

Motor characteristics of students with Attention Deficit Hyperactivity Disorder

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Abstract: Introduction: Children with Attention Deficit Hyperactivity Disorder (ADHD) present accented motor difficulties and possibly present the Developmental Coordination Disorder (DCD) as co-occurring. Objective: Identify the motor profile of students with interdisciplinary diagnosis of ADHD, compare with students with good academic performance, and to verify the incidence of DCD in this population. Method: 46 students of both genders participated in the study, in the age range of 7 to 10 years and 11 months, attending from the 1st to the 5th year of elementary school at public schools in cities of São Paulo state. The students were divided into two groups: Group I (GI) included 23 students with ADHD; Group II (GII) included 23 students with good academic performance. The students were paired according to gender and age. The groups experienced motor assessment (Movement Assessment Battery for Children-Second Edition / MABC-2). MABC Test consisted of eight items grouped into three sections (manual dexterity, aiming and catching, and balance), parents/caregivers responded questions about the Economic Classification questionnaire. Results: The results were statistically analyzed in order to characterize and compare the motor profile of the students, intra, and intergroup. The results showed that 43.38% in GI presented indicative of DCD, whereas, in GII, none of the students presented indicative of DCD. However, it is possible to highlight an incidence of DCD in the population with ADHD in about 43%. Conclusion: These findings emphasize the importance of actions to assist and early diagnose this population by teachers, health professionals, and family, improving the life quality of these children.

Keywords: *Attention Deficit Hyperactivity Disorder, Motor Skill, Developmental Coordination Disorder.*

Características motoras de escolares com Transtorno de Déficit de Atenção com Hiperatividade

Resumo: Introdução: Crianças com Transtorno do Déficit de Atenção com Hiperatividade (TDAH) apresentam dificuldades motoras acentuadas e possivelmente apresentam o Transtorno do Desenvolvimento da Coordenação (TDC) como coocorrente. Objetivo: Identificar o perfil motor de escolares com diagnóstico interdisciplinar de TDAH. Método: Participaram do estudo 46 escolares, de ambos os gêneros, na faixa etária de 7 a 10 anos e 11 meses de idade, de escolas públicas municipais de cidades do interior de São Paulo, distribuídos em dois grupos: Grupo I (GI) - composto por 23 escolares, com diagnóstico interdisciplinar de TDAH; Grupo II (GII) - composto por 23 escolares com desenvolvimento típico e com bom desempenho acadêmico. Os escolares foram pareados segundo gênero e faixa etária. Os grupos passaram por avaliação motora (*Movement Assessment Battery for Children - Second Edition — Movement ABC-2*). Os dados foram analisados estatisticamente visando à caracterização e comparação intra e intergrupos do perfil motor dos escolares. Resultados: Os resultados mostraram que no GI estiveram presentes 43,48% com indicativo de Transtorno do Desenvolvimento da Coordenação (TDC), sendo a Habilidade do Equilíbrio a mais acometida. No GII, não foram encontrados escolares com indicativo de TDC. É possível destacar uma incidência de TDC na população com TDAH, em aproximadamente 43%. Conclusão: Esses achados reforçam a importância de ações voltadas ao atendimento e diagnóstico precoce desta população pelos professores e profissionais da saúde, objetivando uma melhora na qualidade de vida dessas crianças e familiares envolvidos.

Palavras-chave: *Transtorno do Déficit de Atenção com Hiperatividade, Habilidade Motora, Transtorno do Desenvolvimento da Coordenação.*

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Received on Apr. 17, 2017; 1st Revision on Aug. 24, 2017; 2nd Revision on Nov. 30, 2017; Accepted on Apr. 23, 2018.



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1 Introduction

The American Psychiatric Association (AMERICAN..., 1994) in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) characterized the Attention Deficit Hyperactivity Disorder (ADHD) by a pattern of behavior present in several configurations of the context of the individual, for example: school and home, which can result in performance problems in social, educational or work environments. Children diagnosed with ADHD should have at least six symptoms of those described in the handbook and older adolescents and adults aged above 17 years old should respond to at least five criteria. In the current DSM publication, in its fifth edition (AMERICAN..., 2013), the changes that occurred were: in DSM-IV, the symptoms should be present until 7 years old; in DSM-V, the individual's ADHD symptoms must be present before 12 years old. This change is supported by substantial research published since 1994, which found no clinical differences among children identified at 7 years old or later, regarding stroke, severity, outcome, or response treatment. DSM-V does not include exclusion criteria for people with autism spectrum disorder since the symptoms of both diseases co-occur. However, symptoms of ADHD should not occur exclusively during the course of schizophrenia or other psychotic disorder and should not be better accounted by another mental disorder such as depression, bipolar disorder, anxiety disorder, dissociative disorder, personality disorder or withdrawal or intoxication by medication.

