

SLEEP DISTURBANCES IN 50 CHILDREN WITH ATTENTION-DEFICIT HYPERACTIVITY DISORDER

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ABSTRACT - Objective: This study assesses the relationship between sleep disturbances (SD) and attention-deficit and hyperactivity disorder (ADHD) to characterize clinical features and associated problems. **Method:** The medical records of 50 children and adolescents ranging in age from 4 to 17 years with ADHD without the diagnosis of mental retardation or pervasive developmental disorders were reviewed. **Results:** Significant relationships were found between SD and drug therapy ($p < 0.01$), co-morbidity ($p < 0.01$) and greater adherence to treatment prescribed for ADHD disorders ($p < 0.05$). **Conclusion:** The results of this study suggest that SD are an important problem in children with ADHD and may be linked to increased symptoms.

KEY WORDS: attention-deficit and hyperactivity disorder, sleep disturbances, child behavior disorders, sleep, drug therapy.

Distúrbios do sono em 50 crianças com transtorno do déficit de atenção e hiperatividade

RESUMO - Objetivo: Avaliar a associação entre transtorno do déficit de atenção e hiperatividade (TDAH) e distúrbios do sono para caracterizar fatores clínicos e problemas associados. **Método:** Foram revistos prontuários de 50 crianças e adolescentes com idade entre 4 e 17 anos e consecutivo diagnóstico de TDAH sem diagnóstico de retardo mental ou transtornos invasivos do desenvolvimento. **Resultados:** Foram encontradas associações significativas entre alterações do sono e farmacoterapia ($p < 0,01$), comorbidade ($p < 0,01$) e maior aderência ao tratamento prescrito para sintomas de TDAH ($p < 0,05$). **Conclusão:** Os resultados deste estudo sugerem que alterações do sono são relevantes em crianças com TDAH e podem estar associadas a aumento dos sintomas.

PALAVRAS-CHAVE: transtorno do déficit de atenção e hiperatividade, distúrbios do sono, sono, transtornos do comportamento infantil, farmacoterapia.

Attention deficit and hyperactivity disorder (ADHD) is a syndrome with major presence in children and adolescents and well-established clinical criteria for its diagnosis¹⁻¹³. Diagnostic classifications have presented changes in sleep disturbances (SD) in children as diagnostic criteria for ADHD¹⁴, but these symptoms were later removed upon revision of the handbook. Despite this, SD in children with ADHD have continued to be important due to the complaints of patients and their parents regarding sleep, questions related to sleep in instruments for detecting ADHD and gradual increase in the area of SD¹⁵⁻²³. As more studies have begun in this area, questions have appeared about the relationship between ADHD and SD. Suggestions have arisen that predominantly hyperactive children with ADHD suffer from a more fragmented and less efficient sleep²⁴ increasing the

suspicion that the hyperactive or inattention subtypes of ADHD could be different clinical entities. At the start of the nineties, studies began to appear, demonstrating the presence of symptoms similar to those of ADHD in children with sleep disordered breathing problems, so that these children displayed agitated sleep, changes in behavior with aggression and learning difficulties. However, after treating these respiratory sleep disturbances, these symptoms improved²⁵. The presence of obstructive apnea in children continued to be considered responsible for fragmented sleep and poor school performance^{17,18,20,21,26}. This led the question of whether these children diagnosed with ADHD due to their symptoms of inattention and hyperactivity might in reality be suffering from SD. Studies linking ADHD and snoring suggest this condition, indicating that respi-

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ratory and other SD could be responsible for symptoms of up to 25% in all children with ADHD and by treating sleep disorder breathing problems, it is possible to improve or eliminate these symptoms²⁷. In spite of the difficulties of confirming and establishing the link between ADHD and SD, an increasing number of studies on the subject have appeared in the literature. The exact relationship between ADHD and changes in sleep remain obscure, but the relevant findings have generated little discussion, with few debates in the clinical context and the risk of not benefiting patients with the knowledge acquired up to now, that might interfere in the diagnosis and treatment of ADHD²⁸.

