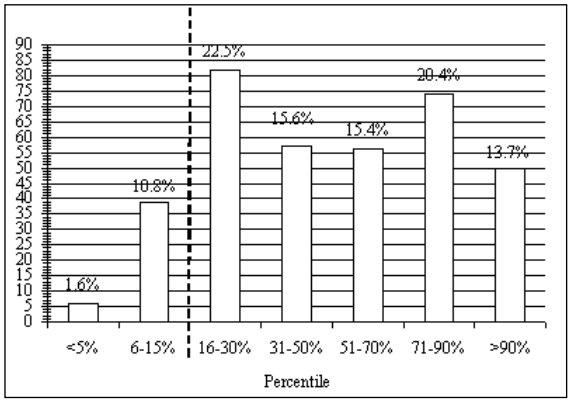

Figure 1. Total sample distribution according to the MABC Norms (<5% denotes severe coordination disorders, <15% denotes "at risk", >15% no movement difficulties)

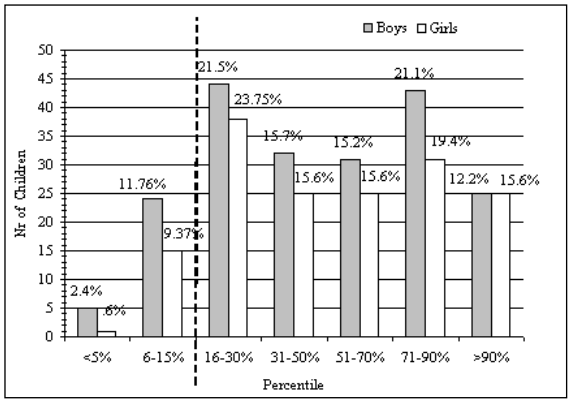

Figure 2. Distribution across gender according to the MABC Norms (<5% denotes severe coordination disorders, <15% denotes "at risk", >15% no movement difficulties)

Univariate analysis revealed no significant difference regarding total motor score between boys and girls ($F_{(1, 231)} = .785$, $p = .377$, $n^2 = .003$, Figure 3). Multivariate analysis of variance was used to examine gender differences on the separate motor domains of the motor performance battery. Results showed a significant overall effect (Wilks'Lambda = .814, $F_{(3, 229)} = 17.444$, $p < .001$, $n^2 = .186$). Follow-up analysis revealed that girls performed significantly better on manual dexterity tasks ($F_{(1, 231)} = 12.169$, $p < .01$, $n^2 = .050$, Figure 3), while boys had better scores on ball skills ($F_{(1, 231)} = 24.883$, $p < .001$, $n^2 = .097$, Figure 3). No significant differences were found on balance ($F_{(1, 231)} = 3.883$, $p > .05$, $n^2 = .17$, Figure 3).

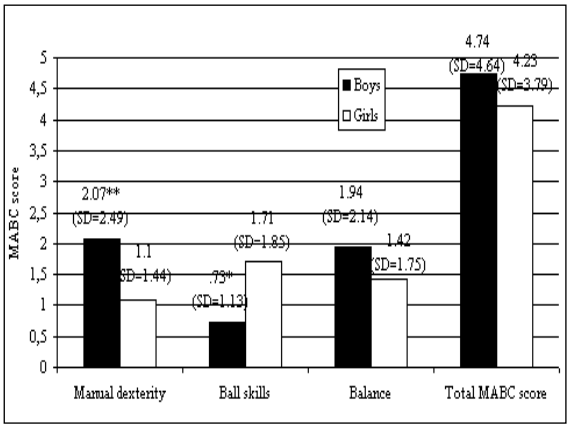

Figure 3. Comparison of the means of the three motor domains and the general motor score of the MABC between boys and girls (higher score indicates more severe difficulties, *p<.001, **p<.01).

DISCUSSION

The purpose of the present study was an initial investigation of the prevalence of Developmental Coordination Disorders (DCD) in Greek schools during early childhood. Depending on the assessment procedure as well as the background and experience of the researcher, the prevalence ranges from 3% to 22%.[13,19,34,35,36,37] Furthermore, according to the Diagnostic and Statistical Manual-IV,[1] the expected prevalence of DCD is 5% to 6% of the total school population.

