05 - DERMATOGLYPHIC PROFILE OF ADOLESCENTS WITH SPECIFIC NEEDS

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Abstract

Introduction: Considering that human development is influenced by both genetic and environmental factors, and that young people with learning difficulties may have low motor coordination levels. Knowledge of the genetic profile allows early stimulation of this physical quality and consequently contributes to the improvement of cognitive functions. Objective: the aim of this study was analysing and comparing the dermatoglyphic profile, with regards to the genetic markers of the five fingers of each hand, of students with High Abilities, with Attention Deficit Hyperactivity Disorder (ADHD) and dyslexics.Methods: The sample consisted of 53 children and adolescents, 25 diagnosed with high abilities (aged 11.88±1.71), 20 with Attention Deficit Hyperactivity Disorder (ADHD) (aged 12.5±1.05) and 8 Dyslexics (aged 12.85±1.35). The dermatoglyphic profile of the sample was defined by their fingerprints collection, their analysis and data tabulation. The data was submitted to a descriptive and comparative analysis using the Kruskal-Wallis test. Results: No significant differences were found between the dermatoglyphic indexes of children and adolescents with High Abilities, ADHD and Dyslexics. The groups showed a genetic potential for speed activities, as well as similar coordination potential. In the other hand, mirroring in the number of lines was observed among students with high abilities, but not in those with ADHD and dyslexics. Conclusion: No significant differences were found between the percentage of each type of digital design. However, there were differences in hand mirroring between the groups studied.

Keywords: Inclusive education; dyslexia; attention deficit hyperactivity disorder; dermatoglyphics; adolescents.

Introduction

The learning process is of great interest and concern within the educational environment, especially when it comes to students who show learning difficulties, which leads to results below expectations in terms of intellectual potential of certain age groups (FELIPE, BENEVENUTTI, 2013). Studies about human intelligences development, which focus on learning difficulties, have presented researches both highlighting genotypic & phenotypic variables (SMITH, STRICK, 2012), and family, emotional and educational (environmental) variables (LEAL et al, 2017) regarding neural problems.

Luna et al (2021) , when comparing the coordinative potential, through the dermatoglyphic profile of children with and without literacy difficulties, found that those who showed greater difficulties in literacy also had worse coordination levels and low potential. Castilha (2020), in carrying out a similar study, despite having worse coordination levels, did not find differences in the coordination potential between children with and without literacy difficulties.

For Harrowella et al. (2018), children with learning difficulties have, deficits in reading, in social communication, hyperactivity and low attention, which can affect motor coordination. In addition to the coordinative potential, which was high in young people with high skills, evaluated by Linhares et al. (2013), they also showed hand mirroring characteristics, in relation to the dermatoglyphic profile.

Highly skilled children and young people are those who have demonstrated high performance in the intellectual, creative and social areas in comparison with their mates of similar age and environment. For working with such students, who are endowed with precociousness and usually show obstinate dedication to certain tasks and creativity, the teacher needs to identify the respective characteristics and provide motivation for their development. (SMITH, 2008)

In the other hand, ADHD is a very common neurobiological syndrome that usually manifests difficulty in maintaining an attentional focus, restlessness and impulsivity, and which may cause significant losses in planning, organization, control of body stimuli and social relationships (Goulardins et al., 2015). Silva (2014) points out that, far from being considered a disease, such disorder, when characterized as accelerated thinking, may help at creating true examples of courage, boldness and creativity, once better known and worked ever since childhood.

Dyslexia, known as a disorder that affects learning, is characterized by a learning disability in writing and in recognizing words (BOETS et al., 2013). It has demonstrated relationship with perceptual factors that compromise results in coordinative tests (LUM et al., 2013), although, no differences were found in the structure-function relationship of the cerebellum and in the volume of local grey substance between adults with and without dyslexia (VAN OERS et al., 2018).

Neural alterations, with differences in the mental activation patterns, cause a deficiency in the pattern of motor functions (BROWN-LUM et al., 2015), as cerebellum is considered one of the main brain structures in charge of sensorimotor function, which is associated with cerebral cortical regions for motor coordination development (D'MELLO; STOODLY, 2015). In addition, Yang et al. (2014) believe that there may be a relationship due to the cerebellum being linked to the pre-motor and frontal areas, such as the Broca's area of the brain, area known for being in charge of the language.