Several other studies have pointed to the presence of hyperactivity symptoms, behavioral problems and poor learning performance in children with respiratory SD. Assessment of children with lowered intellectual ability²⁹, and laboratory studies with rats³⁰ has also strengthened this possibility. Children with lowered intellectual capacity displayed worse cognitive function, worse behavior and major indication for medication. SD were also observed as respiratory disturbances, nocturnal myoclonus and restless legs syndrome associated with behavioral problems in children³¹. Teachers notice more symptoms such as hyperactivity, inattention and changes in behavior in children with SD³². The correlation between nocturnal myoclonus and restless legs syndrome with ADHD has also been confirmed³³, this could interfere in symptoms of a subgroup of children with ADHD³⁴. The possibility that sleep-disordered breathing in children is related to moderate symptoms of ADHD has been discussed during the last few years, whereas children with more severe symptoms present REM sleep changes³⁵, suggesting a major correlation with neurobiological mechanisms. Another line of study is the association of early SD in children with posterior diagnosis of ADHD^{15,16,19,22,23,36,37}.

A retrospective study is reported of a sample of patients with ADHD followed on an out-patient basis, assessing features of the sample medical files, and with objective focusing mainly on SD and the clinical significance of these alterations.

METHOD

This is a retrospective study of 50 patients diagnosed with ADHD, obtained only in their medical files by secondary data, case studies, and use of structured questionnaire for this objective³⁸. The present report is part of a large research project regarding child and adolescent sleep that will be published elsewhere³⁸. The sample consisted of patients seen in a private clinic in the city of Campinas, São

Paulo state, during 2001 and 2004, ranging in age from four to eighteen years, diagnosed with ADHD by professionals of the institution, physicians specialized in neurology of child psychiatry. A standardized 25 items multiple choice developed by the authors questionnaire was used³⁸.

It should be pointed out that this study sources of information were assessed that enabled the diagnosis to be made, such as interview with parents, information from teachers and an assessment interview of the patients, as present in their medical files. Noting that the gold standard diagnosis of ADHD is the clinical analysis.

The patients who presented their complaints or their families complaints about changes in sleep formed a group that was compared to the rest of the sample.

Subjects with diagnosis or suspicion of mental retardation or infantile autism by the clinical interview in the medical files were excluded because of the possibility of their presenting symptoms of hyperactivity as part of their clinical picture.

This research protocol was approved by the Medical Ethics Committee, School of Medical Sciences, University of Campinas (UNICAMP).

Analysis of data – The software “Statistical Package for Social Sciences for Personal Computer – SPSS/PC” was utilized for the statistical procedure. The data recorded in the assessment reports were revised manually by the investigator, then transcribed to the data bank of the Computational SPSS/PC program and revised again to detect and correct any possible recording errors.

Frequency tables of categorical variables and descriptive statistics (average, mean, standard-deviation, minimum and maximum) of the continuous variables were organized to characterize the socio-demographic profile.

The Chi-square test was employed to analyze the link between two categorical variables. The relationship between values of a continuous variables and the classes of a categorical variable was verified using the Mann-Whitney test (the categorical variable was divided into two classes). The level of significance was established at 0.05.

RESULTS

This study included 46 males (92%) and four females (8%) ranging in age from 4.5 to 17.9 (average 10.5 years, mean 10.4 and mode 5.5 years). Forty-nine were attending school at the time of assessment. Six were adopted children (12% of total). The parents of thirteen patients were separated, two were widowed and 34 married. One of the records did not mention the parent's marital status at the time of assessment. Relationship problems among the parents of 24 (48% of total) patients were described, considering relationship complaints independently of whether or not they were married or separated. Financial problems were described in thirteen families (26% total).

The diagnosis was established after interviews

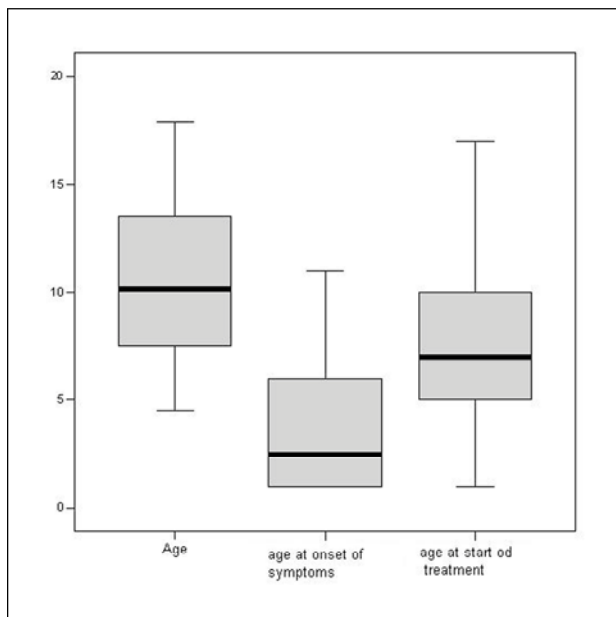


Fig 1. Age of the sample, age at onset of symptoms and age at start of treatment.