Attention Deficit Hyperactivity Disorder (ADHD) is considered to be a heterogeneous picture of neurological abnormalities manifested during the development of the human being, considering that this picture is affected by genetic configurations and diverse environmental exposures. The neurological heterogeneity in the ADHD is composed of abnormalities of the development of the frontal lobe and other related brain areas (CUNHA et al., 2013; CORNELIO et al., 2011; PEDRERO-PÉREZ et al., 2011). Children with ADHD are described by their parents, teachers, and colleagues as children who daydream, do not listen, always lose their objects, are forgotten and easily distracted by the environment, need constant attention and never finish what they start. Also, because of the difficulty in controlling their impulses, they are pointed as impatient, because they always interrupt others, answer early, do not wait their turn and are always trying to make shortcuts in their tasks. As for their excessive motricity or hyperactivity, parents and teachers said

that they have a tendency to “embrace the world,” they twist around without being able to sit down, talk too much, often humming or making unusual noises, and are unable to stop activities motor vehicles. In fact, they do not have middle ground, for example: either they are sleeping or are jumping (JOU et al., 2010).

Studying the motor profile of children with ADHD becomes necessary in the finding of the literature, indicating that children with ADHD may present Developmental Coordination Disorder (DCD) as co-occurrence. The literature review carried out by Toniolo and Capellini (2010) reveals, however, that the overall motor profile of children with ADHD is not known. Williams et al. (2013) emphasized in his research that children with ADHD + DCD have motor control deficits, indicating that the impact of motor deficiency on ADHD and its causal risk factors requires more studies, evidencing that motor impairment in ADHD should not be discarded as a byproduct of inattention. The American Psychiatric Association (AMERICAN..., 2013) describes DCD as a neurodevelopmental disorder classified as a motor disorder characterized by motor performance substantially below expected levels for the individual's chronological age, given the prior opportunities for the acquisition of motor skills. A few national studies on Development Coordination Disorder have been found (BELTRAME; SILVA; STAVISKI, 2007; TONIOLO; CAPELLINI, 2010; BELTRAME et al., 2017) and the scarce literature shows studies with non-standard motor tests for the Brazilian population. The Movement Assessment Battery for Children-Second Edition (MABC-2) was the most used to verify the prevalence of DCD (TONIOLO; CAPELLINI, 2010). Therefore, this research intends to better understand the motor performance of students with ADHD, as this disorder affects children in various aspects of biopsychosocial development, and the motor development is an important characteristic for many activities of daily living and instrumental activities of daily life.

Thus, this article aimed to characterize the motor performance of schoolchildren aged 7 to 10 years and 11 months old with Attention Deficit Hyperactivity Disorder.

2 Method

2.1 Study design and ethical aspects of research

This is a cross-sectional, comparative and descriptive study based on the quantitative approach.

The research project of this study was submitted to the Research Ethics Committee of the Federal University of São Carlos and approved under number 144,553.

According to the resolution of the National Health Council/Ministry of Health CNS/MS 466/12, before the beginning of the evaluations, the parents or caregivers of the selected students signed the Informed Consent Form (TCLE) for authorization to carry out the study. The people who have agreed to participate in this research can at any time give up of the study, at any stage of the research, without any harm to the people involved.

Aiming to remain ethical in research, data collection was sent to the parents/caregivers the evaluation reports of their children, as well as explanations if the child indicated risk or indicative of DCD; meetings were organized with groups of teachers/coordinators of the participating schools on the subject of ADHD and DCD.