Considering that the recognition of high abilities and learning difficulties at the earliest possible ages are of true importance for school success (SANZANA et al. 2017); and that motor coordination is a physical quality of hard identification (GORLA et al., 2014), the use of a low-cost and easy-to-use evaluation tool which allows the recognition of low motor coordination potential would be of great value.

Nowadays, with regards to the analysis of the motor coordination potential and other physical qualities, studies (OFFEI et al., 2014) have proposed the use of dermatoglyphics, which analyse certain fingerprints of the five fingers of each hand.

Thus, the aim of this study was analysing and comparing the dermatoglyphic profile, with regards to the genetic markers of the five fingers of each hand, of students with High Abilities, with Attention Deficit Hyperactivity Disorder (ADHD) and dyslexics.

Métodos

Sample

The sample consisted of 53 children and adolescents, of both sexes, of which 25 were children and adolescents, students of the municipal public education network in Rio de Janeiro, attended by the Instituto Rogério Steinberg, with high abilities in different areas of knowledge (aged 11.88±1.71 years old), whom were diagnosed by specialized professionals in each specific areaThe other 28 students, on the other hand, are teenagers from the federal public network of Rio de Janeiro, from Colégio Pedro II, assisted in the service group for people with specific needs (Napne), being 20 with Attention Deficit Hyperactivity Disorder (ADHD) (aged 12.5±1.05 years old); and 8 Dyslexics (aged 12.85±1.35 years old).

This research was submitted and accepted by the ethics committee of Rio de Janeiro Federal University, under the number CAAE 34173314.2.0000.0053. Students were authorized by their parents or legal representatives to take part in the study, by signing the Free and Informed Consent Letter.

Instruments

For the dermatoglyphics evaluation, rough white paper was used, and the fingerprints of all 10 fingers of both hands were collected by using a fingerprint collection pad (Impress™). The method for dermatoglyphic analysis chosen was the one reported by Cummins & Midlo (1961), with the observation of the three types of fingerprints drawings: Arch, represented by the letter 'A'; Loop, represented by the letter 'L'; and Whorl, represented by the letter 'W'.

Dermatoglyphic indices were also analyzed: the total sum of the number of lines on the ten fingers corresponds to the Total Quantity of Lines (TQL) and the total number of deltas that are present in the ten fingers of each hand, known as Delta 10 Index (D10).

Figure 1 shows the main differences between the three fingerprint types, which are: A-type shows no deltas; L-type shows one delta; and W-type shows two deltas.

Figure 1. Types of Dermatoglyphic Fingerprints.

Procedures

Initially, a description of the research characteristics and the reasons that motivated its development were described. Then, the sample received the Free and Informed Consent Letter to be signed by their parents, so that they could take part in the research. As a follow up, a date for data collection (fingerprints) was set both at Rogério Steinberg Institute for evaluating young people with high abilities, and at *Pedro II* School, *São* Cristóvão campus, to evaluate students with ADHD and Dyslexia. Data was collected only from the students who returned the informed and consent letter signed by their guardian. Finally, the fingerprints analysis and data tabulation were proceeded.

Instituto Rogério Steinberg is an institution dedicated to serving young people with high abilities. They serve students from public schools with referrals who are subsequently evaluated by the institute itself to prove the profile compatible with high skills.

The Colégio Pedro II is a federal educational institution in Brazil, with high recognition of quality in basic education and students who have learning difficulties are advised to undergo a diagnostic evaluation to analyze possible learning disorders.

Statistical analysis

This is an exploratory study carried out from a descriptive and comparative analysis (mean values and standard deviation) of the dermatoglyphic indexes was carried out; then the Kolmogorov-Smirnov test was applied for analysing the data normality. As not all variables showed normal distribution, the Kruskal-Wallis test was performed to compare the means of A, L, W, D10, TQL between the groups (High Abilities vs. ADHD vs. Dyslexia). The statistical program GraphPad Prism™ version 5.0 was used. The critical significance index adopted for all analyses was $p < 0.05$.