with parents and the patients in all 50 cases (100%) and information provided by the teachers in 34 cases (68%). Age at onset of symptoms was described in 37 cases, twelve, mentioned onset during age one and four at age two. The result demonstrated a concentration of onset of symptoms during the early years and at age 6-7 which corresponds to the beginning of the alphabetization (Fig 1). Among the 37 patients supplying information on the records about age at onset of symptoms, 70.3% presented symptoms up to age 6 (52% of total) and 86.5% up to age 7 (64% of total).

The average time reported between onset of symptoms and beginning of treatment in 29 out of the 50 records (58% of sample), was an average of 4.2 years, mean four years and range from zero to eleven years. The age at which they first sought treatment was concentrated in the 5 to 10 year age group.

Out of the 50 cases sampled, 86% showed impairment of their activities. Twelve (24%) had repeated

a grade once, seven (14%) had been left back more than once, nine (18%) had been suspended, thirteen (26%) had changed schools because of problems related to their symptoms, sixteen (32%) had learning difficulties, one (2%) gave up and five (10%) received behavioral complaints. Four (8%) interrupted their studies of some time due to complaints related to ADHD.

Forty-three cases (86%) had relationship problems with their parents, teachers and/or friends. Eighteen (36%) received a diagnosis of associated co-morbidity based on the clinical interview in their medical records: eight (16%) with anxiety disturbances, five (10%) with depressive disturbances and five (10%) with behavioral disturbances.

The average treatment time was 64.3 weeks, ranging between two and 170 weeks with a 74% rate of defecation. Comparing the average follow-up time, the average patients that abandoned treatment was 47.5 weeks and for those who continued the average was 112.4 weeks of medical follow-up.

Complaints of sleep changes were recorded in 23 (46%) of the 50 records studied, some patients described two or three changes remembering that this symptom that not been actively checked at the time of the interview.

Twelve patients (24%) complained of agitated sleep, four (8%) of insomnia, three (6%) of disorders linked to sleep habits, two (4%) of little time for sleep, two (4%) of awakening at night, two (4%) of somniloquism, one (2%) diagnosed with excessive daytime sleepiness, one (2%) of sleep paralysis, two (4%) of nightmares, two (4%) of sleeping during the day, one (2%) of apnea, one (2%) of snoring, one (2%) of bruxism, and one (2%) of night terror.

Evaluation of the study sample regarding the presence of sleep complaints and clinical progress, showed a link between the presence of sleep complaints and later indication of drug therapy, $\chi^2(1)=9.01$: $p=0.003$ ($p<0.001$). Among the patients with sleep changes recorded in the case history, 95.7% were indicated for medications (methylphenidate), and only 59.3%

Table 1. Sleep changes and pharmacological treatment.

Underwent drug treatment	Complained of sleep changes	Did not complain of sleep changers	Total
Yes	22 (95.7%)	16 (59.3%)	38 (76%)
No	1 (4.3%)	11 (40.7%)	12 (24%)
Total	23 (100%)	27 (100%)	50 (100%)

$\chi^2(1)=9.01$, $p<0.01$; $p=0.003$.

Table 2. Sleep changes and co-morbidity.

Co-morbidity	Complained of sleep changes	Did not complain of sleep changers	Total
Yes	13 (56.5%)	5 (18.5%)	18 (36%)
No	10 (43.5%)	22 (81.5%)	32 (64%)
Total	23 (100%)	27 (100%)	50 (100%)

$\chi^2(1)=7.78$, $p<0.01$; $p=0.005$.

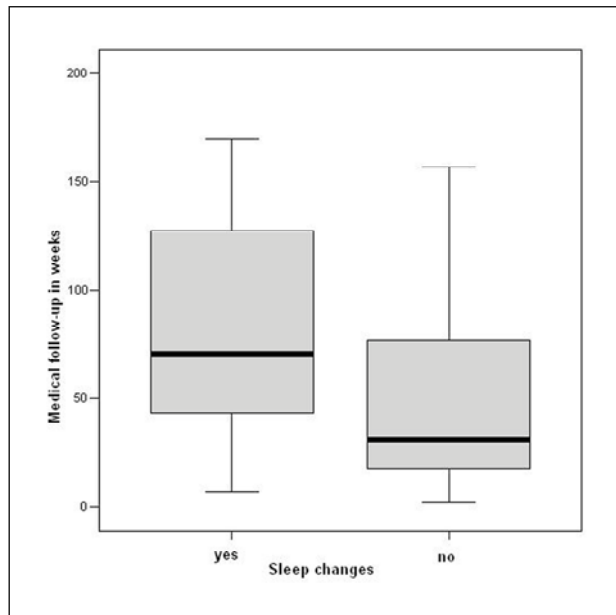


Fig 2. Sleep changes and adherence to treatment in weeks.

of those who did not present changes were indicated for medications (Table 1).