2.2 Subjects

A total of 46 (forty-six) students of both genders aged between 7 and 10 years and 11 months old, attended classes from the 1st to 5th year of municipal public schools of cities in the interior of the state of São Paulo, distributed in two groups:

Group I (GI): composed of 23 (twenty-three) school children with a diagnosis of Attention Deficit Disorder and Hyperactivity, of both genders, aged between 7 years old and 10 years and 11 months old. The diagnosis was made by the interdisciplinary team of the Children's Neurology Outpatients Department of Learning at the Clinical Hospital of the Medical School - HC/FM-UNESP/BOTUCATU in partnership with the Laboratory of Investigations of Learning Disorders (LIDA) - UNESP/FFC/MARÍLIA. The exclusion criterion, the children who were not included in this group were they have no closed diagnosis or without diagnosis, but not taking medication properly, that is, they had not taken the medication until half an hour before the care, and it was not possible to conducting motor assessment; in the process of diagnostic evaluation by the multidisciplinary team; associations with syndromes, disorders and/or disabilities; and who attended private schools. The choice of this laboratory was motivated by being a reference center in diagnostics of Learning Deviance,

thus encompassing the diagnosis of children with ADHD. It is necessary to remember that the diagnosis of ADHD is not done by a single professional, but by an interdisciplinary team, with what we could count on in this laboratory. The research was previously authorized by the outpatient clinic, enabling to collect data referring to the GI group, which occurred in two cities, with children linked to the outpatient clinic, coming from several regions, since this outpatient clinic is a reference in the study and diagnosis of learning.

Group II (GII): composed of 23 (twenty-three) students with good academic performance, from public schools, paired according to gender, age group and socioeconomic level with GI. The indication of the students with good academic performance was made by the teachers of the schools from the information contained in the school records and the report of performance of the students in the last semester of school that preceded the data collection. Those with satisfactory academic performance were considered as students with good academic performance, that is, in their school report, they had scores of 8.0 or higher, thus above the school average (5.0) in two consecutive bi-months, in Portuguese Language, Mathematics and Physical Education. Also, only the children who were good students, had no other difficulties, with a good income inside and outside the classroom according to the teachers' reports were selected.

2.3 Instruments

- a) **MABC-2:** is the second version of Henderson and Sugden's 1992 "Child Assessment Battery" in England. In the MABC-2 manual, the authors present that this motor assessment can be used with children aged 3 years old (16 years old) and 11 months old (sixteen years and eleven months old). It is worth noting that for this study, one of the populations indicated in the manual to be applied to the motor battery is children with learning disabilities, ADHD, among others (HENDERSON; SUGDEN; BARNETT, 2007).

In this research, motor graded tests for each age were used, aiming to identify delay or impairment in motor development. The instrument involves the following areas - manual dexterity; target and

accuracy; and balance - that represent different subsystems of the motor control, providing means to evaluate the school-age child. After the application of this test, the results were summed, first within each set of tasks, so it was possible to obtain the total manual skills, abilities like launching and receiving totals and total balance. Then, the last three values were added and the total MABC of each child was obtained. The total MABC values are compared to the percentiles table, which are present in the test protocol. Children whose total MABCs had a score below the 5th percentile were considered to have motor difficulty. Values between the 5th and 15th percentile indicate that the child has a degree of borderline difficulty (risk of difficulty) and values above the 15th percentile indicate normal development (without difficulty).

The motor battery classifies its results into three zones: green zone - children who present their results within this classification do not present difficulties in their significant motor skills; amber zone - children included in this zone have some motor impairments; and red zone - children classified in this zone have many motor difficulties, compatible with the DCD picture.

The assessment is divided into three parts:

- Manual dexterity: Putting pins on a pierced board, “sew” a piece of wood with holes with a shoelace to pass the lace and labyrinth (a drawing on the paper in which the child has to take the bicycles to the house);
- Aiming & catching: Throwing a tennis ball at the wall to grab it and throw a bean bag into a red circle on the floor; and
- Balance: Keeping in balance with one leg only on top of a thin wood, walking on a line and jumping with one leg only.

b) Anthropometric measurements: The anthropometric measures of weight and height of the children were carried out whose physical characteristics may influence their motor development.

c) Socioeconomic questionnaire: This questionnaire was based on the Brazilian Criterion (IDESE), for the socioeconomic classification of the study participants, in the format used by Pereira (2012). If any of the parents/caregivers had difficulties answering the questionnaire, it could be done in their original formatting and/or as an interview. This questionnaire was delivered to the

parents/caregivers so they could respond and then hand them over to the therapist.

d) Development Coordination Disorder Questionnaire (DCDQ-Brasil 2 - Research Edition):

This questionnaire is divided into fifteen (15) questions regarding the motor skills that the children make with their hands or when they move. The instrument has questions with answers according to the legend: it is not anything like your child, put 1 (one); when it likes a little bit with your child, you put 2 (two); if it is moderately similar to your child, you put 3 (three); and when it looks quite like your child, put 4 (four); and finally, if it is extremely similar to your child, you put 5 (five) as an answer to each related question.