Results

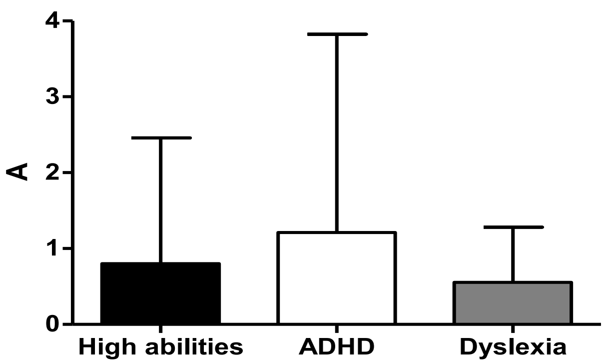
The descriptive analysis with the percentage values of each fingerprint type (A, L, W) that each group presented, as well as the absolute values observed in the dermatoglyphic indexes (D10 and TQL) are described in table 1:

Table 1. Fingerprint types and dermatoglyphic indexes: percentage and mean values.

Variables	A	L	W	D10	TQL
High abilities	8%	68%	24%	11.60	116.32
ADHA	12.1%	67.4%	20.5%	10.84	106.21
Dyslexia	5.7%	76.6%	17.7%	11.22	120.77

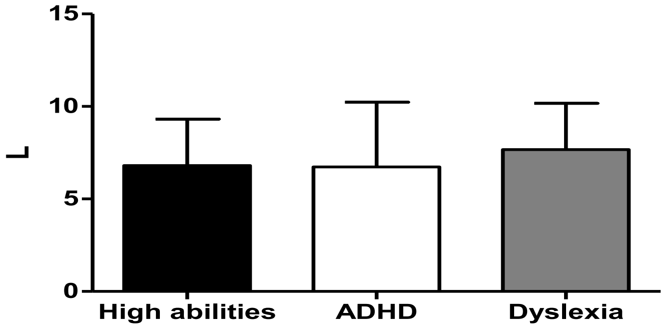
No significant differences were found (p= 0.8869) when comparing the variable “A” between the different groups (0.8 ± 1.65 versus 1.21 ± 2.61 versus 0.57 ± 0.72), as shown in Figure 2.

Figure 2. Mean and standard deviation of variable “A” when comparing different groups (High Abilities versus ADHD versus Dyslexia).



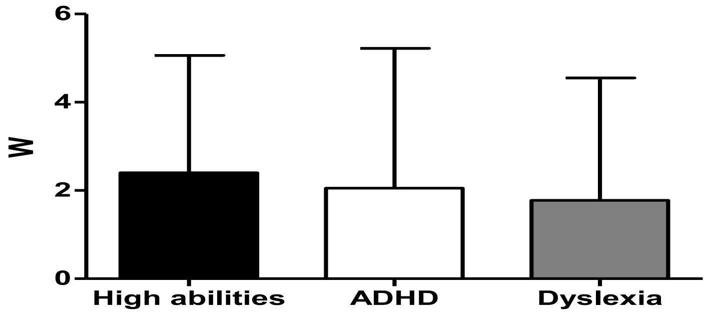
Also, no significant differences were observed (p= 0.6244) when comparing the “L” variable between the different groups (6.8 ± 2.51 versus 6.74 ± 3.49 versus 7.66 ± 2.5), as shown in Figure 3.

Figure 3. Mean and standard deviation of variable “L” when comparing different groups (High Abilities versus ADHD versus Dyslexia).