The link between sleep changes and the presence of a co-morbidity was also statistically significant, value $\chi^2(1)=7.78$, $p=0.005$ ($p<0.01$), (Table 2). Co-morbidity was diagnosed by clinical interviews in their medical files in 56.5% of patients who displayed sleep changes, and in only 18.5% of those who did not present these complaints.

Evaluating the link between the presence of sleep changes and abandoning medical follow-up showed that patients with sleep changes adhere more to treatment than those who did not complain about sleep changes. However, the result was not statistically significant ($p=0.051$). The evaluation of the link between sleep changes and time of treatment, showed that the patient with sleep changes presented an average longer treatment time compared to those without sleep complaints, $p=0.02$ (Fig 2).

The correlation between pharmacological treatment and presence of a co-morbidity was not established, since the concentration of cases in one of the groups jeopardized the chi-square test due to the expected frequency of cells with value lower than five surpassing 20% of the total cells. Evaluating the variable of abandoning treatment associated with the use of medication, the chi-square test was impossible for the same reason. Using the Mann-Whitney method for evaluating the link between use of medication and time of medical follow-up, the latter was significantly greater among patients with pharmacological treatment ($p<0.001$) (Fig 3).

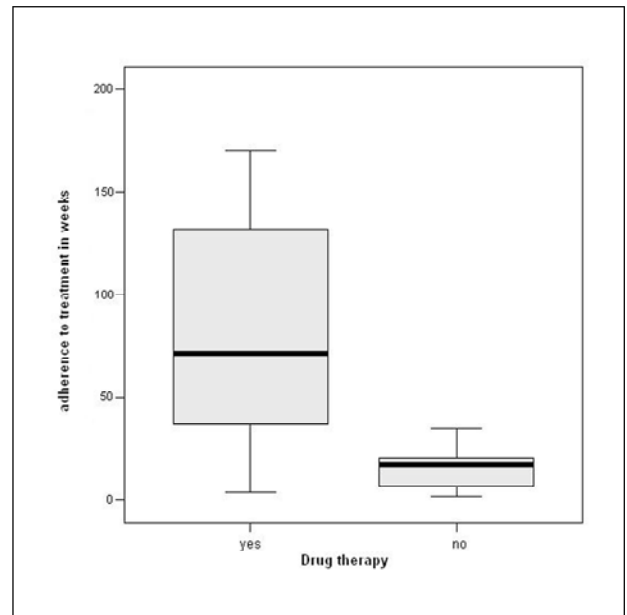


Fig 3. Drug therapy and adherence to treatment in weeks.

DISCUSSION

This study included 46 males (92%) and four females (8%), in agreement with the statistics in the literature regarding distribution by gender of ADHD in clinical samples. The data about onset of symptoms and early treatment are comparable with reports in the literature that many patients present symptoms since early childhood and at the stage of learning to read and write. At this time, the possibility of diagnosis increases due to behavioral problems, in alphabetization and in comparison with other children of the same age³⁹.

The average time between onset of symptoms and start of treatment in the sample was 4.2 years. The sample displayed a high rate of impairment of school activities due to flunking, suspensions, learning difficulties, changes of school and even dropping out of school, raising the question that there is significant damage before the child is even brought for out-patient evaluation or in spite of being seen and treatment started. Since the majority of cases in the sample in which treatment was recorded for the first time, were concentrated between five and eight years of age, an evaluation is appropriate for the efficacy of the diagnoses and proposed treatment for these children when seen for the first time.