The DCDQ-Brasil2 is a questionnaire for parents/caregivers specific for the detection of DCD in children aged 5 to 14 years old (WILSON; DEWEY; CAMPBELL, 1998) which has been translated and adapted for our country. In its most recent version (WILSON et al., 2006), the questionnaire has 15 items that assess the child's performance in different situations of daily living. The questions are divided into three groups: motor control during movement, fine/written motor and general coordination.

When the questionnaire is filled out, the therapist sums up the scores of each item to obtain the final score. The maximum score, summing the points of the three areas, is 75. Three cut-off points were developed to identify DCD (WILSON et al., 2006): in the age group 5 to 7 years and 11 months old, the score of 0-46 indicates that the child has DCD or is suspected of having DCD; the score of 47-75 indicates that the child probably does not have DCD. In the 8-9 years and 11 months old range, a score of 0-55 identifies children who have or are suspected of having DCD. In the last age group, 10 to 13 years and 11 months old, children with a score of 0-57 have or are suspected of having DCD. The authors point to the fact that the end result should be compared to the child's observation in a formal setting, such as therapy, and in informal settings (GREEN et al., 2005). This questionnaire was given to the parents/caregivers so they could respond and later surrender the therapist.

2.4 Procedures

At first, the researcher contacted the places of interest for the purposes of authorization of the research. After the necessary authorizations, a work

was done to raise the awareness of the occupational therapist within the school of the municipality chosen to carry out the collection of the control group, since the city is not accustomed to having researches.

After this stage, the survey of children from 7 to 10 years and 11 months old registered with diagnosis of Attention Deficit Hyperactivity Disorder at the Children's Neurology Outpatient Clinic - Learning Deviants at the Hospital das Clínicas of the Medical School - HC/FM-UNESP/BOTUCATU. A survey was made using an electronic medical record, notes in the old diagnostic notebooks, participation in team meetings to be aware of the new diagnosed children.

With data from children with ADHD enrolled at the outpatient clinic, the researcher called them and those responsible for telephone contact and the outpatient social service to begin collecting the data. The dates of the attendance of each participant were recorded in the electronic medical records. Each child attended with their supervisor to authorize participation in the research and to answer the DCDQ-Brasil questionnaires and the socioeconomic questionnaire. At this point, the researcher asked the parents/caregivers if the children were on appropriate medication and how long they had taken the last dose. After the consent of the person responsible for participation in the study, the child was guided to a motor assessment room (MABC-2: Movement ABC - Second Edition). Each service lasted approximately 40 minutes. At the end of the evaluation, a date was set for the return of the researcher to give a motor assessment report and to talk with those responsible about any doubts. Interventions were also suggested in the reports that could be carried out within the school environment and at home.

In a second moment, with the finalization of the collection of the group of children with ADHD, the data collection with the students of the control group was started. The researcher returned to school for a survey of the school records, regularly enrolled in checking the children's grades and dates of birth, and the teachers in each room were contacted to indicate "good" students in their perspective. Once this survey was carried out, the parents/caregivers of the students who fit the criteria for inclusion in the research were sent through the classroom teachers, the TCLE attached to the DCDQ 2-Brazil questionnaires and the socioeconomic questionnaire. The researcher had the collaboration of the school inspectors, who were

responsible for collecting the TCLE together with the questionnaires. With the documentation completed by the parents/caregivers, the researcher made the pairing of the students with the group of children with ADHD, and only the paired schoolchildren were submitted to the motor evaluation.

After the data collection, the researcher talked to the coordinators of the schools of the group of children with ADHD to explain about the Development Coordination Disorder and proposals of change and intervention within a school environment. The devolution of the control group was carried out individually with the director and the coordinators of the school, and the researcher kept the reports of the students of the control group filed.

2.5 Statistical analysis

The results were descriptively analyzed through means, standard deviations, maximum and minimum values, aiming at characterizing and comparing intra-groups and inter-groups of the motor profile of the students to verify the presence or absence of DCD in the population of this study. The level of significance adopted in the analyses was $p < 0.05$, and the program used for the statistical analysis was STATA S.E. version 13.0.