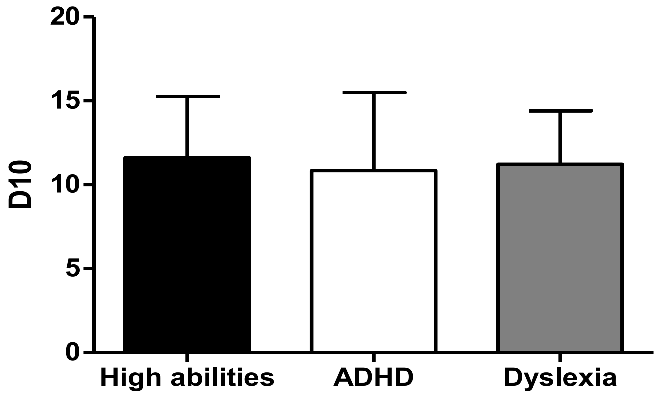
As for the W fingerprint type, again no significant differences were observed (*p*= 0.6064) between the different groups (2.4 ± 2.66 versus 2.05 ± 3.17 versus 1.77 ± 2.77), as seen in Figure 4.

Figure 4. Mean and standard deviation of variable “W” when comparing different groups (High Abilities versus ADHD versus Dyslexia).



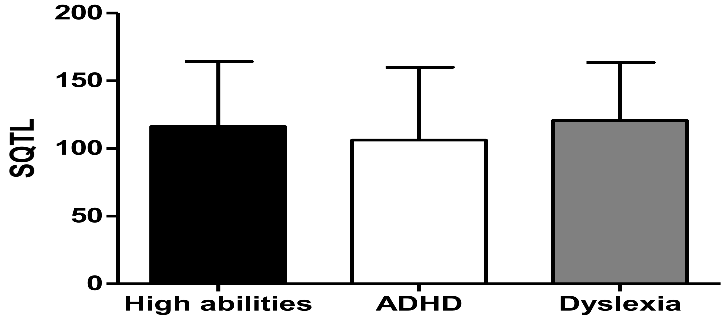
In the same direction, no significant differences (*p*= 0.7861) were found in the comparison of “D10” variable mean values between the different groups (11.6 ± 3.65 versus 10.84 ± 4.64 versus 11.22 ± 3.19), as shown in Figure 5.

Figure 5. Mean and standard deviation of variable "D10" when comparing different groups (High Abilities versus ADHD versus Dyslexia).



The same applies to the TQL index, that is, there were no significant differences (*p*= 0.7799) between the groups (116.32 ± 47.88 versus 106.21 ± 53.89 versus 120.77 ± 42, 78), according to Figure 6.

Figure 6. Mean and standard deviation of variable "TQL" when comparing different groups (High Abilities versus ADHD versus Dyslexia).



The following tables show the incidence of fingerprint types in each finger of the right (RHT) and left hand (LHT) (Table 2), along with the number of lines of each finger of the right (RTQL) and left hand (LTQL) (Table 3). In the comparative analysis between the fingers, no significant differences were found between the fingers of each hand with regards to the type of drawing and number of lines.

Table 2. Mean results for the incidence of fingerprint types in each finger of the left and right hands.

Groups	RHT1	RHT2	RHT3	RHT4	RHT5	LHT1	LHT2	LHT3	LHT4	LHT5
High Abilities	1.2	↓1.2	↓1.1	↑1.3	↓0.9	1.2	↓1.1	=1.1	↑1.2	↓0.9
ADHA	1.1	↓1.0	=1.0	↑1.2	↓1.0	1.0	=1.0	=1.0	↑1.1	↓1.0
Dyslexia	1.2	↓0.8	↑1.0	↑1.2	↓1.1	1.4	↓0.8	↑1.0	↑1.2	↓1.1

Table 3. Mean results for the number of lines on each finger of the left and right hands.

Groups	RTQL 1	RTQL	RTQL:	RTQL4	RTQL!	LTQL1	LTQL2	LTQL3	LTQL4	LTQL5
High Abilitie	13.8	↓9.6	↑10.4	↑12.4	↓11.6	12.5	↓10.6	↑11.0	↑13.7	↓10.4
ADHA	14.7	↓9.8	=9.8	↑11.1	↓9.0	12.7	↓9.2	↑9.6	↑11.6	↓9.0
Dyslexia	16.7	↓8.7	↑10.1	↑14.1	↓11.4	15.8	↓9.5	↑11.2	↑11.6	↑13.2

Discussion

The the coordination deficit is of great concern within the academic environment, as it can lead to difficulties in writing and in the general learning process both in general school environment and in traditional classroom (CAÇOLA; LAGE, 2019). This concern is particularly prevalent in low- and middle-income countries, as 43% of children under 5 years-old may not reach their development potential, as well as in intellectual activities, due to the lack of appropriate and high-quality programs (BLACK et al., 2017).The American Psychiatric Association (2013) also reports that motor disorders may affect the performance of academic activities.