Another aspect of the damage to these patients is the high number that displayed relationship problems. The sample proportion of cases with relationship problems and/or school problems showed a significant concentration of cases in these groups and

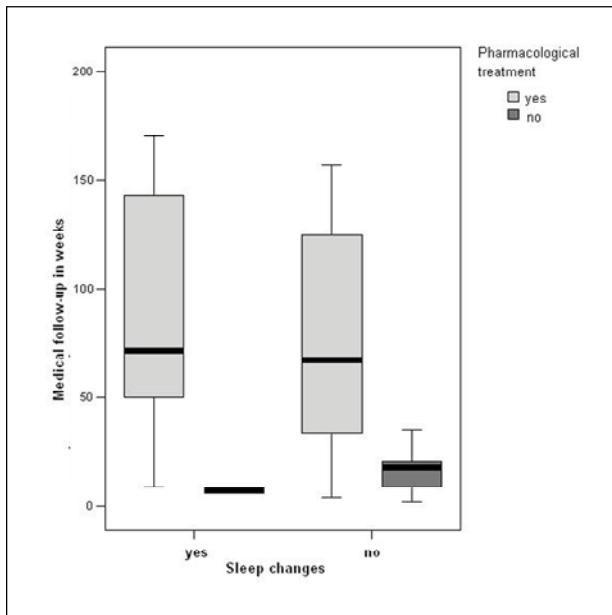


Fig 4. Pharmacological treatment and adherence to treatment in the groups with and without sleep changes.

resulted in an expected much lower proportion in the other groups. Hence, the statistical test (chi-square) was jeopardized because of presenting an expectation of less than five cases without these complaints in some statistical comparisons, so that the adequate use of the test was impossible. This damaged the evaluation of the link between these variables and alterations in sleep of pharmacological treatment. For proper study of these links a much larger sample would be necessary.

Twenty-two (95.7%) of the 23 patients with SD were indicated for pharmacological treatment. Comparison of the indication for medication between the two groups, (with and without SD), showed a statistically significant indication for medication in SD patients ($p < 0.01$). This might suggest a major intensity of symptoms and/or severity of the ADHD picture in these patients. The patients with SD also presented a major presence of co-morbidities ($p < 0.01$).

The tendency of a lower rate of abandonment of treatment by patients with SD complaints was evaluated but without statistical significance in this sample ($p = 0.51$). The greater averages of time of treatment in patients with SD compared to those without changes in sleep, showed a statistically significant link ($p < 0.05$). However, the better adherence to the treatment might also be due to a greater intensity of symptoms and impairment occurring in patients prior to treatment.

The links with abandonment and average time of treatment were also considered regarding the pharmacological treatment, since the initial results described, pointed to a correlation between sleep changes and indication for drug treatment. In this way drug treatment might be a confusing feature in evaluation of sleep changes with adherence and total time of treatment.

The relationship between drug treatment and rate of abandonment of medical follow-up was not statistically significant. Association the use of medication and time of treatment revealed significant major averages in patients that received pharmacological treatment, ($p < 0.0010$), suggesting that drug treatment might positively influence the adherence of patients to the proposed therapy. Not exempting pharmacological treatment and SD as predictive variables of major adherence to treatment as independent form of therapy, since both demonstrated significance, but are also linked with each other. A more significant correlation between pharmacological therapy and longer permanence in treatment was noted than between sleep changes and permanence in treatment. The assessment of drug therapy and sleep changes with relation to increase in time of medical follow-up suggested that the effect can be intensified when both are present (Fig 4).

The literature already indicates a link between SD and changes on behavior in normal children⁴⁰⁻⁴², or those with intellectual disability⁴³ and in the latter age also leading to a major frequency of drug therapy.

The link between sleep changes and ADHD presents complex relationships and even with reduced confirmation and clarification⁴⁴. The interface of ADHD in children's sleep of the possibility of SD simulating ADHD symptoms and/or intensifying symptoms has been cited in the literature, but it seems that in clinical practice its application and discussion is on the weak side.

Existing knowledge already suggests the need for special attention to SD in children during diagnostic evaluation of ADHD. SD could simulate ADHD symptoms leading to an inadequate diagnosis, intensifying the symptoms and interfering in therapeutic indications and evolution of the picture presented, possibly increasing impairment. Among these symptoms, SD breathing deserves special attention because its high prevalence can lead to an inadequate diagnosis, of false positive ADHD. SD breathing might respond to specific treatment with significant reduction or elimination of symptoms that simulate ADHD.

In conclusion, the data point to the presence of sleep changes as important variable in the sample studied, correlated them to a major indication for patients medication, a greater number of patients presenting co-morbidity. Together with the present literature reviewed they do not eliminate the possibility that children with SD are being diagnosed and treated with ADHD due to lack of a more thorough study regarding SD or because the symptoms intensified by SD are not fully assessed.

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