3 Results

The initial design of the research predicted a sample of 60 students, 30 in each group. As an initial result of the work, a smaller number of children in the ADHD group were obtained, which defined the control group with the same sample size. It was not possible to carry out the initial proposal since the children arrived late for diagnosis in the outpatient clinic. The diagnoses in electronic medical records of the institution, diagnostic books of the outpatient clinic and notebooks of the doctor in charge were searched to reach the number of schoolchildren. However, due to the inclusion and exclusion criteria of seven years old to 10 years and 11 months old and without other co-occurrences, only 23 children from ADHD and 23 children from the control group were obtained.

The distribution of schoolchildren in each age group was as follows: GI, 4 (four) children aged 7 (seven), 1 (one) aged 8 (eight), 8 (eight) children aged 9 (nine) and 10 (ten) children aged 10 (ten) years old. In the GII, 4 (four) children aged 7 (seven)

years old, 2 (two) children aged 8 (eight) and 9 (nine) children aged ten (10).

Table 1 shows the differences between the groups according to the means and standard deviations presented in the variables “manual dexterity”, “aiming & catching” and “balance”. GII presented higher mean values than GI, that is, GII presented a higher motor performance than GI. These results are also evidenced when we observe the total of

the MABC-2 since the GII presents an average greater than GI.

In Tables 2-4, the total score values of the variables “manual dexterity”, “aiming & catching” and “balance”, in the ages of 7 (seven) to 10 (ten) years old are distributed in groups I and II.

Table 5 shows the total MABC-2 scores for each group.

Table 1. Distribution of mean and standard deviation of groups I and II for motor skills.

| VARIABLES | MEAN GI | STANDARD DEVIATION GI | MEAN GII | STANDARD DEVIATION GII |
|-------------------|------------|-----------------------------|-------------|------------------------------|
| MANUAL DEXTERITY | 25.89 | 29.81 | 90.45 | 12.60 |
| AIMING & CATCHING | 24.45 | 24.85 | 50.45 | 25.66 |
| BALANCE | 26.18 | 30.33 | 59.39 | 23.83 |
| MABC-2 TOTAL | 15.43 | 19.57 | 76.60 | 21.58 |

Source: Own elaboration (2017).

Table 2. Distribution of the total scores of the variable “manual dexterity” in groups I and II.

| Manual dexterity | GROUPS | | TOTAL n (%) |
|------------------|-------------|-------------|----------------|
| | I n (%) | II n (%) | |
| Green Zone | 8 (34.78) | 23 (100) | 31 (67.39) |
| Yellow Zone | 8 (34.78) | 0 (0.00) | 8 (17.39) |
| Red Zone | 7 (30.43) | 0 (0.00) | 7 (15.22) |
| TOTAL | 23 (100.00) | 23 (100.00) | 46 (100.00) |

Fisher's exact = 0.001. Source: own elaboration (2017).

Table 3. Distribution of the total scores of the variable “aiming & catching” in groups I and II.

| Aiming & Catching | GROUPS | | TOTAL n (%) |
|-------------------|-------------|-------------|----------------|
| | I n (%) | II n (%) | |
| Green Zone | 11 (47.83) | 21 (91.30) | 32 (69.57) |
| Yellow Zone | 4 (17.39) | 0 (0.00) | 4 (8.70) |
| Red Zone | 8 (34.78) | 2 (8.70) | 10 (21.74) |
| TOTAL | 23 (100.00) | 23 (100.00) | 46 (100.00) |

Fisher's exact = 0.005. Source: Own elaboration (2017).

Table 4. Distribution of the total scores of the “balance” variable in groups I and II.

| Balance | GROUPS | | TOTAL n (%) |
|-------------|-------------|-------------|----------------|
| | I n (%) | II n (%) | |
| Green Zone | 11 (47.83) | 22 (95.65) | 33 (71.74) |
| Yellow Zone | 2 (8.70) | 1 (4.35) | 3 (6.52) |
| Red Zone | 10 (43.48) | 0 (0.00) | 10 (21.74) |
| TOTAL | 23 (100.00) | 23 (100.00) | 46 (100.00) |

Fisher's exact = 0.001. Source: Own elaboration (2017).