Nevertheless, little is still known about the relationship between coordination disorder and its relationship with the neural base (DEBRABANT et al., 2016) despite the increasing number of studies within this knowledge field, especially when it comes to the cerebellum region, as its role involves the modulation of other structures, such as the cerebral cortex (VAN OERS et al., 2018).

In the present study, although no significant differences between the groups were noted, the results showed a lower incidence of A fingerprint type among dyslexics, followed by the group with high abilities and those with ADHD. The high incidence of A is related to low coordination potential, especially when associated with low values for D10 and TQL. The results of this study also demonstrated that dyslexics presented lower values of D10, but a higher number of lines in the ten fingers than the other two groups.

Thus, the low quality of motor coordination in individuals with learning disorders may be related to sensory functions and also to the development of the central nervous system. This fact may be related to changes in attention levels.

Debrabant et al. (2013) reported an association between DCD and visual-motor impairment, with alterations in the right dorsolateral prefrontal cortex hypoactivation, in the left posterior cerebellum, and in the right temporo-parietal junction, along with a low nodal efficiency in the VI cerebellar lobe and in the upper parietal gyrus right, respectively.

Bovo et al. (2016), when studying the relationship between reading and learning difficulties in children, reported that such students show cognitive changes, mainly in executive functions such as verbal fluency, inhibitory control and working memory, and that intervening variables will depend on the disorder, so that the executive function can be considered the main or secondary motivation.

In addition to the attempt of analysing the relationship between learning difficulties, mental disorders and general disorders related to neural changes, there are studies that show DCD comorbidities with dyslexia, TDHA, Autistic Spectrum Disorder (BIOTTEAU et al., 2017; WANG et al., 2014), overweight and larger chest circumference (JOSHI et al., 2015) among others. Therefore, motor coordination disorders seem to be highly influenced by environmental factors.

Another point that needs to be highlighted is the similarity between the dermatoglyphic variables in both hands, known as “mirroring”. Mirroring is observed in adolescents with high abilities (LINHARES et al. 2013). With regards to this characteristic, the results in this study show that:

1) Students with high abilities have an almost perfect similarity in relation to the behaviour of fingerprint drawings between the fingers when comparing right and left hands, and very similar TQL. Those with ADHA also showed a close relationship, but with differences in fingers 1 and 2 between hands. Dyslexics, on the other hand, showed similarity between the hands.
2) Regarding the number of lines, those with high abilities showed similarity between hands. Those with ADHD and dyslexics did not show such characteristic, although students with ADHD presented the same number of lines in the 5^{th} finger of each hand.
3) Adolescents with high abilities presented the same fingerprint type in fingers 1, 3 and 5 between hands.
4) Mirroring was noted in those with ADHD, whose fingerprint types of fingers 2, 3 and 5 in both hands were the same.
5) The same applied to those with dyslexia, between the fingers 2, 3, 4 and 5 of both right and left hands.

Studies using genetic markers have been carried out in different parts of the world (POOJA et al., 2020), which allows greater knowledge about the population and groups that share common characteristics. Therefore, such research can contribute to the support of public policies, and contribute to the development of learning in the school environment.

Conclusion

The groups did not show differences in the genetic potential for motor coordination, which brings to light that environmental variables must be taken into account, as well as the importance of physical evaluations, through motor coordination tests.

With regards to the hand mirroring, a relationship was observed in the number of lines among students with high abilities, but not in those with ADHA and dyslexics. Regarding the fingerprint types, the behaviour was almost similar among the talented and with ADHA and similar among dyslexics.

Therefore, it’s considered of great importance the expanding of knowledge about the student's motor state, along with a more reliable analysis of their needs, so that more relevant follow-ups can be carried out, through coordinative training programs.

Conflict of Interests Declaration

The authors declare no conflict of interest.

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