According to the data of the present study, the prevalence of DCD among 364 Greek early childhood children was 1.6% (i.e. 5 children). However, despite the above encouraging results, regarding definite movement difficulties, the prevalence of children with moderate motor problems (children "at risk" according to MABC manual) was much higher. Thirty nine (i.e. 10.8%) out of the 364 children of the total sample fell below the 15th percentile, revealing moderate coordination disorders.

Considering the present results and despite the relatively small sample size of the current study, the conclusion that can be drawn is that the prevalence of DCD among Greek early childhood children is significantly lower than other relative studies.[19,38] However, the prevalence of moderate difficulties are similar to those of other relative studies. It is widely accepted that DCD shows stability over time and across rates[19] as well as that without early identification and intervention the prognosis does not look promising.[2,3,4] Consequently, the children "at risk" of the present study have the potential for the development of a DCD in the future. In addition, the present result in relation to the fact that the participants of the aforementioned relative studies were mainly children aged 7 to 12 years,[39] reinforces the fact that medical and educational systems often fail to recognize early DCD and the children who are identified are usually already in school and are only recognized when secondary academic, behavioral and emotional problems have already emerged.[14]

Boys-girls ratio in the current study ranged from 5:1 regarding severe motor difficulties to 2:1 regarding moderate difficulties. The above result comes in agreement with other relative studies[19,40] which support the fact that more boys than girls exhibit such movement difficulties. However, this systematic finding seems difficult to be explained.[41] Smyth[42] has noted that motor problems may be more easily observed in boys due to the fact that boys tend to engage more frequently in physical activities. Furthermore, socio-cultural expectations may have a partial effect on the identification of boys and girls with movement difficulties.[13] In their study, Revie and Larkin[37] found that teachers using checklists had identified only girls with severe motor problems as having movement difficulties, while boys with a wide range of motor coordination problems were selected. It may be that social demands for motor skill proficiency and the higher social value for boys has lead to a general disregard for gender-based norms in assessment instruments thus contributing to a gender bias in identification of children with DCD.[13] A probable limitation which might have a partial effect on boys-girls ratio found in the present study may be the fact that more boys than girls were available for assessment in the selected early childhood centers and schools.

Regarding gender differences, Henderson and Sugden[15] stated that during the development of the Movement Assessment Battery for Children girls were slightly better than boys on the manual dexterity items and boys tended to outperform the girls on ball skills. However, these differences were insignificant and not consisted and therefore there was no need for separate norms.[15] Boys and girls who participated in the present study exhibited the same trends, although the differences were statistically significant. In particular, the girls performed significantly better than boys in manual dexterity skills while the boys significantly outperformed the girls regarding ball skills. No significance was revealed in balance skills and total motor score.

Results regarding sex differences were more or less expected. Better performance of girls compared to boys in fine motor skills is a fact described by other studies as well. Causgrove-Dunn and Watkinson[43] attributed the above trend to the fact that girls usually prefer to engage in fine manipulation activities and therefore becoming more experienced than boys who, on the other hand, tend to relate strongly with larger objects such as balls, thus practicing and performing better compared to the opposite sex.[43,44,45] The above differences may not be attributable only to ability-related differences, but to stronger social

support and social motivation in favour of the boys regarding participation in related physical activities. Alternatively, some researchers attribute the above differences in harmonic differences between sexes, stating that lower levels of estrogens may result in better performance in gross motor skills while higher estrogens levels result to better performance in fine motor skills.[46]

Girls performed slightly better on balance skills. However, the above difference did not reach statistical significance. Cratty[24] states that although early childhood girls may perform better than boys in balance skills, significant difference should not be expected since balance ability tends to be fully developed between the 8th and 9th year. In addition to that, it should be mentioned that during early childhood there are no large differences regarding balance-related characteristics such as body size and power, and therefore differences in performance should not be expected.

Most of the research on DCD has been conducted with children aged 7-12 years while relatively few have published studies involving younger children.[39] The limited existing data have showed that prevalence of DCD within Greek school population may be similar to that of other western countries.[17]

CONCLUSIONS

Within its limitations, the present study revealed that the prevalence of Developmental Coordination Disorders1 among early childhood Greek children appears to be much lower compared to similar international studies. Considering the fact that, without intervention, the prognosis of developmental coordination disorder does not look promising[2,3] there seems to be a need for more research combining the investigation approaches in DCD and early childhood development. Identifying DCD at an early stage may prevent secondary cognitive, behavioral and emotional problems.

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