Table 5. Distribution of total MABC-2 scores in groups I and II.

| MABC | GROUPS | | TOTAL |
|--------------------|-------------|-------------|-------------|
| | I | II | |
| | n (%) | n (%) | n (%) |
| Green Zone | 11 (47.83) | 23 (100.00) | 34 (73.91) |
| Yellow Zone | 2 (8.70) | 0 (0.00) | 2 (4.35) |
| Red Zone | 10 (43.48) | 0 (0.00) | 10 (21.74) |
| TOTAL | 23 (100.00) | 23 (100.00) | 46 (100.00) |

Fisher's exact = 0.001. Source: Own elaboration (2017).

4 Discussion

The main objective of this study was to investigate the motor profile of schoolchildren with ADHD to evaluate if this group is indicative of DCD. DCD represents one of the greatest health problems for the child, since it is not only a problem of specific coordination of childhood that disappears naturally with growth and maturation, since there is evidence that motor difficulties may persist in adolescence and in adult life (HELLGREN et al., 1994; RASMUSSEN; GILBERG, 2000; DEWEY et al., 2002; CANTELL; SMYTH; AHONEN, 2003; MISSIUNA, 2003; MANDICH; POLATAJKO; RODGER, 2003; MIRANDA, 2010).

The incidence of children with a DCD indicative in children with ADHD in this study was 43.48%, that is, 10 (ten) children presented co-occurring DCD with ADHD, and at the risk of DCD, 8.7% school children with ADHD. In another study, 68% of children with DCD present a multiple diagnosis, with ADHD being the most common, associated with speech and language problems (IVERSEN et al., 2008).

The American Psychiatric Association (AMERICAN..., 2003) pointed out that 6% of children between 5 and 11 years old had DCD. The frequency of this disorder varies between 5% and 15% of school-aged children with severe motor impairment (HAY; HAWES; FAUGHT, 2004) and around 10% are included in the risk category or moderate motor difficulty (HENDERSON; SUGDEN, 1992; HADDERS-ALGRA, 2000; HAMILTON, 2002). Other studies point to an index of 2.7% to 15.6% (VAN DELLEN; VAESSEN; SCHOEMAKER, 1990; WRIGHT; SUGDEN, 1998). Cardoso and Magalhães (2011) found a prevalence of 25.3% in 7-year-old children and 21.1% in 8-year-old children.

Studies by Costa et al. (2013) and Nucci (2007) using the Motor Development Scale (MSD), characterized

the psychomotor profile of 10 children with ADHD and found that 40% of the sample presented normal development, 40%, were normal low, and 20% were low, and presented general motor age lower than the chronological age, collaborating with the findings in this research in relation to the group of children with ADHD. Toniolo et al. (2009) is another study that also corroborates the findings regarding the group of children with ADHD, in which it was possible to verify a delay in the motor development of the students with ADHD when compared to typical schoolchildren of the same age group.

In the study conducted by Nascimento (2011), ADHD students had a prevalence of 10% with a DCD indicative, with a higher incidence in boys. In our study and in the study conducted by Nascimento (2011), the DCD indicative occurs predominantly in boys, which corroborates other studies that indicate a higher prevalence of DCD in boys (COUSINS; SMYTH, 2003; KIRBY; SUGDEN, 2007).

It is worth noting that some studies indicate that ADHD is more common in boys than in girls (BARKLEY, 2002; BELTRAME; SILVA; STAVISKI, 2007). Research has indicated a higher prevalence in males, explaining that, in females, the disorder occurs with predominance of inattention characteristics in relation to hyperactivity, which masks the identification of ADHD (COSTA et al., 2011).

When characterizing the total population of this study, 73.91% of the children had a typical development in the development of coordination, 4.35% presented a risk for DCD and 21.74% were classified as indicative of DCD. In the research by Pellegrini et al. (2006), which aimed to identify children with DCD, found 80.1% with typical development, 11.3% with DCD risk and 8.5% with indicative of DCD.

In this study, it was possible to evaluate the different motor skills of children. It was observed that in children with ADHD the "manual dexterity"

skill had distributions of their students in different zones, being 34.78% in green zone, 34.78% in amber zone and 30.43% in red zone, while the students of the group with good academic performance were classified totally in green zone. MABC-2 students presented difficulties with the “manual dexterity” ability (SILVA, 2009). Such difficulty may be due to the specificity of the manual dexterity tasks, since they involve greater concentration and the children need to be seated during the execution of the manual test and perhaps this causes more discomfort in the child with ADHD to the point that it does not achieve so much success in the tasks of MABC-2, because these tasks involve greater precision. Rosa Neto et al. (2013) pointed out that students with learning problems have a lower performance for the “fine motor” ability. In the study by Martins et al. (2012), school children with ADHD had co-occurrence of dysgraphia. Other studies have shown lower performance in the fine motor coordination in students with ADHD when compared to students with good academic performance (OKUDA et al., 2011; SIQUEIRA; GURGEL-GIANNETTI, 2011)¹.

For the “aiming & catching” ability, it was found in this study that 8 (eight) students in group I are classified in the indicative zone for DCD, while 2 (two) students in group II are classified in the DCD indicative zone. These findings are in the same direction as the study by Miranda, Beltrame and Cardoso (2011), which found 18.16% of the population in the red zone (indicative of DCD) for this ability and in this study, 21.74% of the children of group I was in this classification.

In the Balance skill, 10 (ten) students in the ADHD group were found in this study, that is, approximately 22% are classified in the red zone. Miranda, Beltrame and Cardoso (2011) found 30.67% of the students with a change in this ability.

Many school children with Attention Deficit Hyperactivity Disorder have been characterized in the red zone, that is, indicative for DCD. However, according to DSM-V (AMERICAN..., 2013), the diagnosis of DCD cannot be performed only in an environment, such as the moment of the child’s evaluation by a specific motor test. Therefore, it was opted to use an auxiliary questionnaire that presented characteristics of children in different contexts, such as the home environment.

The results of this research show a concentration of schoolchildren diagnosed with ADHD at

9 (nine) and 10 (ten) years old. This diagnosis is late and according to Cruz and Tavares (2012), the late diagnosis frustrates children in school, nervous, restless and wavering, needing every moment of redoubled attention and tranquility to ease his agitation. Therefore, there is a need for correct, meticulous and early diagnosis, since the manifestations of the symptoms are perceptible mainly in the late school context, where the child presents behaviors characterized by inattention, hyperactivity, and impulsivity, commonly confused with indiscipline and rebellion. In this way, besides providing an appropriate treatment, early diagnosis aims to improve the quality of life of these children. Otherwise, when undiagnosed and treated, ADHD can lead to serious impairments in the academic, social and family development of the child (RIBEIRO; PARISI, 2013).

As future studies, it is suggested a better pairing of the number of children by age group in the groups, since in this study it was possible to verify a higher prevalence at the ages of 9 (nine) and 10 (ten) years old when comparing the younger ages of the study. This characteristic refers to the Brazilian reality, in which schoolchildren are diagnosed late. This data directly affected this research to match the students of the groups, showing the importance of scientific studies at the national level aiming to know the characteristics of these children, dissemination of the term, diagnosis and early intervention, guidance of parents/caregivers and teachers, enabling children diagnosed with social, family and school development without harm and frustration. As for children with ADHD, the need for evaluation of motor coordination is evidenced, since the prevalence of ADHD co-occurrence X DCD has been significant and the revelation of this co-occurrence may have a positive influence on the treatment and development of children.

The occupational therapist who can intervene in this child’s environment can provide diverse motor experiences during the intervention, improving the child’s performance in various motor activities, such as writing, jumping, running, hopping, playing ball among many others. The education professional can generate learning strategies for children who have DCD co-occurring with ADHD.

5 Conclusion

The evaluation with MABC-2 enabled to present with confidence that 10 (ten) schoolchildren with

ADHD, out of the 23 evaluated, had co-occurring DCD, which corresponds to 43.5% of the children evaluated. The characterization showed that students with ADHD have motor developmental patterns that interfere significantly in the performance of children's motor skills, mainly related to the ability to balance. These characteristics may be the basis for more specific treatment directions in this population. With a more adequate treatment, we can contribute to the improvement in the quality of life of these children, avoiding, for example, social exclusion and favoring inclusion.

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Author's Contributions

Cristina Camargo de Oliveira was responsible for the design of the text, data collection and writing of the text. Jorge Lopes Cavalcante Neto contributed with the review of the text and updates. Marina Silveira Palhares was responsible for the orientation of the study, writing of the text and final review. All authors approved the final version of the text.

Funding Source

CAPES.

Notes

¹ Fine mobility refers to the ability to control a set of movement activities of certain segments of the body, using minimal force to achieve a precise response to the task (ROSA NETO, 2002).

Fine mobility is the ability to perform coordinated movements using small muscle groups of the extremities. Example: writing, sewing, typing (GORETTI, 2009).